



FLINT'S ENCYCLOPEDIA

OF

MEDICINE AND SURGERY

BY VARIOUS WRITERS

*ARRANGED UPON A NEW SYSTEM, WHICH EMBODIES THE METHODS OF
TREATMENT EMPLOYED BY EMINENT PRACTITIONERS OF MEDICINE*

COMPILED UNDER THE DIRECTION OF THE PUBLISHERS
AND INCLUDING THE WRITINGS OF

JOHN ABERCROMBIE, T. D. ACKLAND, WM. ANDERSON, E. CLIFFORD BEALE, C. E. BEEVOR, HENRY TRENTAM BUTLIN, GEO. W. CALLENDER, JAS. CANTLIE, WM. CARTER, JOHN CHIENE, J. L. CLARK, SIDNEY COUPLAND, HARRISON CRIPPS, JOHN CROFT, W. CAYLEY, EDGAR CROOKSHANK, DAVID W. FINLAY, T. COLCOTT FOX, J. K. FOWLER, WM. GAY, W. B. HADDEN, G. DE H. HALL, G. E. HERMAN, T. W. HIME, T. HOLMES, E. O. HOPWOOD, LEOPOLD HUDSON, JONATHAN HUTCHINSON, C. B. KEETLEY, PERCY KIDD, W. LANG, ARTHUR P. LUFF, ROBERT MAGUIRE, HOWARD MARSH, ANGEL MONEY, MALCOLM MORRIS, J. W. MOTT, C. MANSELL MOULLIN, A. T. MYERS, ISAMBARD OWEN, HERBERT W. PAGE, W. PASTEUR, F. G. PENROSE, AUGUSTUS J. PEPPER, J. P. PICK, W. S. PLAYFAIR, A. C. POST, J. J. PRINGLE, GEO. REVINGTON, FREDK. T. ROBERTS, ROBERT SAUNDBY, HENRY SEWILL, C. E. SHELLEY, HEYWOOD SMITH, T. SMITH, SIR WILLIAM STOKES, J. BLAND SUTTON, B. F. UNDERWOOD, W. HALE WHITE, WALTER WHITEHEAD, JOSEPH WIGLESWORTH, DAWSON WILLIAMS.

ASSISTED BY

FREDERICK F. EVE, G. P. FIELD, VICTOR HORSLEY, HENRY JULER, WM. MACCORMAC, H. M. MURRAY, and W. E. STEAVENSON.

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ENCYCLOPEDIA
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MEDICINE AND SURGERY

BY J. BENTON FLINT

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PREFACE.

IN the preparation of the Encyclopedia of Medicine and Surgery, the intention has been to present in a concise, complete, and eminently practical form the science and art of medicine as understood and practiced by representative members of the medical profession. Having in view the ultimate object of the science and art of medicine—the prevention and cure of disease—particular stress has been laid upon the treatment of disease, the sections upon which will be found exceptionally complete, the exact doses and combinations of the various drugs recommended in nearly every case being given. In this connection it is hoped that the symptomatic indications presented will prove a feature of more than ordinary value.

The arrangement of subjects in a work of this character, partly owing to the number of synonyms in general use, must be largely a matter of individual opinion, but the endeavor has been to place each article under the heading most commonly used, as the work is intended for ready and constant reference—a book for the desk and not for the shelf. Copious cross-references materially aid in finding any desired subject.

In addition to the subjects usually included under practice of medicine this work contains full description of the diseases peculiar to women, diseases of the eye and ear, diseases of children, as well as lucid descriptions of the more common and the more important surgical operations.

To facilitate reference to any particular section the various subheadings, into which the description of a disease is usually divided, are given in slightly differing order from that generally adopted, the history, symptoms, course, diagnosis, and prognosis being placed before the pathology, morbid anatomy, ætiology, and treatment.

FLINT'S

ENCYCLOPEDIA OF MEDICINE AND SURGERY.

ABDOMEN, INJURIES OF THE.

Contusions.—Contusions of the abdominal parietes are serious in proportion to the area and depth of tissues involved. If the peritoneum be implicated the danger is considerably increased. Subcutaneous rupture of a large muscle or blood-vessel is a serious complication.

Contusions may be classified as:
1. Simple contusion or bruise. 2. Contusion with extravasation of blood. 3. Contusion with ruptured muscle. 4. Contusion with disorganization of tissue. 5. Contusion followed by inflammation and suppuration.

Simple Contusion or Bruise.—*Symptoms.* A. Ecchymosis. B. Tenderness. C. Pain. D. Swelling. E. Shock.

Ecchymosis. The discoloration dependent on rupture of the capillaries of the skin and subcutaneous cellular tissue may occur with no external evidence of its existence. Ecchymosis may be distributed in spots or spread uniformly over a considerable area, especially when it affects the umbilical or epigastric regions.

Tenderness, when experienced immediately after the reception of the injury, does not indicate internal mischief; but its occurrence after the expiration of many hours points to the development of peritonitis.

Swelling depends upon the texture of the contused region and the amount of blood and serum effused. It is sometimes considerable in the loose tissue of the loin.

Pain is caused by injury to nerves, or by the pressure of effused fluid upon them. It is aggravated by movement, and especially by coughing and vomiting.

Shock is an uncertain symptom, being sometimes absent, and occasionally so severe as to cause instant death. Vomiting occasionally accompanies abdominal contusions, and is very apt to occur if

the injury is sustained soon after a meal. Although no symptom may supervene immediately upon the occurrence of an abdominal contusion, peritonitis may nevertheless set in after the lapse of some seven or eight days.

Diagnosis and prognosis.—The diagnosis is based upon a close observance of the development of the symptoms, the character of the vomit, of the fæces, and of the urine. Extreme sudden collapse with steadily increasing pallor suggests internal hemorrhage or the rupture of a viscus.

Treatment.—Every abdominal injury should be treated as if it were serious. Rest in bed and a posture which secures muscular relaxation must be maintained. Pain is relieved by warm fomentations, and collapse must be treated by warmth to the spine and extremities. A blood tumor, if present, must be aspirated, or reduced by cold and pressure with strips of adhesive plaster. Peritonitis must be met by opium, warm fomentations, and leeches.

Extravasation of blood complicating contusions may be due to rupture of the superficial vessels, in which case the skin of the iliac, umbilical, and hypogastric regions may be of a black color, and the blood may descend to the scrotum and thighs. It may be due to laceration of the deep vessels when it occurs between the muscles and peritoneum; or within the sheath of the rectus, causing in the latter case a circumscribed swelling.

The *treatment* of such injuries consists in absolute rest, evaporating lotions, and, in exceptional cases, where the effusion is very copious, the use of the aspirator.

Rupture of one of the abdominal muscles complicating contusion is more prone to take place in the rectus than in the broad parietal muscles, and may be caused by direct or indirect violence.

The retraction of the ruptured muscular fibers gives rise to a gap which is soon filled with blood, the absorption of which leaves the recess again apparent; if not repaired by adhesive inflammation, this gap constitutes a weak spot in the abdominal wall, through which a ventral hernia may subsequently protrude.

Treatment.—This consists in so relaxing the muscles as to approximate the separated edges, and retain them in contact, if possible, during repair. Should a ventral hernia occur, a slightly concave truss, well padded, should be retained by a suitable belt.

Pulpefaction of the injured parts accompanying contusion may cause such disintegration of the affected structures as to induce gangrene. If the injury be superficial, involving only the skin, cicatrization soon follows; but if the disorganized tissues are deeply seated, inflammation and suppuration occur; sloughs are subsequently discharged through the apertures made for the evacuation of pus, and the weakened points in the abdominal parietes frequently form the seat of hernial protrusions.

Treatment.—This must favor the natural separation of sloughs. The parts must be antiseptically treated and warm fomentation applied; the strength must be supported; opium is demanded for the relief of pain, and quinine or ammonia and bark for the improvement of the appetite.

Suppuration and abscess.—*Causes.* Suppuration may result from blows, pressure, strains, breaking down of coagula, or extravasation of urine. Disease of the osseous walls of the abdominal and pelvic cavities is a frequent cause of abdominal abscess. Purulent deposits may occur without any assignable cause in the subjects of scrofula and syphilis. Diffuse abscesses are generally deep-seated, and occur amid the loose cellular tissue under tendinous expansions. Superficial diffuse suppuration follows erysipelas, and is conduced to by conditions involving great depression of vital power. Circumscribed parietal abscesses, occurring in the fore part of the abdomen, are probably either subcutaneous, within the sheath of the rectum, or between the transversalis and the peritoneum. When met with in the lateral and posterior regions they are usually intermuscular.

Symptoms.—In the acute form fever

suddenly occurs, accompanied by rigors, vomiting, and severe local pain, but without general abdominal hardness or tenderness. At length redness and œdema of the skin, brawny hardness, and acute tenderness indicate the seat of abscess, though no distinct fluctuation may be detected.

Diagnosis.—Inflammation and suppuration of the abdominal parietes may simulate the affections of the subjacent viscera. Thus, in the hypochondria the signs of a parietal abscess may resemble those of hydatid, abscess of liver, enlarged gall bladder, diseased spleen, or empyema. In the umbilical area strumous disease of the mesentery, malignant disease of the stomach or pancreas, or fecal accumulation in the transverse colon, may simulate abscess, just as disease of the kidney, colon, or spine may do so in the loin, or pelvic cellulitis, ovarian or uterine disease in the hypogastrium. "Phantom" tumors, due to tonic contractions of portions of muscles, and most frequently found in the course of the rectus, may be distinguished by being fairly resonant, not painful on pressure, and by their disappearance under continued manipulation while the patient's attention is diverted.

Treatment.—Rest, warm fomentations, leeches, and cooling salines to reduce inflammation, and anodynes to relieve pain. As soon as the presence of matter is suspected, an exploratory puncture should be made, and the abscess freely evacuated without delay. Deep-seated abscesses, if left to themselves, may induce visceral adhesions and fecal fistula; blood vessels may be ulcerated into, or the kidney become disorganized by pressure. After evacuation of the pus, antiseptic fomentations and tonics are requisite.

Contusion with injury to nerves.—Blows on the epigastric and umbilical regions, which have caused sudden death without leaving a trace of injury to viscera or the parietes, have been supposed to prove fatal by injuring the solar plexus. Though this mode of death has been called in question by some authorities, a few recorded cases leave no reasonable doubt of its occasional occurrence.

Contusion with rupture of blood vessels.—The aorta, vena cava, and other important abdominal vessels are apt to be ruptured by a sharp blow or some

crushing force. An aortic rent is generally transverse, sometimes involving all the coats, at others the internal and middle tunics only.

Symptoms.—If the rupture be complete in a large vessel, hemorrhage, with syncope, will be extreme. If the rupture affects some of the coats only, or merely causes contusion without actual laceration, hemorrhage will not occur; but the reduced caliber of the artery, and consequently the diminished blood supply, will tend to gangrene, or an aneurism may result from the strain.

Treatment.—Absolute rest in the recumbent posture in a cool room; ice to the abdomen; and opium to relieve pain and quiet the circulation. Evidence of continuous or recurrent hemorrhage demands abdominal section with the view of exposing and securing, if possible, the bleeding vessel.

Rupture of the Viscera. **Rupture of the stomach.**—Owing to its comparatively protected position the stomach is more rarely ruptured than the intestine. The situation and linear direction of the rupture vary considerably. The laceration, as in the case of the intestine, usually involves all the coats.

Rupture of the small and large intestines.—Complete rupture of the bowel may be caused by a smart, not necessarily heavy blow, and need not prevent a person from walking about for a short time. No symptoms may follow laceration of the intestine for several hours, and complete section of the bowel has occurred without escape of its contents. Out of sixty-three recorded instances of ruptured gut there were only four of torn duodenum, this part of the intestine being in great measure protected from injury by the overlapping liver and transverse mesocolon. The cæcum is more liable to rupture than the ascending or descending colon. If a viscus be distended at the time of injury, the risk of complete rupture is greatly increased.

Symptoms of gastro-intestinal rupture.—Faintness and collapse; intense burning pain spread over the abdomen; hippocratic countenance; pulse feeble and intermittent; rigors, thirst, vomiting of the stomach's contents, and then of blood, either alone or mixed with bile; tympanitis, or, on the other hand, flatness and rigidity of the abdominal wall, and, possibly, retention of urine. These symp-

toms may be followed by those of traumatic peritonitis.

Diagnosis.—Prolonged collapse, sudden tympanites, acute pain and tenderness, blood in the ejected matters, but without evidence of marked internal hemorrhage, following a blow on the abdomen which has not caused external injury, are characteristic symptoms. The symptoms attendant upon simple contusion are similar, though much less severe, and more amenable to relief than those of rupture. It is important to distinguish primary rupture from ulcerative perforation, such as that which may occur in the cæcum from the obstructive action of a stricture in the bowel below.

Prognosis.—Death is almost certain to follow rupture, and may occur quickly from collapse, peritonitis, or intestinal obstruction; and at a later date, even some weeks after the closure of the rent, from pyæmia.

Treatment.—For the first forty-eight hours, not a particle of food or drop of fluid should be taken. After this period small quantities at a time of milk, beef-tea, etc., may be given. Thirst is relieved by sucking small pieces of ice, or painting the fauces with acidulated water. Stimulants and purgatives are hurtful. The recumbent posture, with the knees raised and supported by a pillow, must be maintained; subcutaneous injections of morphia, or minute doses of opium, and hot poppy-head fomentations are generally needed to relieve pain. The possibility of retention of urine must be remembered and catheterism resorted to if necessary.

Rupture of the solid viscera.—The causes of rupture of the solid viscera are similar to those of rupture of the stomach and intestines. The peritoneal coat is generally torn as well as the substance of the organ. The liver, spleen, or kidney may be lacerated by broken ribs.

These ruptures generally prove rapidly fatal from hemorrhage, and if the patient survives the first few days after the injury, he will probably succumb to recurrent hemorrhage or peritonitis.

Rupture of the liver.—The position and extent of a laceration of the liver are variable. Either surface or lobe may suffer.

Symptoms.—Extreme pallor and coldness of surface, shallow breathing, feeble pulse, abdominal distension, pain, and vomiting. If death does not occur from hemorrhage, jaundice and diabetes may

follow the injury, as may also peritonitis and abscess.

Rupture of the spleen.—This injury, which is not so common as rupture of the liver, is often associated with fractured ribs. It has occurred spontaneously in the course of typhus or typhoid fever, and in the hot stage of ague. Hemorrhage is the chief cause of death after rupture of the spleen.

Symptoms.—These are very similar to those which characterize rupture of the liver.

Rupture of the kidney.—This is not such a very uncommon accident; hematuria is a frequent though not an invariable symptom of it. The prognosis is not so unfavorable as in the case of rupture of the other viscera.

Treatment of rupture of the solid viscera. Absolute rest, avoidance of solid food; subcutaneous injections of anodynes. Gallic acid, ergot, and iron to check hemorrhage.

Strapping the affected side, by securing gentle pressure and limitation of movement, controls hemorrhage. The bowels must not be disturbed for some days. Fluids only, and those in small quantities, should be given for two or three weeks.

If peritonitis occurs it must be treated on the usual plan. Abscess may require opening and draining. If blood accumulates in the bladder and gives rise to much distress, median urethrotomy or lateral cystotomy should be performed, so that clots may be discharged through the wound in the perineum. If in renal injuries the kidney becomes the seat of exhausting suppuration, nephrectomy is indicated.

Rupture of the gall-bladder and biliary ducts.—Rupture of the gall-bladder, or the ducts of the biliary system, may be caused by external violence, dilatation from sclerosis of their coats, compression by new growths, impaction of calculi, or other pathological processes, leading to ulceration of their walls.

The occasional extravasation of bile into the abdominal cavity consequent upon the rupture of the gall-bladder by impacted calculi has resulted in fatal peritonitis.

It is the considerable and rapid discharge of bile into the serous cavity which causes death in such cases; if, on the other hand, the effusion is so gradual as to allow of the formation of a cyst-

like chamber shut off from the general peritoneal cavity by adhesive inflammation, large quantities of bile may accumulate outside the passages, and form a large tumor in the right hypochondrium. Cases of this kind have been ultimately cured by repeated tapplings; the fæces, which were at first white, gradually resumed their normal color as the proper channel for biliary discharge became re-established.

The gall-bladder may be torn away from all its connections without causing immediate death or escape of its contents; within a few days, however, the fatal issue is ushered in by hemorrhage or acute peritonitis.

The commonest seat of rupture is some part of the cystic duct,

Symptoms.—If no extravasation occur, the collapse, abdominal pain, vomiting, and dyspnoea which attend the injury soon pass off. Effusion into the peritoneal cavity induces acute peritonitis.

Where the gall-bladder itself gives way, instant death is the usual result.

The jaundice which follows rupture of one of the ducts is probably as much due to shock as to obstruction at the seat of injury.

Treatment.—Great quietude should be enjoined, to prevent, if possible, biliary extravasation, and to give time for the surrounding of the wounded part by organizable lymph. Absolute rest in bed is imperative; warm fomentations, and a few leeches applied over the seat of the injury, relieve pain; vomiting, which is apt to prove dangerous, should be restrained by the use of ice and sedatives. Small quantities of liquid food only should be given, and no purgatives should, on any account, be employed, enemata, if anything be necessary, being substituted. If a tumor forms, the bile should be evacuated through a canula. Laparotomy, followed by suturing the rent or attaching it to the abdominal parietes, or by removal of the gall bladder, ought, in certain cases, to be adopted.

Rupture of the thoracic duct.—Very little is known of this accident as a complication of other abdominal ruptures. It may be caused by dilatation of the duct due to the pressure of some growth, or by cheesy concretions in the duct itself,

Rupture of the peritoneum.—The parietal or visceral layer of peritoneum may be ruptured without injury to the muscles of

the parietes or to the other coats of the viscera. Such an accident is rare as the result of a blow or other form of external violence, but not so very uncommon in the case of the peritoneum covering the uterus, or as a result of over-distension of the stomach or intestine. The two chief dangers of this lesion are hemorrhage and peritonitis.

Traumatic Peritonitis. *Causes.*—Injuries to the abdominal parietes, ruptures of hydatid, ovarian, and other cysts, the bursting of an abscess, perforation from disease of the hollow viscera, are the most common causes of peritonitis. Fatal peritonitis has also been induced by the penetration of the gut by intestinal worms.

The term traumatic peritonitis is generally applied only to inflammation started by some blow or other form of external violence. Although no inflammation may follow an operation involving an extensive wound of the peritoneum, provided that antiseptic precautions are adopted, still peritonitis may be the outcome of very trivial wounds if the system be in an unhealthy condition, or if foreign bodies be introduced from without or escape from the viscera within.

Varieties.—Although apt to spread over the whole of the membrane, traumatic peritonitis may be limited to the immediate site of injury. It is generally acute, but will probably become asthenic or puriform in an unhealthy subject.

Symptoms.—These generally set in from six to thirty-six hours after the injury, and then develop very rapidly. Although in some cases the symptoms may occur almost immediately upon the reception of the injury, at other times they may be delayed for some days.

Acute pain of a burning, cutting, or stabbing nature, perhaps ushered in by a rigor, and, though at first localized, soon extending in area, is the earliest and most striking symptom. In order to restrain the abdominal respiratory movements and relax the muscles as much as possible, the sufferer lies with his thighs and knees flexed, and sometimes uses his upper limbs to keep the weight of the bed-clothes from pressing, however lightly, on his belly. Although pain is usually very pronounced, it may be absent in exceptional cases.

Vomiting is an early and distressing symptom, and occurs whether anything

is taken by the mouth or not. At first the contents of the stomach and upper part of the intestine are ejected, the vomited matters then become greenish and watery, and subsequently perhaps feculent. Eructations and hiccough, with constipation and gaseous distension of the bowels, are generally present. With the tympanites are sometimes associated feeble peristaltic movements; and gurgling sounds or borborygmi may be heard. Before the distension occurs the abdominal muscles are rigidly retracted. Micturition of the high-colored urine loaded with urates is frequent and scalding; retention follows from palsy of the vesical muscles. The quick, shallow respiration is entirely thoracic. Vaso-motor irritation is excessive.

The small wiry pulse may range from 120° to 160°; and the arteries are contracted. The heart, nevertheless, beats slowly and feebly. Intestinal movements are visible through the parietes, the muscles of which, though they contract on palpation, even in the early stage, soon render the abdominal walls as tight as a drum, and the normal hepatic and splenic dullness becomes quite lost.

The temperature, rising rapidly, continues high for a day or two. It has, however, no regular course and in asthenic cases is generally subnormal.

The tongue is furred at the sides, and red or brown and dry in the center. Thirst is intense. The hands and feet are burning; the features are pinched and expressive of agony; there is extreme prostration, but rarely any delirium or impairment of the mental faculties. In exceptional cases ascites, with fluctuation, is present, and delirium may be a pronounced and early feature. High fever, bloody vomit and stools, diarrhea, urgent dyspnoea, and albuminuria, are occasionally witnessed.

Diagnosis.—Cutaneous hyperæsthesia, localized inflammation, or even rheumatic affections of the abdominal parietes, when accompanied by distension, obstinate vomiting, and constipation, might, without proper care, be mistaken for peritonitis, just as may colic, if attended by vomiting, rapid pulse, and tendency to collapse. But the history of the case, posture, and pinched expression of countenance, exquisite sensitiveness of the abdominal wall to pressure, observation of temperature—will generally indicate

with certainty the presence of peritonitis.

Prognosis.—The more localized the inflammation, the more hopeful the issue; the more rapid the symptoms, the graver the case. When the peritonitis is the result of direct injury limited to the peritoneum or parietes, the prognosis is comparatively favorable; but when due to lesion of the viscera or the influence of septic poison, death is almost certain. The fatal termination usually occurs within a week or ten days; sometimes much earlier. Death occasionally takes place during the height of the fever, but it is generally induced by asthenia, fatal collapse supervening. As life ebbs away the pain subsides, the temperature falls below normal; the previously hot, dry limbs become cold and clammy; the flickering pulse is too rapid for counting, the voice almost inaudible; and sometimes immediately before or after death a quantity of dark-colored fluid flows freely from the mouth and nose.

Occasionally the acute symptoms of peritonitis subside, leaving the patient prostrate with some localized collection of fluid. This may burst and find its way into some hollow organ, and recovery eventually ensue, or death may be caused by pyæmia, septicæmia, or exhaustion. Although a case of limited traumatic peritonitis may, if the patient be of vigorous constitution and the treatment judicious, terminate favorably, death may occur at any period after recovery from the effects of adhesions or bands, the products of inflammation. Complete intestinal obstruction is occasionally the result of these adhesions.

Treatment.—Of course, absolute rest in such a posture as to diminish abdominal tension is of paramount importance.

Local bleeding, which is only of use in the early stage, and vastly preferable to venesection, may be secured by the application of twenty or thirty leeches. Depletion, though valuable in acute traumatic peritonitis, is contra-indicated in those asthenic forms of inflammation which follow hernia, ovariectomy, or other operations. Hot fomentations are also of great service in relieving pain, especially when supplemented by opium or belladonna.

Ice-cold compresses over the abdomen may prove beneficial in the early stage, but must on no account be tried in the later stages. Subsequently, blisters,

iodine, or mercury may be useful in tending to promote absorption. Grain doses of opium should be given every few hours to relieve pain and quiet the stomach and intestines. Morphia may be subcutaneously injected, but opium must be administered with great caution in the cases of young children or the subjects of renal disease. In young subjects of sthenic inflammation calomel may with advantage be combined with the opium in grain doses. Vomiting is best checked by hydrocyanic acid and ice. Constipation must be tolerated for a few days, and then relieved by enemata. No food, save a little iced milk, is needed for the first forty-eight hours; then thick beef-tea may be given in teaspoonfuls at frequent intervals. If the stomach is very irritable, two ounces of beef-tea may be injected every six hours. Great depression indicates the necessity for wine or brandy. As convalescence advances the diet may become more liberal.

Peritoneal and Retro-Peritoneal Extravasation.—Extravasation into the subperitoneal or retro-peritoneal tissues may consist of air, blood, urine, fæces, or pus.

Air.—The source of the air is not always traceable, but its distribution is often very extensive. Wounds of the loins, groins, and perineum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs with lung injury may be the cause of extravasation of air.

Decomposition may in some cases explain the presence of gas. Retro-peritoneal abscess opening into the bowel may of course give rise to it.

Blood.—Effusion of blood may result from injury to an artery or vein, or to capillaries. Extravasation with the formation of a hematoma which may ultimately break down and suppurate, is very apt to follow violence inflicted upon the loin or pelvis. Lumbar injuries may cause blood effusion beneath the capsule of the kidney.

Some of the most frequent hemorrhages into the pelvis are those known as subperitoneal or encysted pelvic hematoceles, which by a vaginal or rectal examination will be revealed as a soft, smooth, and elastic or fluctuating mass fixing or displacing the uterus. As the extravasation increases, there are fullness, dullness, and tenderness with a sense of resistance in the hypogastrium and iliac

fossa, or in the latter region alone. There is a sense of bearing down with tenesmus of the rectum and frequent desire to micturate; only a little mucus, however, is expelled from the rectum, and there is retention of urine. Occasionally the posterior vaginal wall is pressed as low as the perineum by the enormous extravasation beneath the peritoneum in Douglas's pouch. The effused blood becomes gradually more solid and the tumor irregular, and it is either slowly absorbed, or after consolidation it may disintegrate and soften, giving rise to symptoms of retro-peritoneal suppuration.

The *sources* of blood vary in the different regions; sometimes it is derived from one of the venous plexuses, namely, uterine, ovarian, hemorrhoidal, vesical, or prostatic, or from one of the corresponding arterial branches. Rupture of muscular fasciculi, as in the case of the psoas, iliacus, or quadratus lumborum, sometimes causes free hemorrhage. The bursting of an aneurism of the abdominal aorta is occasionally the cause of extensive retro-peritoneal hemorrhage. There is rarely any pulsation in such swellings, and the diagnosis is next to impossible. Erosion of the vertebræ from aneurismal pressure might lead to a suspicion of lumbar caries with abscess, but to open such a tumor on mere supposition would be a very rash proceeding, and might prove fatal.

The mode of death in cases of peritoneal extravasation dependent on aneurismal lesion may be from peritonitis or syncope, but more generally from anæmia.

Urine.—Extravasation of urine into the retro-peritoneal tissue of the loin may be caused by ulceration, wound, or rupture of the kidney or its pelvis; or by ulceration of the ureter from pressure of a morbid growth. Into the subperitoneal tissue of the pelvis, urine escapes from the bladder after rupture; or through an ulcerous or fistulous syphilitic opening arising either within or outside the bladder walls. The effusion may extend widely, displacing and pushing forward the overlying viscera. The inflammation thus excited may run on to suppuration with pointing in the loin or groin, or the cellulitis may become chronic, and, spreading slowly toward the iliac fossa, cause contraction of the ilio-psoas muscle. In some instances the urine which has been effused becomes encapsuled within a thick-walled

cyst with which the kidney communicates at its point of rupture. The urine contained in such a cavity is deficient in urea, and therefore less irritating than normal urine; occasionally, however, the urea is in excess. Urine may escape from a wounded kidney so slowly that weeks or even months may elapse before the amount of local swelling is sufficient to suggest extravasation, or in the absence of hematuria, even to indicate renal lesion.

After rupture of the bladder, urine diffuses itself widely in the pelvis, or spreads over the front of the abdomen, or descending along the course of the obturator vessels, invades the thigh. Acute peritonitis generally proves fatal in the course of a few days, or pus may form and be discharged into the peritoneal cavity, bladder, or rectum.

Fæces.—In consequences of injury or ulceration, fæces may escape into the retro-peritoneal tissues from the ascending and descending colon, the cæcum, the sigmoid flexure, the rectum, and the second and third parts of the duodenum. Fæces may escape into the cellular tissues from any other portion of the bowel, if adhesions have previously fixed it to the parietal peritoneum. Cancerous, tuberculous, dysenteric, and other forms of ulcer; obstruction followed by ulceration, and abscess opening into the bowel, are common causes of fecal extravasation; penetrating wounds are also occasional causes.

When a *fecal abscess* has been recognized and properly treated by laying it open and irrigating it, or when it has spontaneously ruptured into the bowel or bladder, the prognosis must depend largely upon the cause of the extravasation. If due to simple ulceration or violence, and beginning outside the bowel, there is hope of recovery, even without a permanent fecal fistula. If, on the other hand, it originate in tubercle or cancer; from adhesions resulting in obstruction; from caries of bone or some inveterate disease of the uterine appendages, death from blood poisoning, exhaustion, or acute general peritonitis will be the inevitable result. HENRY MORRIS.

Symptomatic Indications.—In all contused wounds, external or internal bruises, *arnica* is the leading remedy, especially valuable in contusions and lacerations of the muscular fiber, and will often be the only remedy required. In connection

with its internal administration, cloths wet with dilute infusion may be laid over the wound. When laceration is present as well as contusion the *arnica* may be advantageously replaced by *calendula*; applied externally in the proportion of one part of the tincture to twenty parts of water, it promotes healing and prevents suppuration. For the severe pain in lacerated wounds involving sentient nerves *hypericum* has a special value, allaying the pain and preventing trismus. When inflammation follows upon recent injuries *aconite* will be required, the indication for its administration being sthenic fever, with nervous excitability; *belladonna* being more appropriate when the injured part is very painful and swollen, with congestive headache. Should suppuration become inevitable *calcium sulphide* will prove effective, promoting and controlling suppurative process. For the peritonitis consequent upon injury, *aconite* is the principal remedy in the early stage with predominance of febrile symptoms. It may be advantageously followed by *bryonia* when the fever relaxes and effusion threatens. *Mercurius corrosivus* may prove valuable in later stage when there is tendency to fibrinous exudation; especially useful in scrofulous cases.

ABDOMINAL TUMORS, Diagnosis.—In the clinical sense, the term of "abdominal tumor" is of wide significance. It comprises any condition that causes general or partial enlargement of the belly, and is not limited to new growths or cysts. The diagnosis, of the nature of an abdominal swelling, intumescence, or tumor, is often a matter of difficulty by the methods of physical examination available. So great is this difficulty that it has been said that nothing short of actual inspection, after opening the abdominal cavity, can lead to a correct diagnosis. The main difficulties encountered in these cases are due to: 1. The great variations in the form and size of the abdomen in normal conditions. 2. Thickness of abdominal walls from excessive accumulation of subcutaneous fat, and rigidity of the wall from contraction of its muscles. 3. The simulation of true tumors by transient states known as "phantom" tumors. 4. The close proximity of some of the organs to one another, and the variable limits of the

hollow viscera, rendering it difficult to localize the tumor. 5. The very great variety of conditions that, on abdominal inspection, palpation, and percussion, yields the signs of a tumor.

In dealing with this subject, we shall speak of conditions coming under the head of abdominal tumor as arising in connection with (1) the abdominal parietes, (2) the peritoneum and subperitoneal tissue, (3) the several abdominal and pelvic viscera, (4) the pelvic bones, and add a few words concerning (5) abdominal aneurism and (6) phantom tumors. For fuller details and treatment of any of these morbid conditions reference must be made to articles specially dealing with them.

I. Tumors, etc., arising in the abdominal wall.—These often closely simulate tumors lodged within the abdominal cavity. They include swellings produced by extravasation of blood beneath the skin, or between the muscles, or within the sheath of the rectus. Such a *hematoma* may arise from injury to the belly, as a blow or sudden violent strain, causing rupture of muscle fibers; or from the spontaneous rupture of a muscle, preferably the rectus, which has undergone Zenker's degeneration, which is liable to occur in cases of continued or high fever. It is not uncommon in typhoid fever or acute pneumonia, from the patient leaping out of bed in a fit of delirium. The muscular fibers are rendered extremely brittle by this change, and hence readily give way if the muscle be forcibly contracted. The occurrence of this lesion and the resulting hemorrhage may not be suspected during life, but occasionally it is declared by the appearance of a firm, defined, and tender swelling in the abdominal wall, on one or other side of the middle line, and generally below the umbilicus. There is mostly no discoloration of the skin, the effusion being confined within the dense fascial sheath. If the case do not end fatally from the fever, the swelling will be observed to become softer, and will probably suppurate. In other cases there may be a history of injury to aid in diagnosis. Blood may also be effused into the abdominal parietes by the rupture of an abdominal aneurism when this takes place posteriorly and allows of the gradual escape of blood into the tissues. In such a case of "diffuse aneurism" there

may appear a swelling in the flank which will gradually extend forward, and both to palpation and percussion give the signs of a tumor. Should the hemorrhage cease, the anterior margin of the swelling will become more defined, while here and there its surface may become soft and fluctuating. The appearance of such a tumor may precede by some days the final rupture.

In connection with this subject of *infiltrations* in the abdominal wall may be mentioned a condition not infrequently met with in cases of tubercular peritonitis in children. This is a peculiar induration, confined to various parts of the wall, which, on palpation, feels hard and rigid, suggestive of contracted muscles. But the hardness remains when the muscles are relaxed by an anæsthetic. The condition cannot be mistaken for scleroderma, for the induration is obviously deeper than the skin. It is possibly due to some inflammatory effusion into the subperitoneal or other tissues of the abdominal wall; it may gradually disappear.

Abscesses may arise in the abdominal wall from causes similar to those producing hematmata. Thus one of the commonest is as a sequel of rupture or inflammation of a muscle due to violent and sudden effort or strain; and here again the rectus is the muscle most commonly involved. Or a violent blow on the surface may lead to localized inflammation and suppuration. As distinguished from such primary abscesses, the parietes may be invaded by the extension to the surface of deeply seated abscesses connected with caries of spine, rib, or pelvic bones, or from inflammation around the cæcum, kidney, gall-bladder, or other viscus (*e. g.*, fecal abscess), or as the result of pelvic cellulitis, etc. In all cases of abscess in the wall its possible origin in deeper parts must therefore be borne in mind. It is not always easy to determine that an abscess is limited to the wall, especially as it is often beneath the superficial fascia or muscles. Such an abscess forms generally a smooth, rounded swelling, elastic, mostly tender, frequently painful, although, if it be quiescent, this latter symptom may be absent. Fluctuation can generally, but not invariably be obtained. If the abscess be extending, then, besides hectic and other signs of active suppuration, there will probably be some redness and œdema of

skin over the swelling. In every doubtful case the abdomen should be carefully palpated under chloroform, no more forcible manipulation being used than if the patient were not anæsthetized. The diagnosis may only be reached by a process of exclusion, for such an abscess has been mistaken for hydatid, or intussusception—even for aneurism, when seated over the aorta or an iliac artery, the pulsation of the vessel being transmitted through the abscess. In the last named case it is well to palpate the swelling when the patient is in the knee-elbow posture, when the pulsation will be found to cease. To distinguish it from a solid tumor in the wall it may be necessary to make an exploratory puncture with a grooved needle or the aspirator. The fact that the abscess contains gas does not necessarily mean that it is directly or indirectly connected with stomach or bowel, for there is no doubt that the contents of a deep-seated abscess in the wall, in contact with the intestines, may putrefy. It is needless to point out the risk of leaving an abscess in this situation unopened—viz., the liability to rupture into the peritoneal cavity.

Cases of *simple cyst* in the abdominal wall have been described, and require mention, although the condition is a very rare one. It is analogous to the congenital cystic hygromata occasionally met with in the neck and elsewhere. Such cysts may attain a large size.

Besides the forms of new growth arising in the skin or subcutaneous tissue (*molluscum fibrosum*, lipoma, etc.) the abdominal wall may be the seat of *tumors* starting from the fasciæ or embedded in the substance of the muscles. Here again the rectus and its sheath are the structures most frequently involved. Gummata may occur in the muscle; fibromata, myxomata, or sarcomata in the fascia. Such cases are of interest from the manner in which they simulate tumors within the abdominal cavity. The points to be noted in differentiating them are the following: (1) The relation of the tumor to the abdominal muscles as causing the patient to contract the muscle, and observing whether the tumor becomes more or less apparent during the contraction. Of course, if the growth in the wall be beneath the muscle, it will be concealed by the contracted muscle, and the test is therefore not absolutely certain to exclude an intra-

abdominal growth. (2) By palpation when the patient is on his hands and knees the parietal growth becomes more easily felt, and its freedom from deep connections may be ascertained. (3) In many cases examination has to be made under chloroform.

II. Tumors, etc., connected with the peritoneum and subperitoneal tissues.

—There are many conditions, inflammatory and neoplastic, involving the peritoneum or its subjacent connective tissue, which fall under the head of abdominal tumors. But inasmuch as the serous sac lines the whole of the cavity, there are also certain of its lesions which produce a general enlargement of the abdomen. Such conditions are those in which there is effusion of fluid or gas into the peritoneal sac, and they may be first briefly referred to.

Under the general term *ascites*, it is usual to include all serous effusions into the peritoneum, dropsical or inflammatory. The former occur in cases of obstructed portal circulation, as in cirrhosis of the liver, or as part of a general cardiac dropsy, or of renal dropsy; the latter are met with in some cases of chronic peritonitis, and especially in tubercular or malignant disease of the peritoneum, the effusion in some of the latter cases being perhaps partly due to pressure on the portal vein by enlarged glands. There is seldom much difficulty in the diagnosis of ascites, except where the effusion is scanty or is contained in loculi formed by adhesions at various points. In a well marked case the belly is uniformly enlarged, the flanks full, there is free fluctuation to be obtained across the abdomen, and, on percussion, there is dullness in each flank and over the lower half or more of the anterior wall when the patient is in the recumbent position, the dullness shifting with the position of the body. In cases when the intestines are distended with flatus and fluid fæces, this shifting dullness may be obtained without there being any fluid in the peritoneal sac; but it may be safely said that the sign of shifting dullness is almost pathognomonic of ascites. It is less easy to be certain of the peritoneal origin of a loculated or encysted collection of fluid, since in that case the flank may be resonant and the area of dullness may not alter with the position of the body. The condition most likely to be mistaken for

ascites is a large unilocular ovarian cyst (ovarian dropsy). The shape of the abdomen, the resonant note in the flanks, and the history of the case, will aid in the differentiation.

In cases of perforation of the stomach or intestine the belly may become distended by the escape of *gas* into the peritoneum. This may almost invariably be distinguished from tympanites due to extreme flatulent distension of the intestines by the *entire* disappearance of the hepatic dullness caused by the gas collecting between the liver and parietes. It is sometimes of great importance, with regard to treatment, to determine the fact of perforation, and this sign may be fully relied on.

Tubercular disease of the peritoneum is characterized, so far as abdominal examination goes, by various signs. In many cases there is nothing to be made out on palpation. There is generally some fluid effusion, sometimes in considerable amount, but, owing to matting of intestines, the fluid may be collected in different places, and thus the characteristic signs of ascites may not be present. However, in several cases there is typical ascites. The matting together of the intestines is often indicated in the emaciated subjects of this affection by the detection on palpation of irregular, but resonant, tumors in various parts, or by the occurrence of ridges and masses of irregular shape, especially in the umbilical region, when the omentum is infiltrated. The presence of such tumors aids the diagnosis, but more value attaches to collateral evidence—*e.g.*, the age of the patient, family predisposition to tubercle, remittent pyrexia, pain and tenderness in the abdomen, diarrhea (often absent), and in many cases the concomitance of signs of pulmonary phthisis.

Malignant disease of the peritoneum is usually secondary to cancer of one of the abdominal or pelvic organs, but the disease may not have attracted attention until the peritoneum has become involved, and in some cases the primary cancer is quite latent. As with tubercle, so here the main signs may be those of ascites, which can be of excessive amount, necessitating paracentesis. In that event the character of the fluid that is withdrawn is suggestive, for in peritoneal cancer it is often bloodstained, and microscopical examination may reveal in it

great abundance of epithelioid cell-forms. After paracentesis, palpation may detect masses and irregular tumors in the abdomen. The history of the case is of course of considerable importance in diagnosis, which mainly rests between this disease and cirrhosis of the liver. There are two forms of abdominal cancer in which the signs are generally fairly obvious. These are cancer of the omentum and colloid cancer of the peritoneum. When the omentum is affected it becomes thickened and contracted, forming a large lobulated mass with irregular margins situated in the lower epigastric and the umbilical regions. It is well defined, dull on light percussion, and generally separated from the hepatic area by a strip of resonance. The coexistence of such a tumor in an elderly subject with ascites (and perhaps jaundice also), and a history of progressive emaciation and pain, would justify the diagnosis of omental cancer. On the other hand, the omentum may not be retracted as stated, but infiltrated in its whole extent so as to present a wide area of dullness reaching in the median line from xiphoid to pubes; and in such a case the diagnosis from malignant ovarian disease is very difficult. As regards colloid cancer, the greater part of the belly may be occupied by irregular masses separated by areas of resonance, the masses being more or less nodular and even distinctly elastic to the touch.

Tumors arising in the *mesentery* and in the *retro-peritoneal glands* may be found on palpation to be rounded, lobulated, but may not yield dullness, being overlaid by the intestine. The retro-peritoneal growths are moreover fixed, and cannot be moved by pressure or influenced by the movements of the diaphragm. In their case the diagnosis has to be made from renal tumors (*q. v.*) and from growths connected with the lumbar spine.

Passing now to consider inflammatory conditions of limited extent and involving the subperitoneal tissue as well as the serous membrane itself, the most notable and common is that described under the head of *perityphlitis*. This condition, which arises in the vast majority of cases from ulcerative perforation of the vermiform appendix, is mostly a localized peritonitis or peritoneal abscess, so that what applies to it may be applied to such abscesses in general. For it is not every

case of perforated appendix that leads to general and fatal peritonitis. Perityphlitis is characterized by pain and tenderness in the right iliac fossa, where may be felt an area of resistance, and often a fairly well defined swelling in the same region, which yields a dull note on percussion. In cases that proceed to suppuration, further signs appear, as redness and inflammatory œdema of the skin, followed by boggy, and perhaps the crepitation of subcutaneous emphysema. In other cases the abscess, instead of pointing externally, will burrow down into the pelvis and ultimately open into the rectum or bladder, or make its way in the deep layers of the abdominal wall even as high as the diaphragm. As to other abdominal abscesses, they may be found in almost any part of the belly, being, however, mostly the result of perforation of intestine, stomach, or gall-bladder, especially where such perforation has been so gradual as to have given time for the formation of peritonitic adhesions between adjacent coils of intestine, and thus to limit the focus of suppuration. A perityphlitic abscess may be confounded with a fecal tumor or a tumor of the cæcum, but the history of the case, the pyrexia, and the evidence of local inflammation will generally enable a correct diagnosis to be formed. It is only where a perityphlitis persists for a long time without resolving or suppurating that a doubt may arise as to the correctness of the original diagnosis. Sometimes a perinephritic abscess on the right side may invade the iliac region, but its extension from the loin and the history of renal symptoms suffice to distinguish it.

It may also be well to mention that a *pelvic hematocoele* or a *pelvic cellulitis* may extend beyond the limits of the true pelvis and occupy the iliac fossa. In such cases, apart from the history, the result of vaginal examination will furnish facts for a diagnosis, by permitting of the detection of the swelling in Douglas's fossa and the displacement or fixation of the uterus.

III. Tumors, etc., connected with the abdominal viscera.—I. STOMACH.—A *dilated stomach* may cause a marked prominence in the epigastric and left hypochondriac regions, so that the outline of the greater curvature of the viscus can be readily seen. In chronic dilatation the organ often assumes a lower

position than normal, and the epigastric region may then be flat instead of rounded. On percussion a full tympanitic note is yielded by the swelling, while, if there be much fluid contents, a marked splashing can be produced by suddenly palpating it.

Not every *new growth of the stomach* is to be detected by physical exploration; its presence can often only be inferred by the symptoms and course of the disease. But the existence of an obvious tumor materially favors the diagnosis. Thus, cancer of the cardiac orifice is beyond the sphere of external observation, and its symptoms are those of œsophageal obstruction; cancer of the pylorus can generally be detected by palpation, and it is accompanied by gastric dilatation. In either case there is extreme emaciation, rendering palpation easy. Scirrhus, the commonest form of pyloric cancer, may be felt during life as a hard nodule in the right of the epigastrium or the contiguous part of the hypochondrium. It is fixed, and indeed is frequently adherent to neighboring organs, as liver or pancreas, being sometimes quite concealed by the former. If the new growth, cancerous or not, be seated in the anterior wall of the viscus, or near the greater curvature, it is far more mobile, provided that it has not progressed so far as to have caused the stomach to become adherent to the abdominal wall. Indeed, such a tumor may alter its relative position from time to time—according to the varying state of distension of the viscus. It is usually held to be distinctive of gastric tumors, as contrasted with those of the liver (left lobe), that they are but little, if at all, influenced by the movements of the diaphragm. This is not absolutely the case, for certainly there may be some descent of such a tumor with inspiration, although the movement may not be so great as that of the liver itself. It is impossible to distinguish a gastric from a hepatic tumor if the former be adherent to the liver, for in that case the strip of resonance, which otherwise may occur between the tumor and the area of the liver dullness, does not exist. The tumor in the gastric wall varies in its degree of dullness with the distension of the stomach.

In not a few cases of simple *pyloric stricture* or *chronic ulcer* a nodular tumor may be felt, simulating a new

growth, and a correct diagnosis can only be based upon the long duration of the symptoms, since in either case there is marked cachexia with general wasting. In the very emaciated subject of such disease even the normal pancreas may be mistaken on palpation for a growth in the stomach.

2. **INTESTINE** (omitting Hernial tumors).—*Flatulent distension* of the intestines gives rise to more or less general enlargement of the abdomen; it is more marked in the colon as a rule; but in cases where the small intestines alone are distended, as in obstruction at the cæcum or above, then the flanks will appear flattened in comparison with the great prominence of the rest of the belly. In acute peritonitis the whole of the bowels may be distended, and the tense abdominal wall give a tympanitic note on percussion.

Apart from this condition there are three widely different causes of intestinal trouble productive of definite localized swellings or tumors.

1. *Fæcal accumulation*.—In every case of suspected abdominal tumor the possibility of its being a mere fecal tumor must be borne in mind; hence it is always advisable to thoroughly clear out the bowels before arriving at a conclusion as to any abdominal tumor. A fecal tumor consists in the lodgment in the large intestine of a mass of inspissated fæces. It may occur in the cæcum, giving rise to a swelling which has to be distinguished from the graver condition of typhlitis; the tumor is well defined, and not usually tender; it may be indented to a certain extent by the finger. Or it may be formed in any part of the colon, of which the sacculi, especially if the gut be dilated, afford convenient receptacles for such a lodgment of fæces without interfering with the daily evacuation. The sigmoid flexure is a favorite seat, and it must be remembered that this portion of bowel is prone to great variation in its position, according to the length of the mesosigmoid; sometimes it lies on the right of the middle line. Similarly, the transverse colon may be considerably displaced, forming quite a U-shaped curve with the convexity approaching the pubes. Such changes in the position of the colon account for the appearance of these fecal tumors in various parts of the abdomen not occupied

by the large bowel when normally situated. The tumor may be considerably below the umbilicus, and yet be formed in the transverse colon. A fecal tumor is easily grasped, dull on percussion, and sometimes has a manifestly doughy consistence, but the diagnosis requires for its confirmation the frequent administration of large enemata. Even then it may take some time to reduce its size or effect its dislodgment, and in some cases its gradual onward passage along the colon can be traced on palpation from day to day. The conditions for which such a tumor is liable to be mistaken are intussusception or an intestinal growth.

II. *Intussusception*, when present, is of characteristic shape, from the fact that it is formed by the invagination of a segment of gut into the portion just beyond it. Although no part of the bowel is exempt from such an occurrence, yet the most common variety is that in which the invagination begins at the ileo-cæcal valve, the ileum and cæcum being intussuscepted into the colon. Hence the usual site for the smooth, sausage-shaped tumor to occupy is either the right lumbar region or transversely across the belly in the upper part of the umbilical region. Yet in some cases it may even be formed on the left side, and the intussuscepted portion be felt *per rectum*. The diagnosis does not depend merely upon the presence of the tumor, but is largely based upon the history of the attack and the occurrence of symptoms of obstruction, of melæna, etc. It is in cases of so-called chronic intussusception that most difficulty arises, for in such cases the collateral evidence may be wanting to confirm the view taken as to the nature of the tumor (*see* INTESTINAL OBSTRUCTION).

III. *New growths of the intestine* are not very common. Those that are least rare seldom attain a size sufficient to render them palpable, or else they are seated in regions beyond the reach of the hand. Thus the commonest are the limited epitheliomata that are met with chiefly in the large intestine at the several flexures, where they form annular ulcers, and are a main cause of chronic obstruction. The same kind of malignant growth may occur in the cæcum, where also other varieties of tumor are met with; the diagnosis has to be made, not only from fecal tumor or intus-

susception, but also from peri-typhlitis; here the history of the case is quite as useful in differentiation as the determination of the presence of a swelling. In malignant disease the existence of enlarged glands or of œdema of the lower limb may assist in diagnosis. Much more rarely do we meet with cases of tumor (simple or malignant) in the small intestine. Such may be detected on palpation in any of the abdominal regions below the umbilicus, rarely above that level.

3. LIVER AND GALL-BLADDER.—The general characters of a tumor connected with the liver consist in its being situated in the right hypochondrium or epigastrium, in its accompanying the liver in its movements during the act of respiration, in the dullness obtained over the swelling being conterminous with that of the liver, and in some cases in its association with jaundice. An enlarged liver forms the most common variety of abdominal tumor.

Chronic uniform enlargement, such as that due to chronic congestion of cardiac disease, or to hypertrophic cirrhosis, fatty infiltration, waxy degeneration, or leukæmic infiltration, need merely be mentioned; and the signs elicited by palpation and percussion are plain. The conditions with which they may be confounded are not those of other abdominal tumors, but rather with downward displacement of the organ itself.

Distortion of the liver may produce swellings that may be mistaken for true tumors. The liver is sometimes remarkably deformed by the practice of habitual tight-lacing—so that in extreme cases a considerable portion of the organ may be felt below the ribs as a hard, resisting, somewhat rounded tumor. Again, in syphilitic perihepatitis the liver may be greatly distorted, and present on its surface more or less large bosses which might be mistaken for malignant tumors.

Cysts and abscesses.—These fluid tumors are smooth, elastic, and, if not too deeply seated in the substance of the organ, fluctuating. It is well to remember that even a fatty liver or some other condition (as leukæmia), while involving the whole organ, may by some local bulging give rise to an elastic swelling, and therefore a diagnosis may not be possible unless the swelling has been explored by a grooved needle or fine trocar.

Simple cysts are too rare to require detailed notice; prior to exploration, they will probably be taken for hydatid cysts. The characters of *hydatid tumor* are only manifest when the cyst projects above the surface of the liver; but in cases where the hydatid is lodged deeply in the substance of the organ, the latter is more enlarged as a whole, or rather there is disproportionate size of the lobe involved. In some cases the cyst only just presents on the surface, and then it gives the impression of a solid, nodular growth. But, in the more ordinary event it forms a smooth, elastic, round, or oval swelling, which, both by palpation and percussion, can be proved to be intimately connected with the liver. The so-called "hydatid fremitus" is a modified sense of fluctuation, sometimes obtained by placing the palm of one hand upon the tumor, and striking the dorsum with the fingers of the other hand; a tremor or thrill is thereby perceived, this being doubtless due to the physical conditions of a cyst containing fluid, and provided with a tense, elastic wall. An exploratory puncture is necessary to establish the diagnosis, when the characteristic clear, thin, non-albuminous fluid will be withdrawn, containing, perhaps, scolices, hooklets, or shreds of laminated membrane. If suppuration has taken place, the presence of pus is, of course, at once perceived. A degenerate and shriveled hydatid is clinically indistinguishable from a solid growth (*see* HYDATID).

A *solitary abscess* of the liver may point below the ribs and appear in the hypochondrium as a prominent swelling, through which fluctuation may readily be obtained. The history of the case and the concomitant symptoms are of importance, and aspiration should be employed as an aid to diagnosis. In many cases, however, the abscess does not so project, but declares its presence by causing enlargement of the liver and other signs, the consideration of which does not come within the scope of this article.

The forms of *solid tumor* met with in the liver include syphilitic gummata and various kinds of malignant growth, the latter being mostly secondary to disease of other parts. Gummata seldom attain any large size; they may project from the surface of one or other lobe as a hard nodule, which, from its persistence

without much change in size or affection of the general nutrition, is to be distinguished from a cancerous growth. Under antisyphilitic treatment the tumor may entirely disappear. Cancer of the liver is mostly secondary, and generally multiple. The organ is greatly enlarged, and numerous rounded, bossy prominences are to be felt on its surface; or—and this is more common in cases of primary cancer—there is one large firm tumor bulging from the hepatic lobe. As a rule there is not much difficulty in the diagnosis, especially when, as often is the case, jaundice and ascites are present. In the latter event, if the effusion be not extreme, the liver can be palpated through the layer of fluid, which can be felt to be displaced. But many other kinds of abdominal tumor have been mistaken for hepatic growths—*e. g.*, fecal tumor in the transverse colon, tumor of the right adrenal, or right kidney, or growths arising in the perirenal tissues, or tumors of the stomach. In some of these cases a diagnosis is hardly to be made by physical examination alone.

Gall-bladder.—In consequence of obliteration of the cystic duct from impacted calculus, or stricture following ulceration, or compression from without upon this duct or the common bile duct, the gall-bladder may become greatly distended and appear beneath the margin of the liver as a pyriform or oval swelling in the situation of the viscus. Such a tumor is tense, smooth, and it may be possible to detect fluctuation in it.

The undistended gall-bladder is not palpable, so that if the viscus can be felt it must be enlarged. There may or may not be a history pointing to gall-stone or evidence of malignant disease. The smooth ovoidal tumor in this situation is quite characteristic, and can hardly be mistaken for any other form of tumor. The gall-bladder may also be the seat of primary cancer, and in that case a firm, rounded tumor, dull on percussion, is to be found projecting below the rest of the lower margin of the right hepatic lobe. By its position alone can its true nature be surmised, for in all essential characters it resembles a tumor of the liver. In some cases of malignant disease of the gall-bladder there is a history of previous attacks of biliary colic.

4. PANCREAS.—Owing to its somewhat deep situation in the abdomen be-

hind the stomach, an enlarged pancreas is not always palpable, while for the same reason the percussion note over it is resonant. In cases where the stomach is contracted and empty, however, even an unenlarged pancreas may be felt, especially at its head, its situation being to the right of the middle line at the upper part of the umbilical region. The only form of tumor that is likely to be met with is cancer of the organ, a disease which generally attacks the head of the pancreas; its hardness and fixity are distinguishing features; while, from its contiguity to the common bile duct, the growth generally is accompanied by obstructive jaundice. The tumors likely to be confounded with pancreatic are growths in the omentum or stomach; and if, as often happens, such growths have become adherent to adjacent structures, and are consequently no longer mobile, a positive diagnosis may be impossible. The occurrence of fat in the stools is said to indicate pancreatic disease, and recently attention has been drawn to the fact that the stools may become clay-colored in such cases, even although there may be no jaundice.

5. SPLEEN.—An enlarged spleen is for the most part readily detected by abdominal palpation. It is felt as a smooth tumor passing forward from beneath the ribs into the left hypochondrium; its margin may be somewhat sharp or rounded, and the characteristic notch in its anterior border can often be detected. On percussion the abdominal swelling is found to be conterminous with the area of splenic dullness in the lower axillary region, while the fact that the tumor is superficial to the colon affords further proof of its nature. Moreover, the spleen accompanies the diaphragm in its movements. The conditions causing enlargement of this organ include the swelling met with in typhoid and septic fevers, in malaria, from chronic congestion, waxy disease, leukokythæmia, etc. (*see* DIS. OF SPLEEN). Localized tumors are not common; they include hydatid cysts and malignant growths. Occasionally the spleen is movable, but it retains its characteristic shape, and can be pushed upward and backward into its normal position.

6. KIDNEY.—The kidneys are, in moderately thin subjects, easily palpated, the surest way being to support the or-

gan by means of one hand placed in the flank, while palpating the anterior margin and surface with the other hand. An enlarged kidney or a renal tumor may be diagnosed as such if the following characters are present: The surface and margin are smooth, the latter being rounded and thick. There is resonance over the anterior half of the tumor, owing to the relation borne to the kidney by the colon. Then such a tumor is unaffected by the movements of respiration, and, indeed, except in the case of a movable kidney, its situation is fixed. These points may serve to distinguish a renal from a splenic tumor. The occurrence of urinary symptoms of course would materially aid in the differential diagnosis, but such symptoms are often absent.

Hypertrophy of one kidney—which may occur as compensatory to atrophy or congenital absence of its fellow-organ—may render the kidney more readily palpable than it normally is, but the actual diagnosis of this condition is seldom determined during life.

One or both kidneys may be *movable*—that is, from the laxity of the fatty tissue around the organ, or the wasting of this tissue, the kidney may become gradually capable of being displaced from its bed according to the position of the patient, or it may readily be so displaced by manipulation. The majority of instances are met with in women who have borne many children, and in whom, therefore, the abdominal walls are remarkably lax. The practice of tight-lacing has by some been held responsible for displacement of the kidney, especially the right one. The right kidney is more frequently mobile than the left, but in the same subject both may present this abnormality. Sometimes the condition gives rise to considerable discomfort or inexplicable pains. The diagnosis rests upon the following points: (1) The detection of a smooth, firm tumor in the abdomen, of the shape and size of a kidney, and capable of being moved between the hands; (2) although lying, perhaps, close to the middle line of the body, it may be pushed backward into the loin; (3) when the patient is lying prone, a distant hollow is to be seen in the lumbar region, where the kidney ought to lodge, and a resonant note may be found to have replaced the normal area of kidney dullness; (4) the patient will experience a peculiar

sensation when the organ is compressed by the hand. The only other mobile tumors likely to be mistaken for a movable kidney are fibroid tumors of the uterus, which are subperitoneal, are furnished with a long pedicle, and are of the size of the kidney. Ovarian tumors under similar conditions may also simulate movable kidney. Nevertheless, the latter has sometimes been mistaken for a fecal tumor, or a tumor of the liver, gall-bladder, etc.

When, in consequence of obstruction to the overflow of urine, the pelvis and calyces of a kidney become dilated and distended with urine (*hydro-nephrosis*) or pus (*pyo-nephrosis*), the condition is characterized clinically by the appearance in the lumbar region of the abdomen of a prominent swelling, which may extend as far forward as the umbilicus, or even beyond it. The tumor is smooth, elastic, or fluctuating, rounded, or fixed; perhaps it is dull over its whole extent, or anteriorly the resonance of the intestine may limit the percussion area. In some such cases additional evidence of its true nature may be afforded by the tumor alternately increasing and dwindling in size; the latter event being accompanied by an unusual increase in the flow of urine or in the amount of pus that is discharged with the urine (intermitting hydro- or pyo-nephrosis).

Although widely differing in their pathological characters and in their clinical history, there is much resemblance in the characters of the tumor produced by *tubercular disease* of the kidney and that caused by *calculous pyelitis*. In either case a large tumor is to be felt in the loin, attended with pain of a constant, aching character. There may be manifest fullness in the loin, and the tumor may seem to be lobulated; it probably also appears to be solid, for although the kidney is really reduced more or less to the condition of a chambered sac containing pus, yet owing to the thickness of the chronically inflamed capsule, no evidence of the presence of fluid contents may be obtained. The perinephritis that so commonly results from these forms of suppurative disease of the kidney may itself pass on to suppuration, and an abscess be formed in the region of the tumor, or burrow in the abdominal wall, where its presence may be recognized. As to the differential diagnosis

between these two diseases, it must suffice here to point out that calculous pyelitis may be suspected if there has been a history of previous attacks of renal colic and hematuria; while in cases of tubercular kidney the symptom of pyuria (which is common to both conditions) may be associated with evidence of tubercle in other organs, as the lungs or intestines, or, if the patient be a male, in the other parts of the genito-urinary tract—*e. g.*, the vesiculæ seminales, spermatic cord, testes, bladder, or prostate. In either sex, if the ureter be involved, it may be possible to detect it as a thickened cord passing down from the region of the kidney.

Renal or perirenal *new growths* may attain considerable dimensions, and thus come into close contact with the neighboring organs, so as often to lead to much difficulty in diagnosis. This is especially the case with tumors of the right kidney, which may most closely simulate tumors of the liver, both to palpation and percussion. On the left side a renal tumor may mostly be differentiated from an enlarged spleen by the points already mentioned. It may be noted that one form of neoplasm—*viz.*, renal sarcoma—is especially common in early life; otherwise renal cancer occurs in old subjects, like cancer elsewhere. A history of hematuria is not always to be obtained, for the growth in its progress may have blocked the ureter. The advancing emaciation without pyrexia, and the age of the patient, may assist in the differentiation of cancer from tubercular disease. Perirenal tumors (generally myxomata) are rare, and the absence of any renal symptoms with them may quite obscure their diagnosis.

7. SUPRARENAL CAPSULE.—The position of the suprarenal capsules renders it practically impossible to determine whether an abdominal tumor in either hypochondrium has arisen from one of these organs. During life such growths present the characters of tumors of the liver and kidney; and, as they do not produce any symptoms referable to the organ in which they are seated (for cancer of the adrenals does not produce the symptoms of Addison's disease), there are no criteria upon which to rely for their diagnosis.

8. FEMALE PELVIC ORGANS.—Tumors arising in connection with the

ovaries and uterus very often pass out of the narrow limits of the pelvis and occupy the abdominal cavity. Indeed they constitute by far the majority of abdominal tumors in the female sex.

First in importance and frequency are *ovarian* (and *par-ovarian*) *cysts*, which sometimes attain enormous proportions. They may be unilocular or multilocular. If the cyst be *unilocular* and of great size, it may form a tumor that reaches from the pubes nearly to the xiphoid, and may occupy an almost central position. As a rule the tumor displaces the intestines, and dullness may be elicited over the whole area of the cyst. Fluctuation may be easily obtained, the diagnosis from ascites being founded on the fact that the flanks are resonant, and that the dullness which may occupy the whole of the central regions does not shift with the position of the patient. More difficulty is experienced in the diagnosis when the case is complicated with ascites, and when some coils of intestine pass in front of the tumor with which they have become adherent. In cases where the cyst has not attained so large a size, the enlargement of the abdomen is less symmetrical, and both to inspection and to measurement one or other of the two halves of the lower segment of the abdomen will be found to be of larger size. The measurement is made by comparing on the two sides the distance between the umbilicus and antero-superior iliac spine. Then on inquiry it may be learnt that the swelling was at first more unilateral than it appears at the time of examination. In all cases of abdominal tumor in women a vaginal examination should be made; and in cases of ovarian tumor the uterus will probably be found to be drawn up or otherwise displaced by the tumor. In all cases, also, the precaution should be taken to empty the bladder and rectum before making an examination. If the cyst be *multilocular* the diagnosis may not be so easy. The tumor is then more lobulated, firm, and resisting in parts, elastic or fluctuating in others. A *dermoid cyst* would give the impression that one was dealing with a *solid growth*, while the latter are sometimes indistinguishable from large uterine fibroids.

The *tumors of the uterus* most likely to invade the abdominal cavity are the fibro-myomata, commonly known as fibroids—subperitoneal or intramural.

Such a tumor may be felt through the abdominal wall in the hypogastric and umbilical regions as a very solid, perhaps lobulated swelling, which may not be dull on percussion in its whole extent, owing to the intervention of coils of intestine between the tumor and the parietes at the upper part of the former. Much is to be learnt by a vaginal examination conjoined with abdominal palpation in the diagnosis of such cases.

The swelling formed by a *hydrosalpinx* or *pyosalpinx* may attain such a size as to be distinctly perceived in the iliac region, but the points in the differential diagnosis of such conditions will be found elsewhere. Nor need we do more than mention that an *extra-uterine pregnancy* gives rise to an abdominal tumor the true nature of which is largely inferred from the history of the case; or that the *enlarged uterus* in advanced *pregnancy* forms a tumor capable of being mistaken for a growth; but here again the history of the case, as well as the concomitant signs of pregnancy, seldom fail to enable the observer to arrive at a right conclusion.

IV. Tumors connected with bone.—A few words only will suffice to mention the features of new growths proceeding from the vertebral column or pelvis, and projecting into the abdominal cavity. Sarcomata, osteomata, enchondromata, and myxomata are the more common forms of new growth in this situation; and the ilium, sacrum, or sacro-iliac synchondrosis are perhaps the chief seats of origin. Their differentiation from tumors connected with the abdominal or pelvic viscera is determined mainly by their fixity, and in the latter case by the results of vaginal and rectal exploration. Most of these tumors also are very firm and unyielding, but there are cases recorded, especially in connection with the ilium, where a rapidly growing sarcoma has not only a softer character, but is even pulsatile. Tumors growing from the ilium or sacrum sometimes extend through the sciatic notch and appear upon the buttock. In such cases sciatica may be the chief symptom.

V. Abdominal Aneurism.—These are mostly saccular, and can be felt as more or less globular tumors generally seated in the umbilical region and to the left of the middle line. The distinctive characters of such a tumor consist in, *a.* its pulsatile nature, and particularly its lateral

expansion, as ascertained by placing the fingers of each hand on either side of the swelling, and noting their lateral divergence with each cardiac systole; *b.* the fixity of the tumor, so that it retains its position when the patient is on his hands and knees; *c.* the presence of a single or double bruit on auscultation over the swelling. In most cases the existence of resonance over the tumor proves that it is behind the intestines. If the sac be filled with clot, the tumor will feel firm, it will have no lateral pulsation, and will be indistinguishable from a tumor seated over the aorta. In cases of aneurism there is generally a history of pain in the abdomen or back due to the pressure of the advancing tumor. The simulation of aneurism by an abdominal abscess which pulsates by its contiguity with the vessel has been already mentioned. Another condition liable to be mistaken for aneurism is that of so-called pulsating aorta; this is met with in the subjects of dyspepsia, hypochondriasis, and other neurotic states; it may be a source of much discomfort to them. It is differentiated by the fact that the pulsation is diffuse; there is no definite tumor, no evidence of vascular disease elsewhere nor history of injury, and, on auscultation, no bruit is heard unless pressure be made on the vessel. It may be necessary to examine the case under chloroform, as the patient is very likely to keep the rectus muscle rigid, and the absence of a tumor cannot be positively affirmed unless free manipulation has been practiced.

VI. Phantom tumors.—The class of "*phantom tumors*" is of some interest in abdominal diagnosis. These are swellings, generally smooth and rounded, which may occur in any part of the belly, and may come and go like a movable kidney. Met with in hysterical or neurotic subjects, a *phantom tumor* may be mistaken for a fecal tumor, or even graver conditions. Percussion sometimes yields an imperfectly resonant or even dull note, and the patient may complain that the swelling is painful and tender. Produced by localized muscular contractions or by limited distension of intestine, such a tumor may disappear during sleep and under an anæsthetic.

The following classification is based upon the comparative frequency with which they produce respectively either a more or less general intumescence of the

abdomen, or a swelling limited to one or other of the abdominal regions.

A.—CONDITIONS PRODUCING GENERAL INTUMESCENCE.

Tympanites.

Ascites.

Chronic Peritonitis with Effusion.

Tubercular Peritonitis.

Cancer of Peritoneum.

To which may be added, as causing considerable enlargement extending over a great part of the abdomen:

Ovarian or Par-ovarian Cyst.

Fibroid Tumor of Uterus.

Gravid Uterus.

Distended Bladder (extreme).

B.—CONDITIONS PRODUCING PARTIAL OR LOCAL SWELLING.

a.—In Variable Regions.

Phantom Tumor.

Abscess or Tumor in Abdominal Wall.

Fecal Tumor.

Colloid Cancer of Peritoneum.

Peritoneal Abscess, or Limited Peritonitis.

Cancer of Intestine.

Intussusception of Intestine.

b.—Limited usually to Definite Regions.

1.—R. Hypochondrium.

Tumors of Liver and Gall-bladder.

Tumors of Right Kidney.

2.—L. Hypochondrium.

Tumors, etc., of Spleen.

" of Left Kidney.

3.—Epigastrium.

Tumors of Stomach.

" of Pancreas.

(In this region also an abdominal tumor may be simulated by a contracted rectus muscle or a phantom tumor.)

4.—Umbilical Region.

Extension of foregoing, (3), (2), and (1).

Cancer of Omentum.

Tubercular Glands.

Abdominal Aneurism.

Movable Kidney or Spleen.

5 and 6.—R. and L. Lumbar Regions.

Tumor, etc., of Kidney,

Perinephritic Abscess.

Enlarged Liver (R.) or Spleen (L.).

Cancer of Retro-peritoneal Glands.

- 7.—*R. Iliac Region.*
Typhlitis and Perityphlitis.
Cancer of Cæcum.

- 8.—*L. Iliac Region.*
Cancer of Sigmoid.

While there are common to either R. or L. Iliac Region such tumors as are formed by:

Ovarian Disease.
Pelvic Hematocele.
Pelvic Cellulitis.
Sarcoma, etc., of Ilium.

- 9.—*Hypogastrium.*
Tumor of Bladder.
“ of Uterus.
“ of Pelvis.

Pelvic Abscess, etc.

SIDNEY COUPLAND.

ABDOMEN, WOUNDS OF. Abdominal wounds are termed *penetrating* or *non-penetrating*, according as they involve or not the peritoneal cavity.

The *non-penetrating* wounds may, in the lumbar and hypogastric regions, be complicated by protruding or wounded viscera, without implication of the peritoneum. Such wounds, which are not very dangerous, are purposely made in operations on the colon and kidney.

Penetrating wounds, which, as a class, are far more serious than non-penetrating, may also be complicated with protrusion, and injury of the viscera. It is rather surrounding untoward circumstances than the mere fact of their perforating the peritoneum that contribute to render these wounds dangerous. Incised wounds of the abdomen are the simplest and most favorable; lacerated and contused wounds are the most tedious in recovery, and prone to be followed by suppuration and sloughing; and gun-shot wounds the most fatal.

Non-penetrating wounds of the abdomen.—These wounds may be either incised, punctured, lacerated, or contused.

They differ in no essential particular from like wounds in other parts of the body. The degree of gaping the wound presents will depend upon its situation and direction, and the extent to which subjacent muscles are divided. The gaping will be greatest when the cut is at right angles to the axis of the muscle fibers. Severe bleeding may occur from branches of the internal mammary, epigastric, and circumflex iliac arteries.

Inflammation of the deeper structures running on into suppuration, attended by typhoid symptoms, and not unfrequently proving fatal, almost certainly follows wounds inflicted with rusty, dirty, or blunt instruments. Among the first indications of inflammation are swelling of the wound, redness round its edges, cessation of previous discharge, and general abdominal tension. The constitutional symptoms are those of inflammatory fever, and the occurrence of rigors and vomiting is indicative of suppuration.

The treatment of these wounds is the same as that for like injuries elsewhere.

To one rule especial attention must be drawn. Never probe a punctured wound of the abdomen.

Penetrating wounds of the abdomen.

—These may be divided into (1) simple wounds; (2) wounds with protrusion of, but without injury to, the abdominal contents; (3) wounds with protrusion and injury; (4) wounds without protrusion of, but with injury to, the viscera.

The attitude and mental condition of the patient, and the external appearance of the wound, are often very fallacious standards whereby to estimate the extent and danger of an abdominal injury.

The wound, though on the surface simple, may be complicated by serious internal mischief; whereas a large lacerated surface lesion may not be attended with any damage to the deeper structures.

Simple penetrating wounds.—If a wound is narrow, or oblique, it is often very difficult to say whether it penetrates or not. In endeavoring to ascertain the fact of penetration, the relative size of the wound, and shape and size of the instrument, must be compared. The habit of body of the individual, whether corpulent or thin; as well as the site of the wound, whether in the epigastrium or flank; are points to be noticed. A lobule of protruding fat must not be mistaken for omentum. The inflammation excited by the wound results from some visceral injury and peritoneal extravasation, rather than from the admission of air, which used to be considered one great source of danger in penetrating wounds. The limited amount of inflammation following the majority of simple peritoneal wounds usually terminates by adhesion, which rapidly heals the injury. But occasionally the inflammatory action, instead of restricting itself to the lips of the wound,

extends over a wide area of the peritoneum, affecting the vital organs which it covers. It is the tendency to adhesion of its layers, possessed by the abdominal in common with other serous membranes when inflamed, that constitutes the means of cure. Constitutional disposition and visceral degeneration of course influence the character of the local inflammation. The symptoms, diagnosis, and treatment of traumatic peritonitis have been already fully described elsewhere.

Treatment.—Cases occur in which the desperate extent of laceration and injury negatives the chances of recovery in patients suffering from penetrating wounds. However hopeless the case may seem, it should not be given up as lost. The wound having been cleansed, bleeding checked, sutures inserted, and some light antiseptic dressing applied, the patient's posture should be such as to relax the abdominal muscles. The sutures, which should include the peritoneum, with the whole thickness of the parietes, should be passed from within outward. Sthenic inflammation in a plethoric subject should be treated by depletion. Low diet of a strictly fluid consistence should be given. Absolute rest is, of course, necessary; opium may be given to relieve pain, and enemata administered if requisite.

Penetrating wounds with protrusion of uninjured viscera.—The viscera which have the greatest tendency to protrude are the small intestine and the omentum. The duodenum is rarely protruded unless dragged with the stomach, and the cæcum and sigmoid flexure are less likely to escape than the transverse colon. Protrusion of the bladder has occasionally occurred. Cases of protrusion of the solid viscera are comparatively rare.

Treatment.—When the wound is recent and the protruded organ uninjured, it should be returned into the abdominal cavity without delay. The protruded parts should, if necessary, be cleansed with a gentle stream of warm milk and water. They should be returned methodically to their normal relative positions, and care must be taken not to force them between the different planes of the abdominal wall, or into the rectus sheath, or between the peritoneum and pelvic cellular tissue, instead of into the peritoneal cavity. The peritoneum in old people and in certain regions is very

easily detached, so that large portions of protruded viscera may be carelessly forced into such false sacs instead of into the abdomen.

If the narrowness of the aperture through which the structures protrude resists the efforts to return them, relaxation of the parietes should be secured, and retractors inserted to separate the margins of the opening. If such measures prove abortive, the aperture should be enlarged very carefully with a probe-pointed bistoury, the peritoneum being, if possible, spared.

If *omentum* which has protruded be deeply congested, partially strangulated, or adherent to the wound, the proper plan is to apply ligatures to it on a level with the edges of the wound, cut them short, and cut away the part of the omentum beyond the ligatures, leaving the stump at the wound if it be already adherent to its edges, but returning it just within the abdomen if it be not adherent. Care should be taken that no knuckle of bowel is hidden behind or within the omentum; the protruded loop ought to be carefully unraveled before being tied.

Protruded *intestine* may be irreducible, partially strangulated, or completely gangrenous. Where the protruded bowel is so distended with air as to render its return impossible until the parietal wound is enlarged, great care must be exercised in increasing the size of the aperture lest fresh portions of gut protrude. Puncturing the distended intestine has been recommended; but such a procedure should not be adopted unless the bowel is in a perfectly healthy state, and even then moderate enlargement of the parietal aperture is preferable. If adhesions have formed between the bowel and the surrounding parts at or outside the opening, they must be gently broken down or divided.

If the bowel has become simply congested or actively inflamed, or in a state of strangulation, it should be returned as soon and as gently as possible through an enlarged opening. But if the intestine has lost its glistening appearance and is of a brownish-black color, with its friable and swollen coats studded with ashen-gray spots, its condition is gangrenous, and if returned in such a state death would be the inevitable result. Should it be unadvisable to wait for the gut to form a false anus by fixing itself to the

edges of the parietal wound by adhesive inflammation, enterectomy should be performed. This operation is especially indicated where the false anus would be so high up in the bowel that the chyme escaping through it would cause death from inanition. The nearer the strangulation is to the stomach, the more severe will be the symptoms.

Protrusion of the solid organs is a rare occurrence. The treatment must depend upon whether the organ is wounded or not. If not, and the case be seen at once, the protruded portion should be returned, the parietal wound having been previously enlarged if necessary; if the organ be seriously wounded, or damaged from long exposure, it should not be returned. If it be the liver, the protruded part should be cut away, after a ligature has been applied. In the case of the kidney, and perhaps also of the spleen, the whole organ had perhaps better be excised.

Protrusion of the uninjured bladder very rarely occurs. When protruded, the soft compressible swelling readily yields to reduction, which is accompanied by an urgent desire to make water. After reduction a soft catheter should be for a time retained.

The treatment of all wounds after the reduction of protruded viscera is the same as that of simple penetrating wounds.

Penetrating wounds with protrusion of injured organs.—In the case of *wounded intestine* there are certain special characters depending on the action of the bowel. If the gut is cut across, the orifice to some extent opens and closes alternately, and the contents are alternately ejected and arrested, in accordance with the muscular movements of the bowel. In punctured wounds the mucous coat is everted, and constantly fills the opening, thus preventing effusion. Longitudinal wounds of the bowel are naturally more amenable to spontaneous repair than transverse ones.

Treatment.—In the case of a small punctured wound a ligature may be tied round it like a string round the neck of a sack, the ends cut short. If the wound be larger, a continuous suture of fine silk should be used. The gut is then to be returned, and the external wound treated as if the injury had been a simple penetrating wound. An incised wound must be stitched up with Glover's or

spiral suture, Lembert's or Gely's. In complete division of the bowel involving perhaps even the mesentery, the ends may be either stitched together in part of their circumference, and to the edges of the parietal wound in the remaining part after the return of the bulk of the protruded bowel; or the divided edges may be accurately united all round with their peritoneal surfaces in contact, and then returned. The former plan, resulting in a false anus, is applicable to cases where either from enfeebled constitution or contused state of the edges of the wound, adhesive inflammation is not likely to occur.

In wounds of a *protruded stomach* the contents are almost invariably expelled by vomiting instead of escaping into the abdominal cavity. If the wound be small, the prolapsed portion may be simply left in the external wound; but if large the wound of the stomach should be closed by suture, and the prolapsed portion left in contact with the parietal wound, but even then healing may be retarded by a fistulous opening.

If the edges of the stomach wound be bruised or lacerated, it will be advisable to retain them by a suture to the edge of the parietal wound. In no case in which a wounded viscus has been treated by sutures and returned should an attempt be made by means of a suture to retain it near the wound in the abdominal wall, but the external wound should be closed.

Terminations.—Protruded stomach or intestine which has been wounded may heal after being returned into the abdominal cavity, the cure being effected either without an abdominal opening, or being followed by the formation of a false anus or fecal fistula, which may or may not close. Recovery may take place after enterectomy. Death may ensue from collapse or peritonitis in consequence or independently of extravasation.

The mode of union of wounds of the intestine "commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid similar to that which glues together the sides of a recent flesh wound when supported in contact. The adhesive inflammation supervenes and binds down the reverted edges of the peritoneal coat, from the whole circumference of which a

layer of coagulable lymph is effused, so as to envelop the wounded bowel. The action of the longitudinal fibers being opposed to the artificial connection, the sections mutually recede as the sutures loosen by ulceration and absorption. During this period the lymph organized prevents further reaction, and the original cylinder, with the threads attached to it, are encompassed by the new tunic. The gut ulcerates at the points of the sutures, and these fall into its canal. The fissures left by the sutures are gradually healed up; but the opposed villous surfaces, so far as my observation goes, neither adhere nor become consolidated by the granulation, so that the interstice marking the division internally is probably never obliterated" (Travers). An inspection of the external surface of the intestine would not, however, discover, even at a recent period after the injury, the spot at which the division had taken place.

A ligature which includes a portion of the intestinal wall is followed by adhesive inflammation, and thus the ulcerated ligature wound is healed in the same way as a simple incised wound of the bowel. Sutures, except when the ends are retained at the external wound, separate inward and pass off through the anus.

The solid organs, liver, spleen, kidney, and even the pancreas, are not excepted from the liability of being protruded and injured.

Penetrating wounds with injury to, but without protrusion of the viscera.—There are no certain means of verifying a wound in a non-protruding viscus (at the outset, at least), save by the escape of fæces, bile urine, or the ingesta through the outer wound. Much depends on the nature of the wound as to whether the contents of the viscus will be effused or not. If the wound be large and in the longitudinal axis of the bowel, which is itself moderately full at the time, or if the opening be ulcerated, the contents will escape rapidly; whereas if the tube be empty, or nearly so, and the wound a punctured or small incised one, there will be little tendency to extravasation. Effusion does not usually occur unless the wound is extensive and the bowel at the same time pretty full, except in the case of extravasation of blood or air at the time of the injury.

That the integrity of the parietes does not always prevent the escape of the intestinal contents is proved by the greater frequency of effusion in cases in which, without any injury to the abdominal walls, the bowels or stomach are ruptured, or perforated by ulcers, or by worms, or other foreign bodies.

Symptoms.—They vary from those of mere transient shock to all the signs of severe peritonitis. When effusion into the abdomen occurs, the course of the case is generally that of fatal peritonitis. When the effusion is external, there may be more or less shock and local tenderness, followed in a few days by recovery with a temporary fistula. When no effusion occurs, the patient may recover without any serious symptom; or, on the other hand, he may suffer from peritonitis, accompanied by hematuria, jaundice, bloody stools, or vomit, or followed by the passage of a bullet or some other foreign body by the rectum, or some fragment of clothing per urethram. Suppuration and sloughing about the external wound will be followed after some weeks by healing by granulation.

Diagnosis.—A penetrating wound with injury to an organ, unless attended by external effusion of its contents, can only be diagnosed from a simple penetrating wound if blood escape from the mouth by vomiting, from the rectum, or from the urethra, or if the missile or some foreign body, as a piece of clothing, be passed through one of the natural outlets. Hemorrhage from a visceral wound may result in fatal syncope; but there are no means of knowing the exact source of the bleeding. If free effusion of bile, fæces, or urine has taken place, it will be evidenced by distressing vomiting, acute pain, and some of the other characteristic symptoms of traumatic peritonitis.

Prognosis.—Reparation may be looked for in visceral wounds. Effusion is not a necessary result of such injuries. Extravasated blood may conduce to internal effusion, and this effusion may be the cause of fatal peritonitis. Of course, escape of visceral contents through the external wound is not so unfavorable in its results as internal effusion.

Treatment.—If there be no evidence of effusion from any organ, the external wound should be closed and treated like a simple penetrating wound.

If there be external effusion, the wound having been dressed with some warm carbolic acid lotion, its edges should not be brought together, but the discharge should be allowed to flow freely into a pad of oakum or peat moss. If the stomach or hollow viscus is seen to be wounded, the external opening should be enlarged to allow of the visceral lesion being closed by a suture. If internal effusion has taken place, scrupulous care must be taken of the peritoneum before closing the external wound. If severe hemorrhage into the peritoneum occurs from wounded mesentery or bowel, abdominal section for removing the blood clot, ligaturing the bleeding vessel, and suturing the visceral wound, will in some cases prove successful. Probing and dilatation of the wound, except as part of some definite operation, cannot be too strongly condemned.

The general treatment consists in complete abstinence from solid food, small quantities of nutritive fluids being given at definite intervals; sucking fragments of ice to quench thirst; the bowels should be kept as quiet as possible. The recumbent posture, with the knees propped up, should be enjoined. Opium and morphia by the mouth or in the form of subcutaneous injections or suppositories tend to relieve pain and restrain vomiting.

The condition of the stomach is a much more important guide than the state of the pulse. If the stomach be not irritable there is comparatively little to fear.

Penetrating wounds of the stomach.—

Symptoms.—When the contents of the stomach escape through the external wound, there is the clearest possible evidence of the nature of the injury. Whatever is taken by the mouth may be discharged almost at once, and unaltered, through the wound. The chief symptoms of extravasation into the peritoneal cavity are: (1) Sudden, very acute, continuous pain darting from the navel to the circumference of the trunk, and even to the limbs; (2) hardness and rigidity of the belly, owing to spasm of the abdominal muscles; (3) a natural pulse for some hours until the symptoms of acute peritonitis come on. There are also extreme anxiety, collapse, and cold sweats. Blood may be vomited, and escape by the external wound.

Prognosis.—This depends partly upon the occurrence or not of effusion, and also

upon the direction of the effusion, whether into the cavity of the abdomen or externally. Punctured and incised are the most hopeful, lacerated and gun-shot the most deadly wounds. The hemorrhage from wounds at the curvatures is very dangerous. The results of non-fatal wounds are either adhesion of the wound in the stomach to the peritoneum, and closure of the parietal lesion; or the formation of a fistulous opening, which may close after the lapse of years or remain permanent.

Treatment.—The mode of treating a penetrating wound of the stomach, and the peritonitis which may result, has been detailed in describing penetrating wounds of the viscera generally.

Penetrating wounds of the intestine.—

Symptoms.—These are more severe, and more frequently accompanied by extravasation in lesions of the small than those of the large bowel. The severity of the general symptoms is no criterion as to the extent of the injury in all cases. When there is no escape of chyle, fæces, or fecal gas through the external wound the symptoms are equivocal. The most characteristic signs are griping pains, urgent thirst, nausea and vomiting, with bloody stools, and especially tympanites.

Diagnosis.—If there is escape of the intestinal contents through the external wound, the occurrence of a penetrating lesion of the bowel is, of course, certain. The lesion may be suspected if there be faintness, vomiting, extreme anxiety, cold sweats, griping pains and tympanites following upon a penetrating wound of the belly; and the diagnosis is confirmed if, sometime afterward, blood is vomited or passed per rectum.

Prognosis and terminations.—The danger of the case will depend upon: (1) The occurrence or absence of extravasation; (2) the persistence of vomiting; (3) the character of the hemorrhage; (4) the nature of the supervening peritonitis.

When the effusion escapes from a wound high up in the small bowel, death from inanition will ensue. A small wound may cause death from shock, whereas a very extensive and complicated visceral lesion may be followed by no bad results. Free effusion into the peritoneum means certain death. External effusion, if not fatal from peritonitis or marasmus, may terminate in a fecal fistula or false anus. Diffuse peritonitis is fatal. Death may

follow from loss of blood. The presence of blood coagula may cause fatal peritonitis or the clotted blood may become absorbed or encysted.

Treatment.—The general plan of dealing with wounds of the intestine has been already described. If effusion has not taken place, and the visceral wound is small, it is better not to disturb the parietal lesion with the view of applying sutures to the bowel. If effusion has occurred some time before the patient is seen, adhesive inflammation will probably have set in or the wounded structures have passed beyond the reach of repair. If, after transfixion of the belly, the viscera are wounded in several places, it is useless to interfere. If, however, there is clear evidence of extravasation from a wound, or the intestinal wound can be seen through the external opening, the visceral wound ought to be closed by suture.

Penetrating wounds of the liver.—Punctured and incised wounds of the liver are much less frequent than subcutaneous ruptures.

Symptoms.—Hemorrhage is one of the chief dangers. There may be also discharge of bilious matter from the wound. Pain, dull, and extending to the shoulder and larynx; or acute, and located about the ensiform cartilage according as the upper or under aspect of the viscus is wounded; vomiting, hiccough, and dyspnœa, followed by occasional rigors and tympanites, and still later by delirium. If the patient survive many hours, and hepatitis becomes general, jaundice appears.

Diagnosis and prognosis.—If the weapon have passed through the parietes, between the lower right intercostal spaces, the liver must be involved. And, if the penetration be horizontal below the ribs, displacement or enlargement of the organ may subject it to lesion. Small superficial wounds are followed by recovery, but deep wounds, accompanied by free hemorrhage into the abdominal cavity, are rapidly fatal.

The *treatment* does not differ from that described for rupture of the liver.

Penetrating wounds of the gall-bladder and ducts.—These are extremely rare injuries, and very fatal when they do occur, from the accompanying peritoneal extravasation.

Symptoms.—Great tension and pain, especially in the right hypochondrium;

small frequent pulse, dyspnœa, cold extremities, and sometimes jaundice and nausea. Gun-shot wounds of the gall-bladder have been attended with injury to the liver. Obstinate constipation is not a necessary result; indeed, severe prolonged diarrhea has occurred after such injuries.

Treatment.—Penetrating wounds of the gall-bladder and ducts must be treated in the same way as corresponding injuries of other viscera. It is not so much the primary escape of bile that induces death as the continual infiltration into the peritoneum. If it happened that the cyst or one of the ducts alone were wounded, laparotomy, followed by ligature of the duct or stitching up the wound in the cyst, or stitching the cyst to the parietal wound, might be tried, unless the liver were also seriously wounded.

Penetrating wounds of the spleen.—

Symptoms and prognosis.—Swelling and tension of the belly, with indications of copious internal hemorrhage, the effused blood gravitating toward the pelvis. If hemorrhage is not very extensive, peritonitis or localized splenitis and abscess set in. Though hemorrhage and peritonitis frequently cause death, recovery follows some severe splenic injuries. Gun-shot wounds of the spleen, if of a minor degree, are often repaired.

Treatment.—The patient should lie on the injured side, which should be strapped to check hemorrhage. Iced drinks and ergot should be given, and cold applied externally. If peritonitis supervene, it must be treated on the principles already laid down. Excision of the organ is advisable when it is extensively contused, or the hemorrhage is persistent.

Wounds of the pancreas and thoracic duct.—The pancreas, if torn away from the splenic artery, and protruding through an external wound, may be removed without serious consequences. Death after wounds of the pancreas usually results from shock and peritonitis, or else from secondary hemorrhage. Nothing of reliable diagnostic value is known with reference to lesions of the thoracic duct.

Penetrating wounds of the kidney, the ureter, and suprarenal capsule are described elsewhere.

Penetrating wounds of the blood vessels.—*Symptoms.*—When wounds of the

large vessels prove quickly fatal, the blood descends into the pelvis, the belly swells, the patient becomes pale, pulseless, and cold, and after several convulsive movements, dies. In the case of a smaller vessel, some time elapses before the extravasation is considerable. A fluctuating tumor is then felt in the lower part of the abdomen; the consequent pressure on the bladder exciting distressing efforts to micturate, and that on the large bowel causing constipation and tenesmus. Subsequently, the peritoneum perhaps becomes inflamed, and death takes place; or peritonitis may be escaped, and if the hemorrhage ceases, and the effused blood becomes absorbed, convalescence ensues.

Treatment.—In hemorrhage from wounded vessels no reliance must be placed on compression by bandages and pads, or on astringents. The wound should be enlarged, ligatures or torsion applied to the vessel; the blood carefully removed from the peritoneum, and the external wound closed. In wounds of the musculo-phrenic, or superior epigastric arteries, where ligation at the seat of lesion is impracticable, the internal mammary artery should be ligatured in the second or third intercostal space.

HENRY MORRIS.

Symptomatic Indications.—Contused wounds require *arnica*, which may be applied externally in connection with its administration internally. When the parts are lacerated, incised or punctured, *calendula* may be used both internally and externally. When there is severe pain present in lacerated or punctured wounds, owing to injury of sentient nerves, *hypericum* has special value, allaying the pain, and preventing trismus. For poisoned wounds, with symptoms of rapid prostration, restlessness, burning pain, *arsenicum* will be required. The inflammation following upon recent wounds (traumatic fever) may be controlled by *aconite*, the indication for its administration being sthenic fever, with nervous excitability; *belladonna* being more appropriate when the injured part is very painful and swollen, and a tendency to congestion is apparent. Should suppuration become inevitable *calcium sulphide* will promote and control the suppurative process. In the case of peritonitis following upon wounds of the abdomen, *aconite* is the principal remedy, particularly in the ear-

lier stages, and may be followed by *bryonia* when the fever relaxes and effusion threatens. *Mercurius corrosive*, in later stages, when there is apparent a tendency to fibrinous exudation, is a valuable remedy, particularly in scrofulous cases.

ABORTION is the premature expulsion of the ovum before the child is viable—that is, before the end of the sixth month. Its causes may be classified as :

A. **Local.**—(1) *Disease of the fetus.*—Anything which causes the death of the fetus may produce abortion. Among such causes are syphilis and feeble reproductive power in either parent; anæmia, uræmia, jaundice, cancer, or peritonitis in the mother. (2) *Diseases of the membranes or placenta.*—Atrophy of the decidua, myxomatous degeneration of the chorion, separation of chorion or placenta with hemorrhage into it, and hydramnios. (3) *Diseases of the uterus.*—Fibroids, cancer, endometritis, adhesions binding down the uterus and preventing its enlargement, displacements of the uterus, and possibly lacerations of the cervix.

B. **General.**—Acute febrile diseases, such as scarlatina, typhus, enteric fever, smallpox, cholera, relapsing fever, pneumonia, Bright's disease, acute atrophy of liver; diseases obstructing the circulation, such as cardiac dilatation, capillary bronchitis, cirrhosis of liver; most exhausting diseases.

C. **Accidental.**—(1) Local violence, either accidental injury or intentional interference. (2) Reflex influences, emotional disturbances, as from fright; over-fatigue or excitement; mammary irritation, as from hyper-lactation; sexual excesses; violent vomiting or purging; shock of operations, or severe general injuries. (3) Poisons; ergot, savin, rue, cantharides, carbonic acid, lead, and other rarer poisons.

Symptoms.—Pain and hemorrhage are the most important symptoms; if, in addition, there be dilatation of the cervix, abortion is probably imminent. Early in pregnancy, hemorrhage usually precedes the pain, which is not severe; at a later period the pain is greater, and precedes the hemorrhage. The pains are like those of labor, rhythmical, intermittent, referred to the pelvic region, and not affected by position; but they are far less severe. The hemorrhage is the important symptom, and comes from

uterine vessels laid open by detachment of chorion or placenta. If a small part only be detached the vessels may become closed by thrombosis, and the pregnancy go on. If there be extensive detachment, the fetus will die and abortion take place. As successive uterine contractions force the ovum onwards into the cervical canal, more vessels are torn through, and more blood is effused, the hemorrhage only ceasing when the uterus is empty and contracted. Sometimes, however, a dead fetus is retained for weeks or months without provoking any attempt on the part of the uterus to expel it. In the first two months of pregnancy, the ovum is usually expelled entire; later, the membranes often rupture, and the fetus comes away, leaving the placenta to be subsequently extruded or removed. After the first three months this is the rule.

Diagnosis.—Not difficult if the patient is known to be pregnant, although there may be difficulty in deciding as to the pregnancy. When dilatation of the cervix has taken place, abortion is inevitable. Before dilatation has occurred, the guide as to the need of interference is the amount of hemorrhage, which should be estimated by its effect upon the patient's color and pulse.

The chief dangers from abortion are hemorrhage and septicæmia. The best method of arresting hemorrhage before the cervix is dilated is to plug the cervix with a tent; after the cervix has been dilated, to empty the uterus. Septicæmia is to be prevented by antiseptic precautions.

Treatment.—(1) *Prophylactic.*—If there be reason to suspect syphilis, mercury should be given to the mother; if she be anæmic, iron may be required. Exposure to influences likely to induce abortion should be avoided, and any symptoms seeming to threaten abortion should be treated without delay.

(2) Hemorrhage and pain have commenced. *Hemorrhage is slight, and the cervix not dilated.* The patient should remain in bed, and take pot. bromid. gr. x, with ext. viburni prunifolii. liq. 3 j every four hours. If there be pain, liq. morph. hyd. mv or mx may be added to this. Should the hemorrhage continue for some days without increase in quantity, and should no further symptoms appear, the patient may be allowed to get up, and

take ext. ergotæ liq. 3 ss three times daily.

(3) *Hemorrhage is profuse, and the os not dilated.*—The cervical canal should be plugged with a sponge tent, which, before it is inserted, should be dipped in a solution of corrosive sublimate in glycerine, 1 in 1000. The tent will at once restrain hemorrhage and dilate the cervical canal.

(4) *The cervix is dilated, and hemorrhage profuse.*—If a tent has been used, a vaginal douche of 1 in 2000 corrosive sublimate should be given. Then the anterior lip of the cervix should be seized with a volsella and pulled down. The finger should be passed into the uterine cavity, and the ovum detached. If the finger cannot reach the fundus, it should be pressed down by the hand on the abdomen until it is within reach. When the ovum (or the placenta) has been detached, it should be grasped with a pair of ovum forceps, and extracted. Then the finger should ascertain whether the whole of the uterine contents has been removed; if small fragments are felt attached which the forceps fail to hold, the wall of the uterus may be scraped with a blunt curette. If hemorrhage continue, the body of the uterus should be compressed between the hand on the abdomen and two fingers in the vagina; this will almost invariably stop it. Should it not, the interior of the uterus may be swabbed with a piece of cotton-wool dipped in a 1 to 6 solution of perchloride of iron. Lastly, the vagina should be syringed with a 1 in 2000 solution of corrosive sublimate. For the manipulations which have been described chloroform may be necessary, and will generally be advantageous. Under anæsthesia, the dilatation of the cervix and emptying of the uterus may be done at one operation by using Hegar's dilators. It is scarcely needful to add that hands and instruments should be scrupulously clean, and should be dipped in a 1 in 2000 solution of corrosive sublimate before putting them into the uterus.

(5) *The cervical canal is dilated, or dilating, but the hemorrhage is not profuse.*—The patient should be advised to keep her bed, ext. ergotæ liq. 3 ss being given every four hours.

(6) *The discharge contains bodies looking like white currants.*—The case is one of myxomatous degeneration of the

chorion. A sponge tent should be put in the cervix, and ergot given. The uterus will then probably soon expel the tent and the diseased ovum. After the uterus has been emptied, the patient should be given ext. erg. liq. 3 ss three times a day, and an antiseptic injection used twice daily. The patient should keep her bed for at least a week.

(7) If the case be not seen until *the fetus has been expelled* and the cervical canal has contracted, unless the discharges have been saved for inspection, it may be impossible to say whether or not the placenta is still *in utero*. In this condition, if the hemorrhage is slight, ergot should be given, an antiseptic douche used twice daily, and the patient kept in bed. Under this treatment the placenta will often be expelled without ill consequences happening. If the discharge become offensive, or the hemorrhage be profuse, the cervical canal should be dilated, and the uterine cavity explored and emptied, as described under (4). As an antiseptic douche after abortion is complete, carbolic acid 1 in 100, or Condyl's fluid 3 ss to Oj, may be used; but for use immediately after manipulation of the parts, sublimate is better, because more trustworthy.

G. E. HERMAN.

ABORTION, HABITUAL. *Definition.*—Ovum expelled prematurely, often at the same period of utero-gestation.

Causes.—Syphilis primary or inherited; some acute diseases; ovarian tumors; fibrous tumors or fibro-cystic tumors of the uterus; flexions; constitutional weakness.

Symptoms.—Albuminuria; rigors, fever, followed by labor.

Signs.—Gradual weakening of the fetal circulation, discharge of liquor amnii.

Diagnosis.—Cause sometimes difficult to trace.

Prognosis.—Unfavorable often to cure.

Treatment.—If due to syphilis; mercury, iodide of potassium, chlorate of potash, during the whole of pregnancy, and in the intervals. If albuminuria is a symptom, Roman bath, cupping over loins, digitalis, iron and quinine. In flexions, remedy the malposition. If through weakness, either rest or tonics with gentle exercise. In cases of ovarian tumor, the question arises as to the advisability

of ovariectomy during pregnancy, or waiting. Mr. Spencer Wells's experience is in favor of the operation. Each case must be decided on its own merits. In cases of fibrous tumor, rest; further treatment to be deferred until after delivery. In some cases the Cæsarian section may be necessary.

HEYWOOD SMITH.

Symptomatic Indications.—Threatened abortion from fear, fright, or strong mental emotions will require *aconite* or *chamomilla*, aconite having a predominance of febrile symptoms. With aconite there is hemorrhage with fear of death; is sure she will die. Fear and anxiety of mind, with great nervous excitability. The pains of chamomilla are periodical, resembling the pains of labor, with discharge of dark-colored or coagulated blood. Restless, with impatience, the pains are unbearable. Threatened abortion after a fall is best met with *arnica*, especially if labor pains set in, with discharge of blood or serous mucus. Patient feels sore all through, as if bruised. The bed feels too hard. Congestive condition, with flushed face, throbbing carotids and heat in the head, requires *belladonna*. There will also be found pain in the back, as if it would break. Severe bearing down pains as if everything would issue through the vulva; profuse discharge of blood, neither very light nor very dark. Pains appear and disappear suddenly.

Threatened abortion, especially with discharge of dark, stringy blood, which is increased by the least exertion will be met by *crocus sativa*. There is also a sensation of fluttering, as if something alive were moving in the abdomen.

Abortion with profuse hemorrhage will require *erigeron*, *ipecacuanha*, or *sabina*, *erigeron* having also diarrhea and dysuria. The abortion of *sabina* is usually at the third month with violent forcing or dragging pains. Profuse bright red or dark fluid or clotted discharge, with feeling of sinking in the abdomen. The predominate symptom of *ipecacuanha* is continuous nausea without relief. Profuse continuous discharge of bright red blood. Tendency to faint.

Threatened abortion in enfeebled and cachetic women with disposition to passive hemorrhage, spasmodic affections etc., is met with *ergot*; or when the uterus is in a state of atony, or affected with organic disease. Great debility,

feeble, almost extinct pulse, and fear of death especially indicate it. There is little or no pain, but a copious discharge of black, liquid blood, worse from the slightest motion. It is especially useful when abortion has taken place.

Labor-like pains alternating with hemorrhage of dark blood requires *pulsatilla*. The flooding is arrested for a little while, then comes on with redoubled force. The predominate symptoms of *pulsatilla* is sadness.

Habitual abortion requires *cimicifuga*, *caulophyllum*, or *viburnum* op., *caulophyllum* being especially useful as a prophylactic against habitual abortion from uterine debility. There are menstrual irregularities subsequent to and consequent upon miscarriage; there is also a want of uterine tonicities with feeble contractions and very slight hemorrhage. With *cimicifuga* there is uterine irritation often associated with a rheumatic tendency; with the *viburnum* there are frequent and early miscarriages, the ovum being expelled at the fourth or sixth week, causing a seeming sterility. With each expulsion there are labor-like pains of great severity.

For the hemorrhage following miscarriage *cinchona*, *ferrum* met., or *ustilago* madis will be indicated. *Cinchona* is also useful in abortion in anæmic persons or when induced by loss of animal fluids. After miscarriage for hemorrhage unto fainting, with giddiness, drowsiness, and loss of consciousness, Heaviness of the head, ringing in the ears, and coldness of the extremities. *Ferrum* is indicated when there is a hemorrhage of partly fluid and partly black, clotted blood, with violent labor-like pains. The least emotion or exertion produces a red flushed face. The head feels as if beaten with tiny hammers. *Ustilago* is indicated in passive, long continued hemorrhages; flooding more or less for days or weeks. The blood frequently comes away in lumps or clots.

ABSCESS.—A circumscribed collection of pus. Two chief kinds, acute and chronic. Term "cold" is sometimes used as synonymous with chronic, and sometimes means a chronic abscess which has formed without any noticeable signs of inflammation.

Acute Abscess.—*Causes.*—Injury, irritation of a foreign body, follicular ob-

struction, absorption of poison, especially by lymphatics, and some obscure constitutional conditions.

Symptoms.—Chills, rigor; temperature often rises suddenly to 104°. Local symptoms of inflammation. Throbbing pain, which becomes more dull and aching as pus forms. Œdema of skin. Fluctuation. The swelling, which is at first hard, gradually softens in center. Pointing of abscess: the cuticle rises, the skin ulcerates or sloughs, and bursts.

Terminations.—1. When opened either surgically or spontaneously, its walls fall together and it closes; 2, a sinus or fistula remains; 3, acute abscesses sometimes cause serious mischief by opening into blood vessels and serous cavities.

Diagnosis.—An acute abscess can scarcely be mistaken.

Treatment.—Local rest very important; general rest in serious cases. Treat cause if possible. Warm moist applications. Quinine internally. Calomel (5 to 10 grains) if the tongue is not clean.

Indications for opening.—1. When in sheath of a tendon; or, 2, under strong fibrous membranes; or, 3, anywhere else where pus is likely to burrow instead of coming to the surface; 4, near a joint; 5, under the periosteum; 6, when pressure is likely to be dangerous; 7, when it may cause some direct obstruction to some passage; 8, when caused by some noxious infiltrating fluid, *e.g.*, urine; 9, when a spontaneous opening would produce deformity, *e.g.*, in neck; 10, when near anus. After abscess is open, employ pressure, if necessary, to prevent fistula, but poulticing usually suffices as a dressing.

Method of opening acute abscess.—1. By Paget's or Syme's knife or lancet; 2, by Hilton's method when deep and in a dangerous situation.

"*Hilton's Method.*"—Incise skin and deep fascia; then push a director on into abscess; lastly, pass a pair of dressing forceps along director, and when they have entered the cavity, open the blades. Opening to be dependent, parallel with any neighboring important structures and free.

Chronic Abscess.—*Causes.*—Dead bone; all causes of acute abscess, *quod vide*. Scrofula. Constitutional debility.

Signs.—A swelling, at first hard, afterward soft and fluctuating, usually situated

near a lymphatic gland, or in some special situation, *e. g.*, in the psoas muscle, or in loose cellular tissue, *e. g.*, that of buttock. Often a certain amount of pain and tenderness; often evident disease of bone. Pressure on nerves may cause pain or spasm. Abscesses near mucous canals sometimes, but rarely, become emphysematous.

Course.—Often very tedious, usually tends to burst, either through skin or into some internal cavity, but usually the former. May remain stationary for years; and may contract while its contents partly degenerate, partly are absorbed.

Constitutional Effects.—Usually little or none till it opens and its contents are exposed to the air. Then, if the abscess be of any size, decomposition of its contents tends to occur with high fever. *Vide* HECTIC FEVER, SEPTICÆMIA, etc., Liability to burrow, to open into important vessels, and to cause injurious pressure effects.

Diagnosis.—From, 1. Innocent and malignant tumors; 2, aneurism. 1. In cases of doubt, use trochar, grooved needle, or aspirator. 2. *Vide* ANEURISM.

Prognosis depends upon size, position, age of patient, curability of cause, and upon treatment. Middle age most hopeful.

Treatment.—Remove cause; *vide* CRIES. If there is no great tensive pain, or if there is no reason to suspect that burrowing is going on, opening may be delayed. An effort may be made to obtain resolution by counter-irritation, iodine, mercurial plasters, and rest. Various modes of opening—1. By knife; 2, by trochar and canula; 3, aspirator; 4, caustics. Free openings, counter-openings, drainage tubes, repeated partial evacuations by aspirators, etc.

Antiseptic Treatment, quod vide.—Dangerous septic symptoms, a probable consequence of prematurely opening a chronic abscess.

Puerperal Abscesses occur after parturition; are probably pyæmic in nature.

Locality.—Iliac fossa, orbit, joints, thigh, etc. C. B. KEETLEY.

Abscesses, Abdominal.—Four kinds:

1. Those between, and on the exterior of, the viscera of the abdomen; they are often the consequences of abdominal injuries which have given rise to localized peritonitis.

2. Visceral abscesses, or those which have originated in, and are confined to, the interior of some organ; such are hepatic, renal, splenic, omental, and biliary abscesses.

3. Parietal abscesses: those which occur between the layers of the abdominal parietes.

4. Retro-peritoneal abscesses.

Peritoneal abscesses are of two kinds, the circumscribed and the diffused.

Abscesses exterior to the organs and yet circumscribed occur in all parts of the abdomen and pelvis, and are walled in by fibrinous adhesions between viscera and parietes, or between two or more of the viscera, or two or more coils of intestine.

Causes.—Peritonitis leads in some parts of the abdominal cavity to a circumscribed collection of pus. The peritonitis may have been idiopathic, or the result of a blow, kick, sprain, or other injury; it may have followed some accident of parturition, and left behind an abscess in some distant part of the abdomen; or an abscess in the left hypochondrium has resulted from a general puerperal peritonitis. Other causes have been cancer, simple and dysenteric ulcers of the gastro-intestinal tube, gallstones, etc. Sometimes a visceral abscess situated near the surface of the organ will give rise to a circumscribed peritoneal abscess.

Course and symptoms.—Circumscribed peritoneal abscesses may occur at any age; may occupy any part of the peritoneal cavity; and are often multiple. The commonest and some of the most important are those situated between the liver and the diaphragm, and between the spleen, the stomach, and the diaphragm. In a large proportion of hypochondrial abscesses, the corresponding side of the thorax is affected; there may be pleurisy, pneumonia, or empyema. The liver or spleen may be injured; an abscess forms beneath the diaphragm; pleurisy then occurs, followed by adhesion of the base of the lung to the diaphragm; inflammatory effusion takes place; the lung is gradually compressed against the spine; at a later period the abscess bursts through the diaphragm, and an empyema is established. In other cases the abscess may discharge itself into the stomach or transverse colon. There will probably be evidence of severe inflammation, with rigors, following some injury; or coming on in the course of an illness connected with

one of the abdominal organs, there will be high fever, local tenderness, and increased dullness on percussion followed by the appearance of a tumor. Intermittent attacks of severe abdominal pain may occur; there may be constipation and vomiting of blood.

Diagnosis.—Sometimes in diaphragmatic abscesses the chest symptoms altogether overshadow the abdominal. Attention must be given to the previous history, onset, and earlier symptoms of these obscure cases; and if it be borne in mind that they very frequently result from direct external injury, or by extension from some disease in a neighboring organ, a correct diagnosis may often be made. The character of the tumor, when one exists, is not specially diagnostic. It must be remembered that the liver or spleen or some other organ may be displaced by the pus of a circumscribed abscess.

Prognosis.—This is usually unfavorable. When the abscess is caused by tubercular peritonitis, or by malignant disease of the uterus, ovary, or bladder, there can be no prospect of recovery. In subdiaphragmatic abscess, unless early exit be given to the pus, there is risk of perforation of the diaphragm, and secondary rapidly fatal mischief in the thorax. Death sometimes occurs suddenly from rupture into the general peritoneal cavity; sometimes in a fortnight or so from intensity of the inflammation, and in other cases from pyæmia, hectic, or exhaustion.

Treatment.—This is the same as that required for other abdominal inflammations until pus is suspected, when it should be searched for and evacuated by aspirator or trocar. Where a tumor presents itself, or the hypochondrium is bulged, an incision should be made, and the edges of the opening kept apart by a drainage tube. In cases where the abscess has pushed the diaphragm and lung far up, the pus may be evacuated by an incision in the seventh or eighth intercostal space without injuring the lung or pleura. Small hope of good from puncture can be entertained if the abscess have already burst through the diaphragm into the lung or pleural cavity.

In all cases in which the abscess cavity can be reached and drained, the sooner operative measures are adopted the better.

Diffused abscess of the peritoneum.—A form of suppurative peritonitis, in

which the abscess cavity and peritoneal cavity are one and the same.

Causes.—Generally obscure. Typhoid and recurrent fever, chicken-pox, exposure to damp and cold, and suppurating mesenteric lymphatic glands have caused diffused peritoneal suppuration.

Symptoms.—After a period of abdominal illness the belly becomes irregularly swollen, of peculiar shape, and bulges prominently, in the middle or one of the lateral regions. Dullness on percussion, tenderness, and subsequently a thrill may be detected at the prominent part. The varying temperature rises to 101° to 103° F. in the evening. The early symptoms may be shivering and vomiting. There may then be the appearance of an abscess in the parietes which may burst spontaneously, discharging pus at the umbilicus, and causing a fistula through which a probe can be passed into the peritoneal cavity. Or the presence of fluid will be suspected, and the introduction of an aspirating needle will be followed by the escape of some very fetid pus.

Course and prognosis.—The chief danger is the liability of some of the pus to become encysted between one of the viscera and the diaphragm, and lead to subdiaphragmatic abscess, with its serious consequences already alluded to. It may, after becoming encysted, break into the bladder or rectum, and cause death by hectic and exhaustion.

Treatment.—In the early stage, hot fomentations, opium, nutritious and easily digestible food. Evidence of the presence of pus, without any distinct indication as to its localization, demands a cautious but free incision into the abdomen in the median line.

A drainage tube should be left in the wound, and if pus bags in places it should be gently mopped out by means of well-prepared carbolized sponges at the time of operation, but officious interference with adherent purulent lymph may lead to troublesome capillary bleeding. Laparotomy has been performed with a successful result.

Abscesses, Visceral. — Hepatic abscess.—*Causes.*—Contusions of the substance, unattended by laceration of the capsule of the gland, ruptures, and penetrating wounds of the liver may excite abscess.

Hepatic abscess has been known to follow operations for hemorrhoids and fistula

in ano, the cauterization of cancer of the rectum, and violence in reducing rectal prolapse; also lithotomy. Abscesses so caused follow phlebitis, and are due to the transference of septic matters from the seat of operation to the liver, where they form embolic foci, the starting-points of the abscesses. Amputations and compound fractures of the lower limbs have been followed by abscess of the liver. Any suppurating surface or cavity, and any ulcer may, through the medium of the systemic circulation, generate typical pyæmic abscesses of the liver. Hepatic abscess has been caused by hydatid cysts, and by the invasion of lumbrici.

Character and size.—These abscesses may be single or multiple, superficial or deep, encysted or quite undefined, with ragged and shreddy margins. The pus, frequently laudable, may be greenish, or reddish, and vary in quantity from a dram to a gallon.

Symptoms.—Liver abscess is especially common in tropical and malarial districts. The liver not being a sensitive organ, a deep-seated abscess may attain serious dimensions without previously exciting peritoneal inflammation and pain, and if stoutly encysted may remain for years without producing marked constitutional disturbance. On the other hand, a small superficial abscess will cause severe hepatic pain, immediate rise of temperature, and increased frequency and tension of the pulse. If the abscess be near the upper surface, there will be a short dry cough, often attended by a friction murmur at the base of the lung; if it be near the under surface there will be vomiting or irritating diarrhea; and if tending toward the outer aspect of the liver there will be fullness, and perhaps obscure fluctuation. The local signs are a sense of weight in the right hypochondrium, with inability to lie on the right side; frequent spasm of the rectus; tenderness over the liver area, and occasionally fluctuation. The complexion is muddy, and the tongue thickly furred; and rigors and night sweats are especially marked in infective abscesses. Except in abscess dependent on obstruction and ulceration of the bile ducts, jaundice is very rare.

Diagnosis.—Perihepatitis (inflammation of the liver capsule) is often confounded with abscess. Idiopathic perihepatitis simulates pleuritis more than liver abscess, and, unlike secondary peri-

hepatitis, is not preceded for many days by the symptoms of abscess. Acute perihepatitis gives rise to sharp pain, fever, and local tenderness; whereas liver abscess is generally the cause of impaired general health for a long time antecedent to the development of the acute symptoms.

Hepatic abscess has also been confounded with distended gall-bladder, with cancer, and with hydatid cysts of the liver; therefore careful palpation, percussion, and due attention to the clinical history of the patient are necessary.

Prognosis.—This is especially unfavorable if the abscess be of septic origin. Complete recovery may, however, take place if the pus finds an exit, though the discharge continue for many months. An important guide is the point at which the abscess is likely to burst. If rupture takes place into the pericardium or peritoneum death is certain, if into the pleura it is almost inevitable. Abscesses which open into the stomach, intestine, or lung, are the most favorable. If more than one abscess exist, the prognosis is very unfavorable.

Treatment.—The strength must be supported by tonics, nourishment, and wine. Hot fomentations, and leeches when not contra-indicated. Opium to relieve pain. On the occurrence of fluctuation, the aspirating syringe applied to a good-sized trocar and canula should be used, and the canula should be left in for some days. In many cases it is best to open the abscess by a free incision made below the ribs and as near the xiphoid cartilage as possible. A drainage tube should be used. In true infective abscesses, surgical treatment is of little avail. In tropical abscess a sea voyage is often very beneficial.

The sooner an abscess of the liver is opened after its existence and site are ascertained, the better.

Biliary abscesses.—Abscess of the gall-bladder and biliary ducts generally results from obstruction to the free passage of bile from simple or cancerous strictures of the duct, from biliary calculi, or from cancer or some other growth pressing upon the ducts.

Suppuration of the gall-bladder.—*Symptoms.*—Enlargement from suppuration is characterized by a more or less pear-shaped, elastic, sometimes fluctuating swelling in the normal situation of the gall-bladder. It is painful and tender,

and is accompanied by febrile symptoms, and frequently by rigors and night sweats. If the cause is obstruction of the cystic duct, there will be no jaundice; but jaundice will be present in obstruction of the common bile duct. There may be a history of biliary colic. The abscess may burst externally, and pus, and perhaps calculi, be discharged through the resulting fistula, or it may open into the duodenum, colon, or peritoneum.

Diagnosis.—Abscess of the liver so closely simulates suppuration of the gall-bladder in many cases, that a correct diagnosis can only be made by inquiry into the history of the disease. Abscess of the gall-bladder is relatively more common in those who have never lived in tropical or malarial districts. In well-defined cases, the swelling of the gall-bladder is circumscribed, not surrounded by any degree of hardness, and always situated below the false ribs.

Prognosis.—Pyæmia and secondary abscess of the liver are most to be feared. The fistula, resulting from rupture of the sac, may remain open for an indefinite time, or may quickly close.

Treatment.—Rest facilitates adhesion of the inflamed gall-bladder to the parietal peritoneum, and guards against the occurrence of general peritonitis. Opium, leeches, and warm formentations relieve pain. Cooling salines and light nutritious diet are requisite.

As soon as suppuration has occurred, and the distended cyst presents a swelling, it should be opened directly by an incision, instead of an incision being first made down upon it, and then potassa fusa applied to erode it. It is advisable, however, after exposing the surface of the cyst, to empty it of its fluid contents by an aspirator, before cutting through its coats. The gall-bladder should be drawn up into the wound by spring forceps, and when flaccid, its walls should be incised. After removal of the canula, the edges of the divided gall-bladder should be stitched to the margins of the wound in the abdominal wall.

Abscess in the biliary ducts.—Calculi may give rise to abscess in the ducts, at any point at which they may become impacted, or excite inflammation.

Sometimes an impacted calculus excites an abscess in the adjacent liver tissue, and may, after a time, pass from the duct into the abscess cavity; or inflammatory

adhesions may form, and the calculus pass into a circumscribed peritoneal abscess; or it may ulcerate inward, giving rise to an intestinal or gastric biliary fistula.

Symptoms.—In intrahepatic duct abscess these are obscure; there is no jaundice, enlargement of the liver, or pain; but sometimes they cause a sense of weight about the liver, with occasional rigors, followed by sweating. Extrahepatic duct abscess causes biliary colic, hepatic tenderness, vomiting, and intestinal disturbance. If the common duct be the seat of abscess, there will be jaundice.

Treatment.—This consists in relieving pain, checking inflammation, and removing the obstruction, if possible, by giving non-depressing emetics. Surgical interference is rarely advisable.

Abscess of the spleen.—This rare affection is usually of embolic origin, due to blood-poisoning. Diffused suppuration is sometimes a sequel to fevers.

The symptoms are often very ill defined. The treatment resembles that of abscess of the liver.

Abscess of the pancreas.—This is rarely met with. Metastatic abscess has followed disease of the testicle; a calculus in the pancreatic duct and perforating ulcer of the stomach or duodenum have caused abscess of the pancreas. The symptoms and local signs are those common to visceral abscess. Surgical treatment is of little or no avail, measures for the relief of urgent symptoms being alone practicable.

Perinephric abscess.—Suppuration of the cellulo-adipose tissue about the kidney may follow injuries not necessarily involving this organ. It occurs, too, quite independently of urinary extravasation.

It most frequently originates in suppurative pyelitis, or nephritis, by extension through the capsule. Renal calculus, vesical calculus, urethral stricture, or prostatic disease may be the primary cause.

Symptoms.—These are similar to those indicative of deep-seated abscesses. A peculiar lameness, due to flexion of the corresponding thigh to relieve tension, is an important early sign.

The presence of swelling, increased resistance, and obscure fluctuation in the affected loin, may be preceded by œdema of the foot and ankle.

The prognosis is always grave, but not necessarily unfavorable.

Treatment.—Dry or wet cupping, or blistering, may prevent suppuration. When matter is present, it should be evacuated through a free opening, made like the incision for colotomy. The general details of treatment are similar to those described for other visceral abscesses.

Fecal abscess.—Fecal abscess may originate in fecal extravasation *from* the bowel, or in ulceration *into* the bowel of purulent accumulations, which have been formed quite independently of intestinal mischief.

They may be extra- or intra-peritoneal.

Causes.—Primary fecal abscesses generally result from some obstruction in the bowel giving rise to perforation of the intestinal walls. Cancer, the pressure of some tumor or foreign body, ulceration by gallstones, and abdominal injuries, may cause primary abscess.

Secondary fecal abscesses, those, namely, in which fecal extravasation invades an abscess already existing, may arise from causes enumerated under the sections, "Abscess of the parietes," "Circumscribed peritoneal abscess," "Retro-peritoneal abscess," and "Ilio-pelvic abscess."

Special symptoms.—1. Fluctuation accompanied with a certain degree of resonance, or emphysematous crepitation.

2. The presence of pus in the stools, or the occurrence of putty-like stools, or diarrhea with coagula passed in the fæces are significant of fecal abscess.

3. The subcutaneous diffused cellulitis dependent on fecal abscess is more phlegmonous, of wider extent, and accompanied with more marked constitutional depression than that resulting from non-fecal abscess.

Prognosis.—In primary abscess this will depend on the cause chiefly; in secondary fecal abscesses it is rendered less hopeful by the abscess becoming fecal.

Treatment.—The treatment of fecal abscesses in their early stage does not differ from that of other abscesses. As soon as there are signs of fecal extravasation or suppuration, a free incision and frequent changes of dressings are requisite. If the cause of the abscess persists, it should be removed if possible.

Ilio-pelvic abscess.—Ilio-pelvic abscesses may be *subperitoneal*, in which case they are rarely circumscribed; or *subaponeurotic*, situated between the fascia iliaca and iliac muscle, and circum-

scribed for a time, but subsequently burrowing to the front of the thigh, and possibly bursting into the hip joint, through the thin part of its capsule.

Causes.—They are most commonly the sequel of labor, but may be caused by injury, osteal inflammation, laceration of muscle, and extravasation of blood. Ilio-pelvic abscesses have been mistaken for pelvic peritonitis, ilio-psoas abscess, and psoas abscess.

The general *symptoms* are those common to other abscesses. Retraction of the thigh may exist as a special sign, but is not diagnostic, as it occurs sometimes in perinephric and in ilio-psoas abscess.

The *treatment* is the same as for other forms of abdominal suppuration.

Retro-peritoneal suppuration.—*Causes.*—Wounds; sprains of fibrous tissues; cold and poisoned states of blood; necrosis of ribs or pelvic bones; ruptures of cysts; and puerperal inflammations.

The *symptoms* resemble those of localized suppuration within the peritoneal cavity, and the diagnosis in chronic cases, and even in the acute form while pus is confined beneath the abdominal and pelvic fascia, is difficult.

The *prognosis* depends, of course, chiefly upon the direction the pus takes.

The *treatment* is the same as for other forms of abdominal abscess. In all cases the pus should be evacuated through an external opening if possible; but where there is distinct pointing toward the rectum or vagina, an opening should be made in their walls, and the pus withdrawn by means of an aspirator, the use of which may have to be repeated several times.

Abscess, Urinary.—Urinary abscess nearly always occurs in connection with stricture. It may be due to ulceration of the mucous membrane and extravasation of a minute quantity of urine, or it may originate independently of this as a peri-urethral abscess, due to the breaking down of the lymph thrown out by the tissues round a stricture, and bursting either into the urethra, or externally, or in both directions.

Symptoms.—There is sudden rigor, and an intense throbbing pain in the perineum. The pulse is rapid, the skin hot and dry, the face flushed, and the tongue parched. The bowels are constipated, and perhaps there is complete re-

tention of urine. On examination a tense, hard, and painful swelling can be felt in the region of the bulb, generally speaking, or in the penis, or often extending down the median raphe of the scrotum. And nearly always there is a history of stricture (for abscess rarely forms until the contraction is advanced) or some injury to the perineum.

Treatment.—The abscess must be opened at once, and if there is a stricture through which a catheter can pass anywhere near the base of the abscess, it should be divided freely from the perineum, so that, as in the operation of external urethrotomy, the wound may granulate up from the bottom, an instrument being passed every two or three days to maintain the patency of the urethra. If the catheter does not pass easily, or if the connection between the stricture and the abscess is not clear, it is well to wait, and be content with opening the latter. Very often the stricture, being left to itself, no longer irritated by the impact of urine, and after the congestion has been relieved by local bleeding, admits an instrument in the course of a few days.

C. MANSELL MOULLIN.

Symptomatic Indications.—Abscesses in the early stage will require aconite, belladonna, or phosphorus. If the tumor is swollen, red, and shining, with violent cutting pains, the parts burning as from coals, preference should be given to *aconite*. There is usually great nervous and vascular excitement, with febrile symptoms. The patient gets desperate about the pains and declares something must be done. If the part is swollen, hard, and of an erysipelatous appearance, with throbbing, pressing pains, and general congested condition, *belladonna* is the remedy. The pains come and go suddenly and are worse in the afternoon. *Phosphorus* is indicated in the incipient stage to prevent the formation of pus, and is especially useful in mammary abscess.

When suppuration is inevitable resource may be had to *calcium sulphide*, which promotes and controls the suppurative process. In cold abscess or when the discharge becomes fetid, thin, and watery, *silicea* will bring about a healthy condition of the parts. It is especially useful where there are fistulous openings which are slow to heal; in whitlow, where the pain is intense and the swell-

ing unabated; tardy, long continued or unhealthy discharge; chronic abscess and abscess of bone.

Mercurius in the commencement will often prevent suppuration. It is particularly indicated in glandular abscesses, especially when with low grade of inflammation or when there is intense, shining redness; beating and stinging, or where the disease extends to the sheaths of tendons and the ligatures of joints. Painful abscesses, pains worse at night.

When the abscess threatens to become gangrenous, and is attended with great debility and violent burning pains, *arsenicum* will prove of great service. The parts burn like fire. Symptoms of general vital depression are usually present, with much restlessness. Constant thirst, but drinks only in small quantities.

For inveterate cases, where there is a profuse discharge of matter, with emaciation, hectic fever, etc., *sulphur* is indicated. There is a constant tendency to the return of the disease. It is particularly useful with scrofulous persons, who are frequently troubled with boils.

Abscess, Fecal. See ABSCESES, VISCERAL.

ACETABULUM, FRACTURES OF. See FRACTURES.

ACNE MENTAGRA. See ACNE SYCOSIS.

ACNE.—*Acne Vulgaris* is an inflammatory, usually chronic, disease of the sebaceous glands and immediately surrounding skin, resulting from the retention of plugs of altered sebum (comedones) in the gland ducts. The lesions are papular, tubercular or pustular, according to the severity of the inflammatory process, and are usually situated upon the face, neck, shoulders and back, only the palms and soles being invariably exempt from the disease. The individual lesions consist of minute, pink, acuminate papules or pimples, in the center of which is a black-topped comedo (*A. punctata*, *A. papulosa*), or of more extensive perifollicular infiltrations resulting—especially in strumous subjects—in chronic, livid indurations (*A. indurata*) or dermic abscesses (*A. pustulosa*); these forms usually coexist in varying proportions, and appear in successive crops, which run a rapid course, cicatrices resulting from those which deeply implicate the cutis

surrounding the gland ducts. The cicatrices are frequently the starting-point of keloid tumors. The condition, as a rule, gives rise to comparatively little pain, but exceptions are not infrequent.

Acne usually shows itself about puberty, when a remarkable development of the sebaceous gland system takes place, and is common up to the age of thirty, other forms of sebaceous disease being frequently associated with it. It affects both sexes about equally, and appears to be intimately connected with the generative organs, any functional derangements of which (menstrual disorders, sexual excesses, masturbation, etc.) are frequent concomitants.

It is stated that eunuchs are very rarely affected. The disease may occur in persons in robust health, but is much commoner in the debilitated and anæmic, and especially in dyspeptics who suffer from habitual constipation. The condition is usually worse in winter than in summer; persons who have coarse, hairy, or greasy skins are specially prone to suffer from acne. The habitual use of cosmetics is probably conducive to its occurrence and continuance; it is common after variola and around patches of lupus, keloid or other diseases producing scars, probably from cicatricial obstruction to the excretory ducts.

Acne Varioliformis (*A. atrophica*, *A. frontalis*) is a rare form of the disease, which affects the forehead, temples, and hairy scalp. The eruption usually remains confined to these regions, but may occasionally spread over the neck to the back and chest. It generally occurs in middle-aged or old people, and has a marked tendency to relapse or to become chronic, with periodic exacerbations, which may occur at regular intervals. The lesions, which may be sparse or thickly aggregated, consist of small, hard, flat or acuminate papules, not preceded by comedones and not demonstrably connected with the sebaceous glands; in the scalp they generally occupy the frontal, temporal, and sagittal regions. They are indolent, but the majority ultimately suppurate and scab, their subsidence being followed by deep, punched-out, circular pits, which are at first pigmented but gradually become white like the scars resulting from smallpox.

Acne Cachecticorum occurs only in starved or debilitated persons after long

wasting diseases, especially phthisis. Flat, livid, acneiform papules and pustules without comedones develop over the whole body, especially on the trunk and lower extremities; they cause deep, pigmented scars, and are not amenable to treatment.

Differential Diagnosis.—Acne vulgaris may be confounded with rosacea, pustular dermatosyphilis, mild varioloid, and with dermatitis due to the internal use of the bromides and iodides, or to the external application of chrysarobin, pyrogalllic acid, or various tars (*see* MEDICINAL RASHES). Acne varioliformis may be mistaken for variola, and is closely simulated by the small pustular syphilide.

Treatment of Acne.—(1) Constitutional treatment is of the first importance, and must be directed toward the anæmia, dyspepsia, constipation, or sexual derangements which usually accompany the disease; the necessity for exercise and a simple dietary must be enjoined. Among special remedies may be mentioned cod-liver oil—particularly in young persons and in *A. varioliformis*—sulphide of calcium, ergotine, phosphorus, and minute doses of perchloride of mercury, all of which are occasionally useful. The value of arsenic, except as a general tonic, is dubious.

(2) Local treatment to prove efficacious must be active and persistent: occasionally pain and inflammation indicate the use of fomentations, calamine lotion, or other soothing applications, but the majority of cases call for stimulant treatment. Comedones should be expressed at bedtime, the skin having been previously softened by steaming or bathing with hot water, then vigorous friction made with soft soap and flannel or a flesh-brush, and lotions or ointments containing sulphur (gr. xv ad ℥j with glycerine and lime-water), sulphuret of potass (℥j to a quart of water), corrosive sublimate (gr. j or ij ad ℥j), tincture of iodine, iodized glycerine, spirits of camphor, or ichthyol applied, and allowed to remain overnight. Medicated soaps containing sulphur, naphthol, or thymol are specially recommended for daily use. Indurated papules are often absorbed after the application of a belladonna or mercurial plaster, or may be touched with strong carbolic acid or the acid nitrate of mercury. Dermic ab-

scesses ought to be freely incised, their contents expressed, and cooling lotions or compresses applied.

J. J. PRINGLE.

ACNE ROSACEA.—A chronic, inflammatory, composite disease affecting the skin of the face in which erythema, hypertrophy, telangiectasis, and sebaceous disorders are present in varying proportions. The name is somewhat of a misnomer, the acneiform lesions being, as it were, secondary or accidental features of it. Persons, however, who have suffered from ordinary acne in early life are prone to become the subjects of rosacea in middle life, when the disease is most common. It is generally considered to be a reflex vasomotor neurosis, and may result from disorders of digestion (especially flatulent dyspepsia with acid eructations and constipation), from habitual alcoholic excesses, and especially from menstrual disorders; this latter circumstance explains the much greater frequency, at all events of its milder, non-hypertrophic forms, in the female than in the male sex. Its subjects are frequently of neurotic temperament, and suffer from hot or cold extremities, evidences of "mobility" or ill-balance of the peripheral circulation. In such persons exposure to heat or cold, or the use of inappropriate cosmetics, may be the determining cause.

The disease is characterized by its chronicity and by the variations which it undergoes from day to day or even from hour to hour. Its mildest form is exemplified by the flushing of the nose, cheeks, and ears, attended with burning or tingling sensations, which so frequently follow the ingestion of certain foods, of alcoholic stimulants, or of tea, coffee, soup, or other hot liquids. Gradually these attacks become longer in duration, until finally some erythema becomes persistent, especially about the nose and cheeks, the affected part being slightly infiltrated and of a somewhat "butterfly" shape. The color at this stage entirely disappears upon digital pressure, and the temperature of the patch is slightly elevated; its edge is sometimes pretty clearly defined, but more usually merges gradually into the normal skin, and its extent varies with the digestive and other conditions previously referred to. The forehead and chin also

frequently become implicated, and it may extend to the scalp, especially in bald persons, or more rarely still to the neck.

In a considerable proportion of cases, especially, perhaps, in persons of eczematous habit or with thick oily skins and liable to stearrhea, implication of the sebaceous glands is a marked and early feature. It may result in a seborrhea oleosa, which gives the part a glistening or greasy look, or in comedones and characteristic acne lesions, culminating in "pimply" papules, tubercles, and pustules, either sparsely distributed over the erythematous area or closely grouped. The consequent disfigurement is sometimes very great. There is often general dilatation of the sebaceous gland ducts over the affected area, and it may become the seat of a secondary eczema (*E. seborrhœicum*), which may spread widely and mask the original nature of the malady. As the result of the long-standing over-distension of the capillaries and venules, and of the impaired tone of their coats, they dilate and become varicose, and constitute visible or even prominent objects, especially upon the alæ and about the tip of the nose. Such is a picture of the commoner, non-hypertrophic type of the disease.

The hypertrophic form is much commoner in men than in women, especially in those who combine habitual alcoholic excesses with occupations which necessitate exposure to all vicissitudes of climate—*e. g.*, drivers, cabmen, etc. The hypertrophy is generally confined to the nose and its immediate neighborhood (*rhinophyma*, *lipoma nasi*). The distension of veins is usually marked, and, despite the brilliant redness, the part feels cold to the touch. The chronic inflammation, infiltration, and inflammatory new growth of the skin result in enlargement of the nose, which sometimes assumes enormous proportions; generally it is somewhat bilobate in form, the two halves being separated by a sulcus, and the hypertrophied organ may hang down in a pendulous manner over the upper lip and mouth. The lumen of the nostrils is not, however, usually encroached upon.

Pathological anatomy.—Includes congestion of the cutis vera, beginning in the lower to extend to the more superficial longitudinal plexus, paralytic distension of vessels with thickening of their coats, diapedesis of leuco-

cytes, and the formation of new connective tissue around them, and sometimes special implication of the sebaceous glands and their ducts.

Differential Diagnosis.—From acne vulgaris, eczema, lupus vulgaris, lupus erythematosus, and dermatosyphilis. Only the two latter present sufficient resemblance to rosacea to render confusion probable. In L. erythematosus the presence of atrophic scarring may always be determined; but certain late syphilides closely simulate rosacea, especially when combined with iodic acneiform lesions. All three conditions (*i. e.*, rosacea, dermatosyphilis, iodic acne) are not infrequently coexistent.

Treatment generally satisfactory, but seldom permanent. Careful attention to diet and regimen is of the highest importance. Alcohol is as a rule to be studiously avoided; hot tea, coffee, cocoa, and soups, spiced dishes, and starchy vegetables must be interdicted. Moderate exercise short of fatigue is generally advisable; tight-lacing is to be strongly condemned, as a common and generally unsuspected cause of the complaint. Special attention must be paid to regular and copious action of the bowels, the drugs most generally useful for this purpose being sulphur and senna—as confection—aloes, cascara sagrada, compound liquorice powder, and the salines, preferably in the form of the purgative mineral waters of Hunyadi Janos, Carlsbad, Püllna, Friedrichshalle, etc., taken on rising, with an equal quantity of warm water. The familiar iron and magnesia mixture is often of great use. Menstrual and uterine derangements must be treated on the lines laid down in the articles devoted to them, but special reference may here be made to the utility of the prolonged warm douche in chronic inflammatory conditions of the pelvic organs.

For the gastric troubles no remedy is so useful as bismuth, either in the form of carbonate or subnitrate, combined, it may be, with the alkaline bicarbonates, dilute hydrocyanic acid, and vegetable bitters according to circumstances. In other cases the dilute mineral acids are valuable, and liquor strychninæ (m iij to v) may be often advantageously given with them. Among supposed “vasomotor steadying” drugs, ichthyol certainly appears to have more decidedly

beneficial effects than ergot, belladonna, or arsenic; it may be given in the form of gelatine-coated pills, each containing $2\frac{1}{2}$ grains, two being taken immediately after each meal, and the dose being gradually increased according to the tolerance of the patient for the drug, which is a very disagreeable one.

Local measures are also of the highest importance. In mild erythematous phases a lactate of lead lotion is most valuable; it is made by mixing a dram of liq. plumbi subacetatis with an ounce of fresh milk, and may be dabbed on night and morning. Calamine lotions, (gr. xx—3 j ad $\frac{3}{4}$ j) with glycerine, lime-water, and rose-water, are of the greatest use, and, when acne is a prominent feature, sulphur lotions, as described under that head, are applicable. Hypochloride of sulphur freshly prepared (3 j—3 ij to the ounce of lard) with carbonate of potash (grs. x) and a little almond oil constitutes a favorite remedy in similar circumstances. And Unna’s ichthyol plasters are also useful.

Dilated veins may be opened longitudinally with a fine scalpel. Free bleeding being afterward encouraged by warm bathing, their obliteration results from the operation, but may be perhaps more satisfactorily attained by electrolysis, the negative pole being inserted into the venule while the positive is held in the hand. A current of 2 to 5 milliampères, generated by three or four cells, is usually sufficiently powerful, and does not cause scarring. Puncture of the pimply lesions with Kaposi’s acne lancet and multiple linear scarifications often yield excellent cosmetic effects. Excision is the only procedure applicable to the enormous hypertrophic growths and its results are remarkably satisfactory, the wound generally healing with great readiness.

J. J. PRINGLE.

ACNE SEBACEA.—A condition due to increased secretion of the sebaceous glands, in which the sebum mixed with dirt accumulates on otherwise healthy skin.

Kölliker shows that the sebaceous glands are constantly giving off cells, which, when first formed at the bottom of the glands, are pale and only slightly granular, but which, when they are forced to the surface by the formation of fresh cells, become filled with a quantity of fat-granules. These granules at a later stage

coalesce into a single globule, and the wall of the cell becomes stronger and more horny. Seborrhea consists in the increased production of these oil-globules, and may be divided into three varieties—*S. oleosa*, *S. sicca*, and ichthyosis sebacea neonatorum.

Symptoms.—Seborrhea oleosa occurs usually between the ages of fifteen and twenty-five, and affects the cheeks, nose, and forehead. The exudation of oil from the sebaceous glands gives a greasy appearance to the skin, which next becomes dirty, owing, to the liability of the oil to attract and absorb particles of dust and dirt floating in the air. When this condition has lasted for some time crusts are formed, which may vary greatly in color, and when they are raised small processes of sebum can be drawn from the follicles. When the disease occurs on hairy places the hair becomes matted, in consequence of which dirt adheres and vermin accumulate, constituting the condition known as plica Polonica.

S. oleosa also occurs on the genitals of both sexes, and is known as smegma præputii et clitoridis. When neglected it forms thin crusts, which in the male are situated on the glans penis beneath the prepuce, and in the female around the clitoris and in the neighboring grooves. If allowed to remain untouched for a long time, they cause severe local irritation and inflammation, a condition which may be mistaken for gonorrhea. Vernix caseosa is a name given by Hebra to a similar deposit over the whole body of new-born infants.

Seborrhea sicca is produced in a similar way to *S. oleosa*, but gives rise to the formation either of a dry, light yellow crust or a branny coating to the skin. The regions most usually affected are the scalp and other hairy parts of the body. Scales of epidermis and dried sebum, which are constantly being formed and ought to be removed, are, owing to a want of cleanliness, allowed to accumulate in the hair, and are known as scurf. The affection does not last long without injuring the hair itself, which gradually falls off and is replaced by badly developed hair till partial baldness is the result. When the disease is of long standing further changes take place in the scalp, and itching, which is absent in the earlier stage of the disease, may eventually arise from an eczematous condition of the skin.

Ichthyosis sebacea neonatorum must not on account of its name be confused with true ichthyosis, but Hebra has thus termed the affection of new-born infants formerly known as ichthyosis congenita. The symptoms appear within a few hours of birth, when the skin presents a smooth, glossy, and somewhat purple appearance. It is also covered with a quantity of fissures, which are most numerous on the fingers and toes and over the flexures of the joints. The slightest movement causes pain, and in severe cases the child is unable to suck.

Diagnosis.—*S. oleosa* may be mistaken for lupus erythematosus, but greater swelling and redness, more adherent scales, and a tendency to scar are found in the latter.

S. sicca may be mistaken for three diseases when it attacks the scalp,—eczema, psoriasis, and ringworm. For the diagnosis from the two former see those diseases. From ringworm it may be distinguished by the history of the case, the absence of short broken hairs, the greater difficulty in extracting the hairs, and by aid of the microscope.

Ichthyosis sebacea neonatorum may be distinguished from genuine ichthyosis by the fact that the former is local and not general.

Prognosis.—This depends on the cause of the condition, for when it occurs in the course of a serious disease the prognosis is unfavorable, while under suitable treatment recovery is in ordinary cases usually rapid.

Treatment.—Both local and constitutional means are used, but the former are the most important. In all varieties thorough cleanliness is necessary, and if crusts are formed they should be removed with oil, soft soap, or lard. After removal of the crusts the part should be dressed with a slightly stimulating ointment, such as zinc, weak carbolic acid, or tar, and in *S. sicca* of the scalp a lotion of borax is useful.

Internally tonics, such as arsenic, iron, and the mineral acids, should be administered in full and repeated doses.

MALCOLM MORRIS.

ACNE SYCOSIS.—Hebra's definition is "a disease of chronic course, non-contagious, attacking the hairy parts of the cutaneous surface, and characterized by the development of papules and tubercles.

continuous thickenings, and pustules of various sizes, all invariably having hairs passing through them."

Symptoms.—Acne sycosis consists of a chronic inflammation and suppuration of the hair follicles, and therefore attacks only the hairy parts of the body, but the most usual site is the beard. The cause often suggested for A. sycosis is the use of blunt razors, but this is doubtful, since persons who never shave are liable to it. The pimples first appear like those of A. vulgaris, but with a hair passing through each of them, and as they get larger and assume the character of tubercles they may coalesce and form a thick, indurated mass, limited entirely to the hairy region and through which the hairs protrude. These hairs are easily extracted on account of the inflammation at their root, which itself appears swollen. From the indurated mass pus oozes, which dries and forms thin yellow scabs, and when the eruption disappears cicatrices are left and the place remains bald. The disease is specially liable to follow attacks of eczema.

Diagnosis.—A. sycosis may be mistaken for A. vulgaris, eczema, or a syphilide. From them it may be distinguished because it always attacks the hairy parts alone, and does not spread beyond them, because the hairs pierce the pustules or tubercles, and no similar eruptions are seen elsewhere.

Prognosis.—The course is always tedious and the disease is difficult to cure, but it rarely terminates fatally unless erysipelas occurs as well.

Treatment.—This consists, in the first place, in epilating the hairs of the diseased parts and in shaving the rest of the patch, but to be of real service epilation should be commenced as early as possible in the attack and should be continued as it spreads. The pustules should be pricked and the pus let out, and if the part is not very painful or inflamed they should be lightly touched with acid nitrate of mercury, but if it is tender cold-water rags covered with oil silk should be applied. As the disease becomes more chronic ointments and lotions similar to those recommended in A. vulgaris should be tried. Hebra strongly insists on the importance of regular shaving after the disease has been cured, to prevent its recurrence.

MALCOLM MORRIS.

Symptomatic Indications.—Simple acne requires belladonna or borax,

preference being given to *belladonna* for acne in young people, especially when the pimples are bright red. Also in severe cases of acne rosacea. It checks abundant secretion from sebaceous follicles. For acne in plethoric young women; red, papulous eruption on the cheeks or chin, *borax* is the best remedy. Acne rosacea in young persons, with much itching and burning, may be met with *rhus tox*.

Chronic cases require arsenicum or sulphur, *sulphur* being indicated in chronic cases of acne simplex; the *arsenicum* applying to acne rosacea and to cases occurring in drunkards. Acne rosacea from the use of alcohol or cases attended with disorders of digestion requires *nuxvomica*.

ACONITE, POISONING BY.—

The leaves and the root are the parts most often taken.

Symptoms.—A cool, numbing sensation in the mouth and throat sets in almost at once; this is followed by numbness, tingling, and loss of power in the legs. There is generally acute pain in the stomach, with vomiting and purging; the pupils are dilated, the vision impaired, and the pulse exceedingly feeble. Death may take place from syncope, and is preceded by collapse and clammy perspiration. There are no special post-mortem appearances.

Treatment.—The patient must be kept in the recumbent position, vomiting should be encouraged by emetics, and the stomach should be washed out; digitalis (20-minim doses of the tincture) or atropine (gr. $\frac{1}{60}$ hypodermically) may be used as antidotes. Artificial respiration may be necessary; the patient must be kept warm, and stimulants freely administered.

ACROMEGALY.—A condition characterized mainly by hypertrophy of the hands, feet, and face. The pathological nature of this affection is obscure.

Symptoms.—The most striking feature of the disease is an enormous enlargement of the hands and feet, both bony and soft parts being involved. The hands and feet, though gigantic, are not deformed, and the skin over them is not materially altered in its appearance or in its functions. In spite of the gigantic size of the hands, they are not unwieldy,

and delicate operations, such as threading a needle, are performed readily. The nails are broad, vertically grooved, and occasionally large. Sometimes the wrists are enlarged, and rarely the lower part of the forearms, but the arms are never affected. The legs do not undergo general hypertrophy, but it is not uncommon to find thickening of the malleoli, head of the fibula, patella, and condyles of the femur. The face becomes elongated, and the outline oval; the nose is much broadened, the cheek-bones prominent, the lower lip thick and everted, the chin square and massive. The neck is short and thick, and partly on this account and partly on account of the enlargement of the lower jaw, the chin tends to fall on the upper part of the sternum. The eyelids, and sometimes the ears, undergo hypertrophy; the tongue is often enormously enlarged. The teeth are not hypertrophied, but the intervals between them are frequently widened. In consequence of the enlargement and projection of the lower jaw, the teeth do not meet those of the upper jaw, but protrude in a very remarkable way. The frontal eminences sometimes become unduly prominent, and the vault of the skull may present some light increase in size. The skin often has a yellowish-brown tinge, and is coarse, flabby, and somewhat dry, but the dryness never approaches the degree of harshness seen in myxœdema. The male and female genital organs have been found hypertrophied, and sexual power may be impaired. The catamenia usually disappear early in the disease. The hair does not fall out, but is often coarse and rough; it may, however, be natural. In the spine there is often great exaggeration of the dorsal curve with compensatory lordosis in the lumbar part. The thorax undergoes increase in the antero-posterior direction, with marked lateral flattening. The clavicles, ribs, and sternum are frequently hypertrophied. The thyroid gland has very commonly presented some abnormality; in some cases being apparently atrophied, in others much enlarged. The laryngeal cartilages may be hypertrophied. Partly on this account, and partly in consequence of the hypertrophied tongue, the voice becomes thick and deep-toned, though quite distinct. The mental faculties undergo no impairment, except perhaps in the later stages. Head-

ache, often severe, and pains in the body, especially about the joints, are common. Of the special senses, the sight is most frequently affected. Optic neuritis, passing on to atrophy, with associated blindness, has been noted in some cases. The senses of hearing, taste, and smell may be deficient.

The duration of the disease may be twenty years or more. The initial symptoms in many cases are headache and suppression of the catamenia, the changes in the extremities and face occurring very gradually at a later date. In the advanced stages, cachexia supervenes, the patient becomes bedridden, and may remain in this condition for years, finally dying of exhaustion.

Diagnosis.—The disease is most likely to be confounded with myxœdema; but in acromegaly the sudoriparous and sebaceous secretions are not suppressed, the skin does not assume the dry and harsh character seen in myxœdema, the hair undergoes no marked nutritive changes and has no tendency to fall out, and bodily and mental torpor are not present. In myxœdema the bones never undergo hypertrophy, and disease of the optic nerves does not occur. From osteitis deformans acromegaly is especially distinguished by the absence of deforming changes in the shafts of the long bones, by the symmetrical distribution of the hypertrophy, and its limitation in the limbs to the hands and feet, and by the remarkable enlargement of the bones of the face, whereas in osteitis deformans the cranium is mainly or exclusively hypertrophied. In osteitis deformans the face is triangular with the base upward; in acromegaly it is egg-shaped with the large end downward, and in myxœdema it is round like the full moon. From leontiasis ossea and rheumatoid arthritis there are many and obvious points of difference, on which it is unnecessary to dwell.

Prognosis.—This has been already indicated in the description of the disease. It is sufficient here to say that there may be prolonged stationary periods, and that occasionally the disease undergoes temporary recession.

Ætiology.—The actual cause is unknown. Both sexes are affected in about equal proportion, and the disease may occur at any period between the ages of fifteen and sixty. Heredity is believed by

Virchow to have an important share in causation. In several cases there was an early cessation of the catamenia, but this was probably a symptom of the disease. Acromegaly occasionally occurs about the period of puberty, and this fact, together with the early arrest of the catamenia, has led some observers to the gratuitous assumption that the disease has some relation with the sexual processes or changes in the sexual development.

Treatment.—Treatment is to be conducted on general principles. Massage is favorably mentioned by one observer.

W. B. HADDEN.

ACTINOMYCOSIS.—A disease of frequent occurrence in cattle. A similar, if not identical, disease has been recognized in man.

The name is derived from the presence of a characteristic micro-parasite, *the ray fungus*, which is found in the affected tissues.

Its manifestations are essentially those of chronic inflammation, with or without suppuration, often resulting in the formation of granulation tumors.

The disease cannot with certainty be recognized except by the detection of the fungus in the discharges, or in the substance of the infected part, although in many cases the peculiar structure of the tumors has given the clue to a correct diagnosis. The symptoms depend more on the locality of the tumors than on the nature of the organism.

This disease has not unreasonably been mistaken for many other affections, such as tubercle, osteo-sarcoma, strumous abscess, etc., the organism having in most cases been overlooked.

The fungus grows embedded in the tissues or floating in the pus. In the latter are seen minute spherical granules, varying in size from a small pin's head downward. The granules appear sulphur-yellow by reflected, and greenish yellow by transmitted light, and in the discharge from a tumor which is suppurating freely are often very numerous.

There is much doubt as to the true nature of the growth; it has been generally accepted in Germany that it is a bacterium, and that the clubshaped bodies are only degenerative forms. This is contrary to analogy, and is, it

would seem, founded on the result of imperfect cultivation experiments. There can be little doubt that it is a mold, that the threads are delicate hyphæ forming a dense mycelium, and that the clubs are organs of fructification analogous to the asci of ascomycetes (Delépine).

Morbid Anatomy.—The appearances presented by the tumors vary according to the structure of the tissues primarily attacked. It is remarkable that in most of the cases recorded in England the liver has been affected, and has seemed to be the primary point of infection. In this organ the structure of the growth is very characteristic. It consists of minute foci of inflammation, which tend to run together, forming larger areas. These again unite, forming small abscess cavities filled with thick creamy pus, separated from each other by dense bands of fibrous tissue. By this process, as it extends, the disease slowly destroys the proper tissue of the affected part, and replaces it by a sponge-like mass of interlacing fibrous bands filled with pus, the amount of pus being greater in proportion as the course of the disease is rapid.

In the extremely chronic example of the disease seen in the tongues of cattle (wooden tongue) the growth consists almost entirely of fibrous tissue, embedded in which are minute specks of inflammation, the organism being the central spot of each inflammatory area.

In the softer and more rapidly extending growths, such as occur in the thorax, masses of the fungus are found floating in a pultaceous mass of pus, mixed with products of inflammatory degeneration.

If very chronic, the tumors may become calcified, or even partly converted into bone.

The disease spreads by the formation of secondary foci of inflammation caused by the transportation of the fungus.

Nothing certain is known of the communicability of the disease from cattle to man, and the origin of the disease itself is doubtful.

Treatment.—No drug is known to exert any specific influence on the organism. Removal of the infected tissue is the only method which holds out any chance of ultimate success. If the main growth can be removed, there is hope of complete recovery.

T. D. ACLAND.

ACRODYNIA.—Acrodynia is defined by Dunglison as a “painful affection of the wrist and ankles, especially with an erythematous eruption, which appeared in Paris as an epidemic in 1828–31, supposed by some to be rheumatic, by others to be owing to spinal irritation. It appears to have been the same as dengue.”

ACUPRESSURE.—Four chief modes: 1, a long needle is thrust right through the flap and made to bridge over the artery; 2, a short needle, with a twisted wire through the eye to extract it by, is thrust into the soft tissues on each side of, and made to bridge over, the artery; 3, the vessel is compressed between a needle and a loop of wire, like a common hair-lip suture; 4, the needle is thrust through the soft tissues beside the artery, then twisted down upon the artery through an arc of a circle, and thrust into the neighboring soft tissue again. Advantages of acupressure.—No foreign body is left in the wound more than a day or two, as, after that time, the needles are removed. A few hours suffice for small arteries. Acupressure does capitally in scalp wounds and when varicose veins burst.

C. B. KEETLY.

ADDISON'S DISEASE is characterized clinically by a progressive asthenia with a great liability to nausea and vomiting, and a peculiar discoloration of the skin.

Symptoms.—The onset of the disease is gradual. Sometimes the discoloration is the first thing noticed, but in the majority of cases, at any rate, an increasing debility will have already set in. The patient, though often anæmic, it is not necessarily so to any marked degree, and, though there may be wasting, there is not great emaciation. The extreme weakness, for which no sufficient signs of organic disease can be found, is the chief feature of the early stages. The heart-sounds are clear but weak, the pulse small and frequent, and the patient suffers from breathlessness, cold extremities, and a tendency to faintness. He has a downcast, sad look, and constantly complains of weariness; the nervous enfeeblement affects the mind as well as the body. Anorexia, nausea, and vomiting are generally present; they usually appear early in the disease, and recur at intervals.

The bowels are sometimes confined, sometimes relaxed, and that without any obvious cause; the urine is pale and free from albumen, and may be increased in quantity. As a rule, the temperature is below the normal. Among other symptoms, more or less pain in the loins and epigastrium, vertigo, tinnitus, and headache are often present. The discoloration or bronzing of the skin is probably not an essential feature, but is found in a large majority of the cases. It is due to an increase in the normal amount of pigmentation, and even when most extensive, and affecting the whole body, is never uniform throughout, except in places where the skin has suffered injury or abrasion, as from recent blistering; but no sharp lines of demarcation will be found. The change occurs in small patches or diffused areas, varying in color from a light yellow or greenish-brown to a slaty blue-black shade or deep olive tint. It is usually first seen on the face; and here, and on the neck, and backs of the hands—*i. e.*, in the exposed regions of the body—it is most marked. It is merely an exaggeration of the normal pigment of the part, and is therefore very marked on the penis and scrotum and about the nipples. It is also seen on the parts subjected to friction—*e. g.*, the site of the garters. Scars that are not very deep and places where blisters have been applied are apt to become highly pigmented. The sclerotics are always pearly white, in strong contrast to the rest of the patient's face; the nails, hair, and teeth may show increased pigmentation. Here and there on the body a few small spots like pigmented moles will be seen. The mucous membranes may also be affected, and patches may be found on the lips, palate, cheeks, sides, and under-surface of the tongue, and in the vagina. The intensity of the color may vary with the patient's general health, and leucoderma may coexist. The disease progresses, but not always at a uniform rate, to a fatal termination. The prostration increases so that the patient is confined to bed or to the recumbent position, from which he cannot move without great risk of syncope; his voice becomes weak, and he is constantly sighing or yawning or troubled with hiccough. The intellect gradually becomes dulled, and delirium, coma, and convulsions usher in the termination, or the patient is carried off by

incoercible vomiting and diarrhea. In a considerable number of cases death occurs suddenly from syncope during some slight exertion. It is believed that the disease is invariably fatal, and there is evidence that the cases in which no discoloration is observed run the shortest course. There may be periods of remission, and the illness may be prolonged for a few years, but it usually terminates in about eighteen months.

Diagnosis.—Always difficult, especially in the early stages, when discoloration is slight or absent, and it is probable that some of the fatal cases of so-called nostalgia which have been recorded were, in reality, instances of this disease. Where the asthenia and pigmentation are both well marked, there need not be much hesitation in pronouncing an opinion, but it must be remembered that pigmentation is met with in abdominal cancer and tuberculosis, lymphoma, pregnancy, chronic uterine disease, hepatic disorders, and melanotic cancer.

Pathology.—An increase of pigment is found in the cells of the rete muscosum, chiefly in the lower layers; also in the deeper parts of the connective tissue, the cells of the papillæ, and in the subcutaneous tissues. Chronic phthisis or general tuberculosis will often be found; the heart is sometimes small, and the spleen occasionally enlarged; but the chief interest centers round the suprarenal bodies and adjacent structures. The commonest change, and one that for a long time was believed to be essential, is a caseo-fibrous one, whereby the capsules are enlarged, though retaining their normal shape, and are adherent to the structures in their immediate neighborhood. In this state they are firm or indurated, and on section show grayish-white or caseous nodules of various sizes, the rest of the organ presenting a semi-translucent, grayish aspect; or the whole may have undergone caseation; the caseous areas may be softened into a creamy material or may have become calcareous. When this latter process has not occurred, the final stage is one of absorption, the capsule shrinking into a small, puckered, fibrous mass, adherent to the structures round it, being then much smaller than normal and recognized only with difficulty. Tubercle bacilli have been demonstrated to be present. Some undoubted cases of this disease, however, have been re-

corded in which the suprarenal bodies had not undergone this change, but were found atrophied either from interstitial changes or apparently from mere wasting. Other diseases of the capsules, such as cancer, are probably never followed by the special symptoms of this disease. Among the structures to which the capsules are sometimes adherent are the semilunar ganglia and the plexus of nerves in connection therewith, and sclerotic changes have sometimes been found in these, the nerve cells being deeply pigmented, while both fibers and nerve cells may be compressed and ultimately destroyed by the growth of connective tissue taking place between them.

Ætiology.—The causes of the disease are unknown. It is much more common in males than females, and is most often met with between the ages of twenty and forty; it is very rare in children under ten or in persons over fifty. It is more common among the working classes than among the well-to-do, possibly because the former are much more exposed to injury, as it has sometimes seemed to follow upon an injury to the abdomen or back, and in not a few cases it has been associated with caries of the spine. It is not, strictly speaking, an hereditary affection, nor, though it is frequently dependent upon tubercular disease, is it more common among phthisical families. No theory as to the nature of Addison's disease which satisfactorily meets all the difficulties has yet been framed, but at the present time the balance of authority is strongly in favor of the theory that the disease is primary in the adrenals, and that the changes found therein are due to the presence of tubercle.

Treatment.—There is no specific against this malady, nor is any drug known to have exercised any influence over its course, although there is often a remission of urgent symptoms for considerable periods; the treatment, therefore, can only be symptomatic. The patient should be warned of the liability to syncope, and in the late stages should be strictly confined to the recumbent position. The diet should be most carefully regulated (remembering that vomiting and diarrhea are very apt to occur and difficult to check), and the strength maintained by such general tonics as may seem indicated.

JOHN ABERCROMBIE.

Symptomatic Indications.—The remedies which have been used in the treatment of this disease include *arsenicum*, which corresponds to the constitutional symptoms of the disease: the anæmia, languor, debility, irritability of the stomach and the feebleness of the heart action; *creosote*, which may relieve the irritability of the stomach; *iodine*, which has been used on the theory of the scrofulous nature of the disease; and *argentum nitricum*, which is reported to have benefited in one case, but no indications have been given.

ADENOCELE, ADENOMA, ADENOMATA.—A growth, the whole or part of whose structure resembles that of some gland. [But the term “Lymphoma” is usually applied to any tumor resembling a lymphatic gland.] When not pure these tumors are called adeno-sarcoma, adeno-myxoma, etc. Occurrence: In the “mucous polypi” of the nose, rectum, and uterus: *vide* POLYPI; in thyroid gland: *vide* BRONCHOCELE; in parotid, lips, tonsils, and skin. Physical character: movable, rounded, ovoid, or lobulated. Growth, variable in rapidity.

Treatment.—Divide capsule and enucleate in suitable cases. See POLYPI, BRONCHOCELE, MAMMARY TUMORS, etc.

C. B. KEETLY.

Symptomatic Indications.—For tumors following injuries, blows, contusions, sore aching pains, *arnica*. For tumors with much inflammation, painful even to light touch, *belladonna* will be indicated. There is usually present a general congested condition, with pains that appear and disappear suddenly. Indolent tumors of slow growth, with imperfect suppuration, are relieved by *bryonia*. Fatty tumors in persons of a scrofulous diathesis with enlarged glands, etc., require *baryta carb*. For tumors, especially schirrous, coming on after contusion, with stony hardness and feeling of weight, particularly mammary tumors, *conium*. For warts, polypi, and benignant tumors of encysted variety, *calcareo carb*. Tumors in herpetic persons; wens with sebaceous cysts; induration of glands, *graphites*. For painful tumors on the scalp, worse from pressure, with itching, *kali carb*.

ADENOID VEGETATIONS, a term applied to hypertrophy of the adenoid tissue, normally existing in the naso-phar-

ynx, to which the name of Luschka's tonsil has been given.

Symptoms.—The points which most attract attention are the vacant expression of the child, the open mouth, and usually somewhat noisy breathing. The face is elongated, and the nose narrow. It will probably be found that the patient's hearing is more or less impaired, and that at times he suffers from an increased amount of deafness, accompanied by earache and discharge from the ears. The child usually suffers also from a hacking cough, is subject to attacks of cold in the head, laryngeal and bronchial catarrh, snores at night, and mucus tinged with blood will often be found staining the pillow in the morning. Over and above the appearance of stupidity, produced by the mouth being kept habitually half-open, and the deafness, there is no doubt that the existence of these growths unfavorably influences the mental condition and leads to a want of the power of application. When the child talks the voice has a muffled character, the so-called “deadness of speech,” with inability to pronounce the nasal consonants *m* and *n*. Enlarged tonsils and granulations at the back of the pharynx are often found associated with adenoid vegetations. Owing to the constant secretion kept up by the presence of these growths, a muco-purulent discharge will be seen trickling down the pharynx. If a rhinoscopic examination is practicable the naso-pharynx will be found more or less occupied by these growths, so that the normal outlines of the septum and choanæ are obscured. If the examination by means of the mirror fails to give satisfactory information, a digital investigation may be made, and, on introducing the finger behind the soft palate, the vegetations may be recognized by the touch: if small, they have a velvety feel; if larger, they impart the sensation of a bag of worms. On account of their vascularity, there is usually blood on the finger when it is withdrawn. Adenoid vegetations are often associated with a lateral narrowing of the alveolar arch and prominence of the upper incisor teeth, and their presence exercises an unfavorable influence on the development of the chest, which becomes pigeon-breasted. Hernia has recently been attributed to nasal stenosis, the frequent and long-continued efforts to get rid of the secretion from the nasal passages giving rise to increased abdominal

pressure. That adenoid vegetations exert an injurious influence on the physical development of children is shown by the rapid increase in height and weight which follows their removal by operation.

Pathology.—Adenoid vegetations precisely resemble in their structure enlarged tonsils and the granulations seen in the posterior wall of the pharynx.

Ætiology.—Youth is the most important predisposing cause, as with advancing years the growths have a natural tendency to shrivel up and disappear, but, too often, not before they have done grave and permanent damage. They are met with in all classes of life and in all climates, but they occur especially in temperate and moist climates. Some authors regard them as an outcome of the scrofulous diathesis.

Treatment.—Too much stress cannot be laid on the importance of the early and complete removal of these growths and on the folly of waiting for their spontaneous disappearance. Between the ages of four and twelve is the best time for the operation, but good results may be had in patients of fifteen and sixteen. Older patients derive much less benefit from operation, as in them permanent changes have probably already taken place as the result of the presence of these vegetations. Various methods of removal have been suggested, but the most satisfactory method is to place the patient under chloroform, and to thoroughly clear out the naso-pharynx at one sitting by means of Loewenberg's forceps. This procedure has the advantage of allowing the tonsils to be excised at the time if, as is so frequently the case, they are enlarged, and, if need be, portions of the inferior turbinated bodies may also be removed.

F. DE HAVILLAND HALL.

Symptomatic Indications.—For simple hypertrophy of strumous origin *calcarea iod.* is the most generally useful remedy, but preference may be given to *baryta carb.* in delicate children, when there is dwarfing of mind and body, and tendency of the glands to suppuration. Induration and ulceration with fetid breath, and profuse discharge of saliva with nightly aggravations will require *mercurius*. *Baryta iod.* will be indicated when the disease is the result of repeated attacks of inflammation. Irritability and emaciation may also be present. *Calcium*

sulphide may also be useful in cases of scrofulous origin; sticking pain as from a fish bone in the throat on swallowing; inclination to suppuration.

AGORAPHOBIA, a fear of open places. This symptom, first described by Beard, occurs, usually in association with others of greater importance, in cases of neurasthenia and in persons of neurotic inheritance. The fear seizes the patient indifferently in a large crowded square of a town or upon a lonely plain. The dread which many people have of looking down from a height is a strictly parallel psychological state. Agoraphobia is comparable to some sensations of the insane, such as that of the body growing too large for the room, shriveling, or becoming buoyant.

AIR, COMPRESSED, Therapeutics of.—Several forms of apparatus have been devised for the purpose of inhaling compressed air, the most practical being constructed upon the principle of the gasometer (Waldenburg's), or upon that of the accordion. In either of these the pressure can be regulated with some degree of precision, and is under the control of the patient. A more complete method of inhaling compressed air is by means of the compressed-air bath. It consists essentially of small iron chambers, capable of holding from one to four persons, and rendered completely air-tight. Air is forced in at the lower part of the chamber and allowed to escape through a graduated outlet at the roof, the degree of pressure being carefully regulated by this means. A compressed-air bath should last about two hours, the pressure, which may range between 2 and 10 lbs., being increased very gradually at first, until it reaches the maximum that is required, and, when this degree of pressure has been retained for about one hour, it should be as gradually diminished, till the normal atmospheric pressure is again reached. The effect of compressed air upon the lungs, by whichever method it be inhaled, is to cause greater depth of inspiration, and consequently greater expansion of the lung tissue. The number of respirations per minute becomes slower. The heart's action also is slowed by several beats, and the arterial tension is very considerably increased. The chief physiological action is the introduction of a larger proportion of oxygen with each inspiration, and hence

the induction of more rapid tissue changes. The cases most suitable for treatment by this method are chronic inflammatory conditions which have been followed by collapse of lung tissue or temporary closure of bronchioles. By some observers the compressed air is said to have a direct sedative action upon the respiratory passages, and so to be of value in cases of asthmatic dyspnœa. In all conditions, its effects are in the first instance temporary only, and the forced expansion of the lung is not maintained. After prolonged use of the bath, however, a more or less permanent expansion is gradually induced, which is accompanied by marked relief to the dyspnœa, but to obtain such a result upward of a hundred baths are sometimes necessary. The temporary relief in some cases of chronic bronchitis and emphysema, or of the latter condition without any inflammatory change, is very decided. In cases of chronic pleurisy, where the lung has become bound down and partly disused and collapsed, the force of compressed air may be advantageously employed to re-open as much of the shrunken tissue as may be capable of re-expansion, and in certain cases of imperfect recovery after acute pneumonia it may have a beneficial effect. In cases of phthisis compressed air must be used with caution. It would appear to be most efficacious in those cases where the disease is not active, and where there is but little evidence of any inflammatory condition of the mucous membrane. It should not be used where there is any tendency to hemorrhage, or where the disease appears to be progressing rapidly. The treatment is contra-indicated in all cases of marked arterial degeneration from whatever cause, and in all cases where there is any reason to anticipate hemorrhage from any of the internal organs, as the stomach, uterus, kidney, etc. Compressed air is not suitable for old persons, nor for those in whom the chest-walls have become rigid.

E. C. BEALE.

AIR, RAREFIED, Therapeutics of.—Rarefied air may be employed as a remedial agent either by means of apparatus similar in construction to that used for the inhalation of compressed air, or by a residence at high altitudes in some of the mountain health resorts. Its immediate effect upon the function of respiration is to increase the muscular efforts required

to fill the chest, and by this increased effort a certain amount of lung tissue becomes re-expanded which in ordinary shallow breathing has been allowed to remain at rest, and perhaps collapsed; the expiratory movements at the same time are more complete, and the average of residual air and carbonic acid left in the lungs after each respiration is less than before. By this means, therefore, an increased degree of tissue change is induced, and, when the treatment is persevered with for a long period, the lungs themselves tend to become more or less permanently increased in capacity. Various methods have been tried whereby the inhalation of compressed air might be so combined with expiration into rarefied air as to increase still further this mechanical expansion of the lungs, but hitherto the results obtained have not been satisfactory enough to warrant the adoption of the method as a regular method of treatment. Expiration into rarefied air has, however, been found to be beneficial to certain cases of emphysema by assisting the more complete emptying of the chest of the regular tidal air and of some of the residual carbonic acid, which is rendered difficult in that disease by the loss of elasticity of the vesicular tissue.

E. C. BEALE.

ALBINISMUS is the congenital absence of pigment from the skin, hair, choroids, and irides. The condition is frequently hereditary, and generally affects more than one member of the same family. The hair is usually white, fine, and silky, but occasionally its color is reddish. Photophobia and nystagmus are usually present; the iris appears pink, and the pupil has a dark red spot in its center. Albinos are frequently poorly developed, both mentally and physically, but the rule is by no means an invariable one. Partial albinismus is fairly common among negroes, giving them a "piebald" appearance. The patches occasionally occupy the area of distribution of some nerve; the eyes are usually unaffected. Some cases are said to recover.

ALBUMINOID DISEASE is also known as **waxy**, **amyloid**, or **lardaceous** infiltration or degeneration. It is a peculiar change, usually affecting several of the viscera at the same time, and supervening upon, and in consequence of, some

pre-existing disease. The spleen, liver, kidneys, intestine, and lymphatic glands are the organs most frequently affected, and in the order named. The first result is to produce an increase in size of the organ, which is pale, and, on section, presents a glistening, waxy, bacon-like appearance. The change always commences in, or in connection with, the capillary vessels. In the spleen it is first seen, and is most marked in the Malpighian bodies, which become visible to the unaided eye, looking like grains of boiled sago, whence comes the term "sago-spleen." In the liver the change commences in the hepatic capillaries, and consequently first affects the intermediate zone in each lobule. The liver cells are not infiltrated. In the kidney it is often confined to the glomeruli, or some of the afferent arteries may also be affected. Occasionally the cortex escapes, and the straight vessels in the pyramids are invaded. Not frequently albuminoid disease of the kidney is accompanied by some other form of chronic renal mischief. In the small intestine the blood vessels of the villi show infiltration. The change is found less often in the stomach, and still less frequently in the large intestine. Albuminoid deposit has also been found in the pancreas, suprarenals, in the skin, in certain new formations, and in the endothelial lining of the aorta. In a few instances renal casts have given reactions characteristic of this change. In the latter stages the organs may be found so enormously enlarged that the liver, for example, almost fills the abdominal cavity, and the spleen may reach a hand's breadth below the costal margin. If the cause of the disease be removed, the infiltration may be absorbed, the affected organs returning to the normal size. The *iodine test* for the lardaceous change is easy of application, and reliable. The cut surface of the organ having been rendered free from blood by washing, a solution of iodine, alone or with iodide of potassium, is poured over it, when the affected parts will become of a deep mahogany-brown color, the degree of staining depending upon the amount of disease. This test can be applied to a section under the microscope in a doubtful case.

Ætiology.—The conditions under which the change occurs are in cases of chronic suppuration secondary to bone or joint disease; also of phthisis, empy-

ema, pyelitis, ulceration of the skin; of syphilis with or without bone disease or suppuration; it is said that congenital syphilis alone may be a cause. Other causes have been named, such as malaria, malignant growths, etc., but more evidence is required on this head. Very little is known as to the length of time required for the production of the disease; much depends upon the severity of the original affection.

As a rule, the change appears in several of the viscera about the same time, and a *diagnosis* would be justified by the simultaneous occurrence of a smooth enlargement of the liver and spleen, unaccompanied by jaundice or ascites, together with albuminuria, diarrhea, and a waxy cachectic complexion. As has been already stated, other forms of Bright's disease may coexist, so that the signs of a chronic nephritis should not exclude the diagnosis of albuminoid disease.

Treatment.—In the syphilitic cases it would be always worth while to give iodine of potassium and mercury a trial, and examples of apparently complete recovery have been recorded. In the other cases, good food, pure air, iron, cod-liver oil, and quinine are the most important remedial measures, and perhaps the salts of potassium might be beneficial. The removal of the cause, if it be possible, is the only reliable means of arresting the disease.

Specific Indications.—See organs affected.

ALBUMINURIA.—Various forms of albuminous matter are at times found in pathological urines, but that which clinically is known as albumen is a mixture of serum albumen and serum globulin in various proportions. In behavior to the ordinary tests these are identical, and for practical purposes are detected and estimated as one body.

TESTS FOR ALBUMEN.—*Heat.*—Generally speaking an acid albuminous urine, when boiled, becomes turbid, from the coagulation of the albumen, and the turbidity does not disappear when a few drops of acid are added. This, when properly carried out, constitutes one of the most delicate tests for albumen. The urine should be clear, or, if not so, should be filtered. A turbidity from the presence of urates does not interfere

much with the reaction, since such turbidity will disappear at a temperature below that required to coagulate the albumen. The proper acidity of the urine is of the greatest importance. In an alkaline urine the albumen tends to become alkali albumen, which is not coagulated by heat. Moreover, in such urine the phosphates are deposited on heating, although afterward dissolved by the addition of acid (*see URINE*). Similarly in a too-acid urine, a small quantity of albumen may be changed into acid albumen, and again become non-coagulable by heat. A most common error arises from this fallacy, in that a test-tube, imperfectly cleaned, may contain a sufficient amount of nitric acid to acidify its contents and prevent coagulation. The test should be carried out thus: A tube, some 6 inches in length, should be filled to about two-thirds of its length with the urine to be examined. The reaction of the urine being ascertained, it should be rendered neutral by the addition of either dilute acetic acid or of liquor potassæ, as may be required. Dilute acetic acid is now to be added until the reaction is faintly acid, and then still one drop more of the acid. The test-tube being held by its *lower* part, the *upper* part of the column of urine is boiled over a flame; the albumen, if contained therein, is shown as a white cloud, which is the more easily seen when the upper part of the column of urine is contrasted with the lower and unboiled portion. As additional security, a few drops more of acetic acid may be now poured in to dissolve any phosphates which may possibly have been precipitated. As is seen, there are very many fallacies in connection with this test, and the following is generally preferable.

Nitric acid.—Nitric acid coagulates albumen. The best method of applying this reaction clinically is to pour a little fuming nitric acid into a test-tube; and then, inclining the tube as much as possible, allow the urine to flow gently down the side, so as to float on the surface of the denser acid to the height of about an inch. At the line of junction of the two fluids, the albumen, if present, is coagulated, forming a white ring, which, if only a small quantity be present, may not appear for some fifteen or more minutes. Frequently, immediately above the albumen ring, is seen a more

hazy zone, believed to consist of mucin, though this is doubted by the writer. This ring disappears if the tube be slightly shaken. Urine containing large quantities of urates will precipitate them on the addition of the acid: but the cloud thereby produced is usually first seen at the top of the urine column, and disappears when the urine is warmed. Similarly, copaiba and cubeb, if taken internally, appear in the urine and are precipitated by the acid; but these again disappear on the application of slight heat. A colored ring is very frequently seen at the junction of the acid and the urine, and may hinder the recognition of the albumen cloud. Such a ring appears in urines which contain an excessive amount of indican or skatol absorbed from the intestine, and in the urine of persons who are jaundiced, or who have taken iodides or bromides internally.

The *magnesium-nitric test*, recommended by Sir William Roberts, is the best test for albumen in the urine. The magnesium-nitric test is made by mixing one part of strong nitric acid with five parts of a saturated solution of sulphate of magnesium. It is applied in exactly the same way as the nitric-acid test. Its advantages over the ordinary nitric-acid test are that it is more delicate, the albumen ring being denser and appearing more rapidly, while the fluid used is not so corrosive.

Picric acid.—A saturated solution of picric acid constitutes, when used with care, a very delicate test for albumen. It may be applied by the contact method, as described above, though it is much more difficult to keep the two fluids separate than in the case of the nitric-acid tests. Picric acid also throws down peptones, albumose, mucin, and quinine, but the clouds produced by the precipitation of these bodies are removed by heat.

To separate serum globulin from serum albumin the urine should be neutralized, and a large quantity of solid magnesium sulphate added to it. The mixture is then to be allowed to stand for some hours—best at a temperature of about 35° C. The globulin is thus precipitated, and its separation is hastened and rendered more complete if the mixture be repeatedly shaken. It is to be noted that the globulin is precipitated, not coagulated, and it can therefore be

filtered off and re-dissolved in water, the albumen remaining in the original solution.

QUANTITATIVE ESTIMATION OF ALBUMEN.—The most accurate method of ascertaining the quantity of albumen present in a given fluid is by precipitation and weighing, but this method is so troublesome, and requires so much special technique, as to be useless for clinical purposes.

As a rough method of estimation, a column of the urine may be acidified in a test-tube and thoroughly boiled. The tube is then allowed to stand for a little time until the coagulated albumen has collected at the bottom of the tube. The height of the column of albumen is then compared with the height of the whole column of urine, and expressed as a fractional proportion, such as a half, a quarter, a twelfth, and so forth, but such proportion refers only to the relative heights of the columns of albumen and urine respectively, and not to the actual amount of albumen present in the whole urine.

A similar but much more accurate method is that of Esbach. The urine to be examined is first diluted to a specific gravity of not more than 1010, and, if necessary, should be rendered acid with acetic acid. It is then poured into a special graduated tube up to a line *u*, and to it is added a mixture of equal parts of saturated solutions of picric and citric acids up to a line *r*. The solutions are well mixed, and allowed to stand for twenty-four hours, at the end of which time the coagulated albumen has subsided to the lower portion of the tube, and its height is read off on a graduated scale, which gives the proportion of grams per liter.

The dilution method was proposed by Sir William Roberts. By this method the albuminous urine is diluted with water until, when nitric acid is added, it will give an opacity before forty-five seconds have elapsed, but not before thirty seconds. The observer, with a watch before him, adds nitric acid to the urine by means of a pipette, so that the acid sinks to the bottom of the tube. Should the opacity appear before thirty seconds, the urine is diluted with so many times its own bulk of water as will suffice to produce the desired reaction. The quantity of water added is

expressed in terms of the original bulk of the urine employed, as degrees of dilution. It is found by actual weighing that each degree of dilution corresponds to 0.0034 per cent., or to 0.0148 grain per fluid ounce.

ÆTIOLOGY OF ALBUMINURIA.—Albumen may accidentally reach the urine from the admixture with it of some albuminous fluid, such as pus or blood. This is not true albuminuria, and is readily distinguished from it by the detection of the other elements of the admixed fluid. It must be borne in mind, however, that cases occur in which, although pus be present in the urine, true albuminuria may coexist, and it is often a matter of importance to determine whether the amount of albumen present is more than would be accounted for by the pus discovered.

The causes of albuminuria may for practical purposes be grouped as follows :

1. *Organic disease of the kidneys.*—From this cause albuminuria is found in acute and chronic Bright's disease, abscess and tumors of the kidney, and inflammation of the kidney spreading to it from the pelvis of the organ. In most case of diabetic coma albumen is found in the urine, and is probably caused by the changes in the renal epithelium known to exist in this state.

2. *Pyrexia.*—Febrile disorders of all kinds are prone to be accompanied by the presence of a small amount of albumen in the urine, which disappears when the febrile action ceases. This incidental albuminuria is entirely independent of the cause of the pyrexia. It may occur when the fever is due to some local inflammation, just as when it is part of a general zymotic disorder. Nevertheless, during the pyrexia of pneumonia and diphtheria, albuminuria is specially marked. It is to be distinguished from the more serious albuminuria which is a characteristic of certain specific fevers, such as scarlet fever, and which is due to the supervention of Bright's disease upon the original disorder.

3. *Congestion of the kidneys.*—The congestion may be active, representing the early stage of an inflammation of the kidneys, or passive, from obstruction of the outflow of blood from the renal vein. Venous congestion may be part of a general obstruction to the venous flow,

and may be caused by heart disease of various kinds, emphysema, and intrathoracic tumors. On the other hand its cause may be more local, such as the pressure of tumors within the abdomen, or of ascitic fluid upon the renal veins.

4. *General anæmia*, if of severe degree.

5. *Pregnancy and the puerperal state*.—Although not necessarily productive of organic kidney disease, this cause of albuminuria will be fully discussed under the head of BRIGHT'S DISEASE.

6. *Certain general blood disorders*, such as purpura, scurvy, and septic conditions, apart from the accompanying pyrexia. In hemoglobinuria, which is of similar origin, albumen also appears in the urine in large amount.

7. *Lead poisoning*.—The association of albuminuria with lead-poisoning is well known. In such case it has been proved both clinically and experimentally to be accompanied by such organic disease as is found in the granular kidney of Bright's disease.

8. *Nervous disorders*.—Grave nervous diseases, such as tetanus, delirium tremens, and cerebral hemorrhage, are sometimes productive of a temporary albuminuria. A trace of albumen in the urine is frequently observed after an epileptic seizure, and also after mere emotional disturbance. It may be noted here that albuminuria has been experimentally produced by puncture of the floor of the fourth ventricle. Albuminuria of intermittent occurrence has been noticed in cases of Graves' disease.

9. The condition variously known as functional, simple, transient, physiological, or *cyclic albuminuria*, or albuminuria of adolescence. This will receive further mention below.

10. *Various functional disorders*.—Dyspepsia, a highly nitrogenous food, such as eggs, used in excessive amount, a prolonged rigor, cold bathing, the inhalation of sewer gas, excessive muscular exertion, and the blowing of wind instruments have been shown to be causes of albuminuria. By whatever causes albuminuria is induced it is subject to the influence of these and other functional disturbances. Thus the albuminuria of chronic Bright's disease is often more pronounced after meals; is governed by the amount and character of the food assumed; is increased by muscular exercise and by the upright posture,

while diminished and even caused to disappear by rest in bed.

Cyclic Albuminuria.—It is not uncommon to meet with albumen in the urine of persons who appear to be otherwise healthy, or who complain of but slight symptoms of disease. The state of the urine is frequently first discovered during an examination for life insurance. A large majority of the subjects of this condition are young persons of both sexes at about the age of puberty, whence one name for the condition, albuminuria of adolescence. The urine contains as a rule only a small quantity of albumen, but this is not invariably the case. It is, moreover, noted that the conditions mentioned above (section 10) as influencing all albuminurias have more effect in increasing or diminishing the quantity of albumen in this form. Thus the urine may be free from albumen before breakfast, but contain an appreciable quantity after that meal. The upright posture and muscular exertion greatly increase the amount of albumen. Frequently, too, the albumen makes its appearance only at stated times of the day, but regularly at those times, whence also its term "cyclic." The urine is seldom of a specific gravity lower than normal; its color is sometimes deeper than usual; it may deposit crystals of uric acid or oxalate of lime, and even occasionally a few hyaline casts. The amount of urea contained in the urine is not diminished, but may be increased. Bile salts are said to be increased, and peptones or sugar have been known to alternate in appearance with the albumen. The subjects of the affection may be in apparently robust health, or they may be pale and languid, and suffer from dyspeptic disorders. The writer believes that two separate categories of these cases may be distinguished by a reference to the arterial tension. In one group there is a high arterial tension, as indicated by the condition of the radial pulse, and in such cases it is not uncommon to find a deposit of uric acid in the urine. Sometimes the pulse of persons of this class presents the characters of "virtual" tension, where the heart fails to entirely overcome a peripheral resistance. In the second group the pulse is that of low arterial tension, and such persons often suffer from dyspepsia and general want of tone. The nature of cyclic albuminuria is still obscure. It has been variously asserted to

be due to changes in the circulation of the kidney, to atony of the vessels and nerves, to a food albuminuria, and to increased destruction of red blood-corpuscles. Probably the first is the correct view in most cases.

Pathology of albuminuria.—Two views have been put forward to explain the absence of albumen from normal urine. The one assumes that albumen is actually transuded into the glomerular capsule, but is afterward re-absorbed by the renal epithelium; the other, which is more generally advocated, being that the albumen of the blood plasma is prevented from reaching the interior of the glomerular capsule by the layer of epithelium which covers the glomerular tuft. This epithelium has a selective secreting power, and normally eliminates water and urinary salts, but keeps back the albuminous matters. Any condition which interferes with the nutrition of the glomerular epithelium, or, in certain cases, of the renal epithelium, causes albuminuria, since the epithelium then no longer retains the blood albumen. Thus, an inflammation of the epithelium, as in parenchymatous and glomerular nephritis, is accompanied by albuminuria. But a mere functional disturbance of the epithelial nutrition will act similarly. Delay of the blood-flow from heart failure or other cause, or possibly irritation of the epithelial layer by the excretion of abnormal matters, will thus disturb its nutrition and allow the albumen to transude. Disturbance of the arterial tension probably acts upon the kidney function indirectly by influencing the circulation of blood through the capillary vessels, and so again causing disorders of the nutrition of the epithelium.

Prognosis.—Albuminuria being only a symptom, its prognosis must be the same as that of its cause. If the latter be functional, the prognosis is usually good; if organic, it is bad. The greater the quantity of albumen passed in twenty-four hours the more likely is the cause to be organic. A persistently low specific gravity of the urine and a deposit of granular, epithelial, or fatty casts are positive signs of organic kidney mischief. A few hyaline casts may be found in functional disorders, but a large number of them is indicative of more serious trouble. The long persistence of an albuminuria is of grave omen. The prognosis

of cyclic albuminuria is still in dispute. Some assert that it is of no moment; others that it is liable to lead to organic kidney disease. Long and extensive experience is necessary to determine the latter point. The writer is of opinion that albuminuria, even when of undoubtedly functional origin, should always be considered as a diseased condition and for purposes of life insurance be taxed, in spite of the otherwise healthy state of the system.

Treatment.—The treatment of albuminuria depends upon its cause. In the presence of organic disease the symptom itself rarely requires separate attention, but this will be considered in the section on BRIGHT'S DISEASE. The writer recommends for each of the two varieties of cyclic albuminuria a different treatment. The cases in which there is high arterial tension are best treated by alkalies (such as the tartrate of soda and potash, the sulphate and phosphate of soda, or the acetate of potash) and by fairly free purgation by salines with the occasional use of a mercurial pill. Those in which there is low arterial tension require the mineral acids, strychnine, and sometimes iron.

PEPTONURIA.—Peptones are detected in the urine by the following test: Liquor potassæ is poured into a test-tube to the height of nearly an inch, and to it is added one or two drops of a solution of sulphate of copper, so as to make a fluid having the faintest possible blue color. On the surface of this the urine is allowed to flow gently. A purple ring at the junction of the two fluids indicates the presence of peptones. Peptones are never present in the urine in more than small quantities, and their detection is of no practical utility.

HEMI-ALBUMOSE IN THE URINE.—This body has been found in the urine in osteo-malacia, in glycosuria, and in phthisis. It gives a precipitate with nitric acid, which is dissolved in the acid on heating, giving a bright yellow color. The urine on being heated becomes cloudy but clears on further heating, the precipitate re-appearing on cooling.

MUCIN IN THE URINE.—Mucin is very frequently present in the urine. It is precipitated by the addition of citric or acetic acid. The "mucin" ring obtained by the addition of nitric acid has been already described.

ROBERT MAGUIRE.

Symptomatic Indications.—In incipient cases: chill followed by febrile symptoms, anxiety, fear of death, *aconite*. Albuminuria of pregnancy, or as a sequela of scarlet fever or diphtheria, scanty, high-colored urine, *apis mel*. Albuminuria from nervous irritation, depression of spirits, restlessness, burning and aching in the lumbar region, unrefreshing sleep; after scarlatina or as a complication of pregnancy, *helonias*.

Albuminuria from organic disease of the heart or kidneys, dry skin, scanty urine, œdema and dropsy, *apocynum can*. Albuminuria with cerebral complications, even to convulsions, *cannabis indica*. Incipient albuminuria, *plumbum met*. There is great emaciation, dryness of the skin; prostration of the mental and physical powers with profound melancholy; severe constipation.

When the disease depends upon lesions of the liver, *aurum met*. will prove useful. Also in mercurial or syphilitic cachexia, with induration; caries; swelling of the liver; melancholy and despairing moods, ammoniacal smell of the urine, which decomposes rapidly. *Chimaphila* has also a specific action upon the urinary organs and is of unquestionable benefit in albuminuria.

ALCOHOL (ethylic alcohol, $C_2H_5.OH$) has not been obtained in a perfectly pure state. "Absolute alcohol," the purest form obtainable, contains from 1 to 2 per cent., and "rectified spirit" 16 per cent., of water; "proof spirit" contains 53 per cent. of alcohol by volume.

Alcohol evaporates readily, and when applied to the skin, carries off heat rapidly, producing a sensation of cold and causing contraction of the blood vessels. If evaporation be prevented, as by covering the surface with a layer of oiled silk, it penetrates the epidermis and stimulates the cutis, producing hyperæmia and a feeling of warmth. In either case the cuticle is hardened.

Applied to a mucous membrane, it causes coagulation of the mucus lying on the surface, and astringes the membrane.

In the mouth alcohol stimulates the salivary secretion. In the stomach, in small amounts, it stimulates the vascular supply of the wall, producing an increase of secretion, a feeling of warmth and appetite, an augmentation of peristaltic movement. In large amounts alco-

hol checks the action of the gastric ferment, and causes irritation of the gastric mucous membrane, with consequent diminution or perversion of its secretions.

Probably from the mouth it exerts a reflex stimulus on the cranial circulation, and from the stomach a similar influence on the heart. These reflexes are with difficulty separated from the direct action of alcohol.

Alcohol is absorbed unchanged from the stomach and carried into the circulation, where it is in part destroyed, and in part excreted by the lungs. A small amount passes out in the urine. Alcohol is absorbed also from the lower bowel, and may be administered in the way of an enema.

In the blood it diminishes the oxidizing power of the hemoglobin, and thereby lessens tissue change and waste. Alcohol acts also as a food, like sugar and other carbo-hydrates.

It causes dilatation of the vessels of the surface of the body, producing a feeling of warmth and a general flush, especially observable in the parts which are usually exposed to the air, and whose vaso-motor mechanism is therefore the most active. The pulse is quickened, and the whole circulation becomes accelerated.

Owing to the increased activity of the circulation, the cerebral functions are stimulated, producing, for a time, liveliness, alertness, mirth, and good-fellowship, with increased hardihood and power of muscular exertion. These effects are, however, but of short duration.

The action of alcohol on the circulation, causing an increased surface elimination of heat, unites with its action on the blood—whereby heat production is diminished—to lower the bodily temperature.

After a time, supposing a considerable dose to have been taken, the direct effects of alcohol on the nervous system become manifest.

The intellectual faculties are first attacked, the judgment being early impaired; the power of articulation is soon affected, and speech becomes "thick"; paralysis of the cerebellum produces double vision, vertigo, and staggering. Drowsiness and loss of power in the limbs follow; and if a very large dose have been taken, the respiratory center is paralyzed, sleep passes into coma, and death occurs from asphyxia. If, in

animals, artificial respiration be maintained, a large dose of alcohol is found to produce death by gradual paralysis of the heart.

Very large amounts of strong alcoholic liquor rapidly ingested have been found to produce death by shock—that is to say, by a sudden reflex inhibitory action from the stomach to the heart. Persons intoxicated by alcohol are, on the other hand, remarkably exempt from the shock of severe injuries, probably owing to the paralyzed condition of the reflex vasomotor apparatus.

Alcohol appears to exercise an inhibitory action on the bowels, and a dose of strong alcoholic liquor will frequently check diarrhea; but the nature of the action is obscure.

Large amounts of alcohol produce irritation of the stomach, causing vomiting, loss of appetite, dryness of the tongue, a feeling of intense depression, and severe general headache. The more concentrated the alcohol, the greater is the irritation of the stomach. Alcoholic liquors therefore irritate less when taken with food than when inhibited on an empty stomach. Strong alcoholic liquors derange the functions of the liver, but in what manner is not clear.

The physiological action of alcohol itself is somewhat difficult to separate in practice from that of the ethers with which it is found associated in most alcoholic liquors.

The continued ingestion of alcoholic liquors in considerable amounts is liable to produce fatty infiltration of the liver, omentum, heart, and subcutaneous tissue, shrinking of the brain from partial degeneration, and thickening of its membranes. In rarer cases a degeneration of peripheral nerve fibers is found, coupled with increase of the fibrous elements of the nerves involved (*vide* PERIPHERAL NEURITIS). The habitual use of the stronger forms of alcoholic liquors leads to serious disease of the liver, involving a thickening of its fibrous elements and atrophy of its parenchyma (*vide* CIRRHOSIS).

The excessive use of alcoholic liquors predisposes, at least in the elderly, to the development of tubercle. There is some reason to believe that in the young it checks for a time this form of growth. The development of malignant disease,

there is also reason to believe, is hindered by the free use of these liquors.

The use of certain kinds of alcoholic liquors markedly predisposes to gout, and through gout to granular disease of the kidneys, but alcohol appears to have no direct pathological action on the kidneys. Intemperance has a distinct effect in the production of mania, dementia, and certain other forms of insanity. It is doubtful whether it is to any great extent a cause of general paralysis.

The induction of pathological lesions is the more probable the more concentrated the state in which the alcohol is introduced into the circulation. Independently of this, special forms of alcoholic liquor have a particular tendency to the production of special lesions. Those in which much alcohol is combined with sugar or much free acid, for example, tend to induce gout. Whisky and gin particularly give rise to cirrhosis; brandy is especially prone to excite delirium tremens. Some special nervous maladies are attributed to particular kinds of wine in the neighborhoods in which those wines are grown.

That the general health is deteriorated to a marked degree by the use of alcoholic liquors beyond very moderate amounts is certain. Dr. Parks regarded the daily consumption of an ounce and a half of alcohol as the utmost amount compatible with the maintenance of full vigor in a strong man. This would be equivalent to a pint and a half of ordinary English beer, three parts of a bottle of sound French or German wine, or three ounces of Scotch or Irish whisky. Any increase of the alcoholic habit, beyond some such grade as this, is attended with a progressive decline in the average longevity of the subjects of the habit. The strictly temperate in the use of alcoholic liquors would appear, on the average, to enjoy at least ten years more of life than the habitually intemperate. The shortening of life, however, caused by the *extremes* of intemperance is probably much greater than ten years.

The shortening of life due to alcohol is only in part caused by the induction of special "alcoholic" lesions of so well marked a type as cirrhosis, gout, and peripheral neuritis. The changes wrought by the drug in the body appear to be such as to induce an increased predisposition to the attacks of disease in

general. Deaths from "old age," as it is termed, without obvious pathological lesions, are far more frequent among the temperate than the intemperate.

The prevalent belief that the liability of pneumonia to a fatal issue is increased by alcoholic habits is not borne out by the statistical evidence available; nor does it appear that the intemperate are especially liable to prostatic enlargements and the vesical disorders incident to advanced life, as has been asserted. The tendency to arterial degeneration seems to be augmented by alcoholic excess, and the intemperate are more liable than the temperate to death from cerebral hemorrhage, but not to such a degree as to justify us in considering this a specially "alcoholic" form of disease. The same may be said of degenerative diseases of the heart-wall. It is doubtful whether bronchitis is materially induced by alcoholic liquors, though the predisposition to catarrh of the upper part of the air passages is undoubtedly increased by the use of the stronger forms.

It is clear, however, from a comparison of statistics, that any general detriment to health that may be thought to arise from total abstinence from alcohol is small in comparison with that caused by even moderate excess in its use. For the ordinary run of mankind living under fairly healthy conditions, alcoholic liquors must be regarded as luxuries, practically harmless if indulgence in them be restrained within strict bounds, but distinctly hurtful if those bounds be exceeded, and containing in themselves, for a large part of the population, a very serious temptation to excess. In conditions of mal-nutrition, during convalescence, and in cases of scrofula and phthisis, wines and sound beers are often found to have a distinct tonic and restorative effect, but, a certain proportion of such cases and some conditions of severe illness apart, it is only exceptionally that the practical physician need insist on the use of alcoholic liquors, or hesitate to sanction their disuse if on other grounds it may seem desirable to do without them.

Medicinal uses.—The rapid evaporation of alcohol, and its consequent power of reducing the temperature and, when applied locally, of contracting the blood vessels of the surface of the body, is taken advantage of to relieve "nervous" headaches and to check the inflammation in

sprains and recent injuries. In the former case brandy, whisky, or eau-de-cologne is either rubbed on the forehead and temples or sprayed upon them or applied upon a piece of lint or linen, and allowed to evaporate. In the latter case a piece of lint, soaked in some form of spirit, is placed upon the injured part, kept constantly moist, and exposed to the air. Evaporation may be promoted by fanning.

Its power of hardening the epidermis is utilized to prevent threatened bedsores and cracks in the nipples. The part affected is simply bathed in spirit two or three times a day.

Diluted spirit is used also as an astringent wash or gargle to the mouth or throat in cases of relaxation, ulceration, and salivation, and as an application to the eyes in slight conjunctivitis.

Friction with spirit is employed as a stimulating application to the surface in cases of sluggish circulation, local chill from exposure to cold, passive œdema, chilblain, muscular pains, sprains, and chronic affections of the joints. It is similarly applied to the præcordia with the view of reflexly stimulating the heart in syncope or shock, and indeed to any part for which a mild local stimulant or counter-irritant is indicated.

A teaspoonful of strong brandy, whisky, or liqueur held in the mouth is sometimes found to relieve toothache.

Internally administered, its power of exciting the gastric functions may be utilized. In cases where, without obvious reasons, the appetite fails at meal-times, a glass of light wine, taken about a quarter of an hour before sitting down to table, is sometimes found to arouse a desire for food. In many people a little wine taken with a meal promotes the operation of digestion, and in some weakly and aged persons a small glass of liqueur or strong spirits taken after the meal is a needed stimulant to gastric activity. The need for alcohol as an aid to digestion is most often found in convalescents and in persons exposed to overwork and worry, especially in those engaged in a close and unhealthy atmosphere. In such cases it is difficult to separate the direct effects of the drug on the stomach from the indirect effects brought about by the promotion of cheerfulness and the relief of mental depression. The action of the alcoholic stimulant is probably complex. The physician should be careful in such cases

to avoid recommending it until he has made every effort to ascertain and remove the cause of the symptoms, as few uses of alcoholic liquors have a greater tendency to lead to excess than this. In many instances a small cup of beef-tea taken shortly before a meal, or one of strong coffee, or even of hot water alone, immediately after, will succeed as well as the alcoholic stimulant, and is without its disadvantages. Ten grains of bicarbonate of sodium taken in half a wineglassful of water may replace the beef-tea, and the judicious use of pepsin or of bitter tonics may obviate the need of a stimulant altogether. It is hardly necessary to add that in a large number of such cases over-feeding is the sole cause of the symptoms. In cases of irritation of the stomach alcoholic liquors should be wholly avoided.

Wine and beer, as above stated, may be of restorative and tonic value in cases of malnutrition, especially in scrofulous and phthisical states.

Alcohol, usually in the form of brandy or other spirit more or less diluted, is constantly used to stimulate the circulation and relieve embarrassment of the heart in cases of heart disease, functional or organic, bronchitis, emphysema, and other chest affections; and to restore the circulation in syncope, shock, or chill of the surface from exposure to cold.

In the last-named case it is not safe to employ alcohol unless the body can be at the same time placed in a warmer atmosphere. The power of alcohol to restore warmth to the surface results from its property of dilating the peripheral vessels. If the surface remains exposed to cold, the blood as a whole is liable to be cooled down to a dangerous degree.

A dose of alcohol is of service in fitting the body to undergo some unusual exertion, or to withstand the shock of unusual suffering, or to resist exposure to unhealthy effluvia or zymotic contagia, but the effects in this regard are transitory, and it is best avoided, on account of the succeeding depression of the nerve centers, when the exertion or exposure is likely to be prolonged.

Its continuous use, however, sometimes relieves the weariness, restlessness, pain, and mental depression of chronic illness.

Alcohol is a food, not, it is true, of much value in ordinary health, but, as it requires no digestion, of great utility in some cases of severe illness or extreme

senility, when the digestive functions are in abeyance, and other kinds of food are either not tolerated or not properly assimilated.

The stronger kinds of alcoholic liquors, especially brandy, are often employed with success in relieving colic and diarrhea. The relaxation of the vessels which alcohol causes, renders it of service in inducing the menstrual flow in cases of dysmenorrhea without organic cause. In such cases it needs to be given with great caution, as the risk of temptation to excess is great. It should be prescribed in a pharmaceutical form, and not in the shape of wine or spirits.

Alcohol is employed in the treatment of fevers and febrile diseases with five objects: first, to aid the stomach in digesting food; secondly, to provide an easily assimilable form of food; thirdly, to check the excessive tissue waste of the pyrexial state and to aid in lowering temperature; fourthly, to maintain the circulation against the depressing effects of the disease; and, fifthly, to relieve weariness, restlessness, and pain.

The disadvantages of its use in these conditions are its tendency to irritate the stomach and hinder the assimilation of food, and its paralyzing effect, if large amounts are absorbed, on the respiratory center. Irritation of the stomach will be evidenced by dryness of the tongue and decreased inclination for food; respiratory paralysis, by enfeebled action of the respiratory muscles. The use of alcohol in any given case must be governed by the balance of advantages and disadvantages.

It is certainly not required in all cases of severe fever or inflammation, and should never be prescribed as a matter of routine or without some definite object in view. If prescribed, its administration should be as carefully regulated with reference to time and quantity as that of any other drug, and its effects on the pulse, respiration, complexion, tongue, and general condition closely watched. If the pulse, respiration, and general state improve, while the tongue remains moist and the capacity for taking food is unimpaired, the drug may be continued. If, on the other hand, the tongue becomes dry and brown and tolerance of food decreases, without any counterbalancing improvement in other respects, the alcohol is probably doing harm, and the dose should be lessened or its use abandoned.

Diluted brandy or whisky are the forms of alcohol usually tolerated best in cases of fever; but some form of wine, still or sparkling, is in many cases found to agree better. As regards the amount it is impossible to lay down any rule. Much depends on the patient's previous habits, and in every case the dose must be a matter of experiment.

In prolonged convalescence alcoholic liquors may be useful in relieving the sense of tedium and weariness incidental to the condition and in stimulating the enfeebled digestive powers. In recovery from enteric fever they sometimes aid the patient in supporting the necessary abstinence from solid food.

An irritable condition of the stomach, the larynx or pharynx, or of the urinary organs, is generally speaking a contra-indication to the use of alcohol. It should be avoided, for reasons given above, by persons liable to prolonged exposure to cold. In ordinary health alcoholic liquors should be taken only at meal-times, and especially avoided when the stomach is empty.

All experience goes to recommend abstinence from alcohol, as far as possible, to Europeans living in a tropical climate.

To conclude: In advising the use of alcoholic liquors the physician must constantly bear in mind the risk of exciting a taste for them which may lead to the development of the craving for drink to which probably one-third of the population are more or less liable. In doubtful cases the needed amount of alcohol may be more safely prescribed as a pharmaceutical draught than given in the form of wine or spirits.

ISAMBARD OWEN.

ALCOHOLIC LIQUORS. — The forms of alcoholic liquor in use in this country comprise wines, beers, and spirits besides cider, perry, and liqueurs. Natural wines are the product of the fermentation of grape-juice. If the fermentation be complete and all the glucose converted, a "dry" wine results; if it be checked at a certain point so as to leave some glucose unchanged, a "sweet" wine is obtained. "Liqueur wines" consist of grape-juice only slightly fermented and preserved from further change by added spirit. "White" wines are the product of white grapes, or of red grapes the skins of which have been excluded from the fer-

menting juice, or "must." If the skins of purple grapes are left in the must as it ferments, a "red" wine results. In "sparkling" wines a part of the carbonic anhydride generated in fermentation is retained in the liquid, and not allowed to escape until it is drunk. "Muscat" wines are made from grapes partially dried in the sun.

Natural wines contain, besides alcohol and water, acid tartrate of potassium, tartarates of sodium and calcium and other salts, free tartaric acid, malic and other vegetable acids in small amounts, extractive matters, a little free carbonic acid, and a number of delicate ethers formed by the action of the acids on alcohol, of which cœnanthic ether is the most constant.

Sweet wines contain also a variable amount of glucose; red wines hold in solution some tannic acid and a coloring matter from the skins. Even white wines contain a trace of tannic acid.

The "strength" of wines is the proportion of alcohol they contain; the "body" depends on the amount and proper blending of the solid ingredients: the "bouquet," or perfume perceived by the nose, and the "aroma," or effect on the back of the nostrils when the wine is on the palate, are due to the ethers, and and in some red wines to a volatile oil from the skins; the "savor" or taste is produced by the ethers, the acids, and the acid salts. "Roughness," or astringency, is the result of the tannic acid.

The stronger red wines, on keeping, deposit a "crust" of acid tartrate of potassium with tannic acid, coloring and extractive matter. A further development of flavoring ethers takes place when wine is kept. This is known as "maturing."

Natural wine may contain from 5 to 20 per cent. of alcohol. Practically, no wine of less alcoholic strength than 10 per cent. comes to this country. The weaker wines require the addition of so much spirit to enable them to travel by sea, and more or less spirit is added to all before the voyage. An amount of alcohol over 14 per cent. is most probably artificial.

The medicinal and pathological effects of wines depend on the alcohol, the ethers, the free acids, the tannin, the sugar, and the salts they contain.

The effects of alcohol have already been discussed. The presence of the

ethers enhances its stimulant action, especially on the stomach and the brain. Hilarity is the characteristic cerebral note of intoxication by natural wine. The disengagement of gas from sparkling wine reinforces and accelerates the reflex stimulation which alcohol exerts on the brain and the circulation. The ethers have probably a pathological influence of their own on nerve structures; special nervous symptoms are locally attributed to certain wines rich in them. The acids and acid salts promote appetite, but in excess may derange digestion. The tannin acts as a bitter tonic. The more astringent wines are apt to constipate. The salts as a whole supply some important elements of nutrition, and aid in the restorative effects of wine. An excess of tartar is apt to disorder the bowels. Wines containing a high proportion of alcohol in combination with sugar, as port, sherry, and Sauterne, or with much free acid, as Burgundy and Rhine wine, are prone to induce gout and lithiasis, and to cause digestive disturbances. Sweet wines are, of course, inadmissible in diabetes.

Most of the wine drunk in this country is supplied, or purports to be supplied, by France, Germany, Spain, and Portugal. Madeira is being re-introduced, and a few varieties of Italian and Hungarian wine have become commonly known.

Good red Bordeaux, or "claret," wines, from the district of the Gironde, are hygienically the ideal wines of the world. Moderately alcoholic (from 8 to 13 per cent. of alcohol) and completely fermented, they are of good body and well supplied with ethers, but, when properly matured, contain no excess of tartar or of tannin, and only so much free acid as is necessary to keep them from tasting "flat." They can therefore be borne by even the most delicate stomachs, and, while tonic and restorative, have little or no tendency to excite gout or lithiasis. Unfortunately, genuine claret is difficult to obtain even in Bordeaux itself, large quantities of inferior red French, Spanish, Portuguese, and Italian wine being fortified and flavored, and sold as the produce of the Gironde. The white Bordeaux are slightly more alcoholic than the red. They are less sophisticated and less imitated. They are only slightly acid, and are well borne by the stomach. Sauterne is made in dry and sweet varieties;

Graves and Barsac are usually somewhat sweet. The sweet varieties should be avoided by the gouty.

The red Burgundy wines are more alcoholic and of greater body than the Bordeaux. They possess marked stimulant, tonic, and restorative properties, but, though fully fermented, are less suited to delicate digestions, and are prone to excite gout by reason of the amount of free acid they contain. Chablis, the best-known white Burgundy, is a perfectly "dry" wine, and not over-acid. It is less "gouty" in tendency than the red kinds.

The sparkling white wines of Champagne contain from 6 to 13 per cent. of alcohol, and more or less sugar. A part of the alcohol, and in most cases all the sugar, are artificial additions; the latter is inserted in the form of cane-sugar, but becomes altered in the direction of glucose by keeping. The acid in most champagnes is moderate in amount, but the sugar renders them unsuitable to the gouty, and apt to disagree with the stomach. The "drier" kinds are, of course, less hurtful in these respects than the sweeter. They are exhilarating wines, speedy in their action on the brain and circulation, calculated to promote temporary cheerfulness, or to supply a rapid stimulus in conditions of syncope and exhaustion, but of little restorative value.

"Roussillon" is a sweet red wine, used as a substitute for port. Its alcohol, as it issues for sale, ranges from 11 to 16 per cent.

The white wines of the Rhine, between Mayence and Coblenz, generically known as "hock," are fully fermented and rather highly alcoholic, ranging from 7 to 14 per cent., or even higher in the best class of wine. They are of good body and possess restorative properties, but contain an excess of free acid, which renders them unsuited to the gouty or lithatic. They are extensively imitated by fermenting glucose on the lees of the real wine, and care is needed to procure them genuine.

Moselle wines are for the most part of low alcoholic percentage, and require the addition of spirit to enable them to travel to England. Like the Rhine wines they contain much free acid.

The sparkling "hocks" and Moselle wines resemble champagne in character,

but are usually very sweet. Sparkling Moselle is flavored with tincture of elder-flower.

Port, from the upper valley of the Douro, as made for market, is a partially fermented wine brought up to a high alcoholic percentage (15 to 23) by the addition of brandy, and further flavored and colored with slightly fermented grape-juice. It is a full-bodied wine, and contains a large amount of tannin, but has little free acid, and when new is deficient in ethers. It is a powerful stimulant on account of the large proportion of alcohol, but its effects are not of an exhilarating character. It possesses marked tonic and nutritive properties, and the combination of alcohol and tannin renders it of service as an astringent gargle in relaxed conditions of the throat. It is a form of alcohol well suited for administration in fevers. Its "gouty" tendencies are decided, but diminish by keeping.

Sherry, as made in the district of Jerez de la Frontera, is an incompletely fermented white wine heavily fortified with brandy. The tartar and free acids are extracted by sulphate and carbonate of calcium (a process termed "plastering"), a large amount of sulphate of potassium, a little sulphate of calcium, and a trace of sulphuric acid being left in the wine. Further sweetening, flavoring, and coloring are effected by means of concentrated must, concentrated wine, cane-sugar, or caramel. Some of the "pale" sherries are artificially bleached by charcoal. The completed "sherry" contains from 15 to 25 per cent., of alcohol, more or less sugar or unconverted glucose, sulphates as aforesaid, no tartar, and hardly any free acid. Except in the drier varieties, the ethers are deficient. The drier varieties of sherry are more natural wines than the sweet. "Manzanillas," which possess a flavor of chamomile, are fully fermented wines, and contain little or no adventitious spirit. The "Amon-tillado" flavor is a special ethereal product developed by some specimens of fully fermented Jerez wines. The exhilarant power possessed by the finer dry varieties is wanting in ordinary sherry, which, though highly stimulating in virtue of its alcohol, possesses no tonic or restorative properties. Even the dry sherries are too alcoholic to be drunk undiluted by the gouty with impunity; the sweeter

kinds are as "gouty" as port, and their tendency to cause digestive disturbances, partly due to the sulphate of potassium, is strongly marked.

The remaining wines commonly drunk in this country are the Hungarian Carlowitz, a fully fermented red wine of full body and high alcoholic strength, containing an excess of tannin and possessing marked tonic properties; the Tuscan wines sold under the name of "Chianti," which at their best closely resemble Bordeaux, though stronger and richer in tannin; Marsala, a highly alcoholic sweet white wine made in Sicily, resembling sherry in flavor; and Madeira, of which we have sweet and dry varieties. Madeira contains from 17 to 22 per cent. of alcohol, some of which, as is also the case with Marsala, is probably adventitious. It has, when new, an excess of tartar, which is deposited on keeping. The maturation of Madeira is aided by a hot climate.

Beers are fermented infusions of malted barley, rice, maize, or other grain, flavored with hop. The "body" of beer consists of dextrin, malt-sugar, and extractives, and constitutes about 5 per cent. of its weight. English beers contain about 5 per cent. of alcohol (the stronger kinds go as high as 10 per cent.) and a little aldehyde. The Continental beers brewed on the "Bavarian" system have no aldehyde and only about half the alcohol of the English. Beers contain also a little free acid, lactic, malic, gallic, and acetic, some dissolved carbonic acid, which gives the "briskness," and a small amount of salts with bitter hop-extract and a trace of volatile oil. Porter and stout are brewed from high-dried malt, and are blackened by products resembling caramel derived from the charring. "Bottled" beers are made on the same principle as "sparkling" wines. The dextrin, maltose, etc., contained in beers are utilizable as food, and tend to adiposity. The hop-extract exercises tonic properties. The light Continental beers have only slightly intoxicating qualities; the English beers exercise far more effect on the brain than the foreign, in consequence of the aldehyde they contain. This also tends to render the intoxication of a stupefying character. Beers are apt to disagree with the stomach, and have a tendency to aggravate cough. The combination

of sugar and alcohol in English beers makes them unsuitable for the gouty. New beers are liable to induce oxaluria.

Spirits are strong alcoholic liquors prepared by distillation. They usually contain 45 to 60 per cent. of alcohol, but they range much higher.

Whisky is distilled from a fermented mash of malt, or malt and grain mixed. Besides alcohol and water, it contains, when new, fusel oil (chiefly amyl alcohol), with some propyl, butyl, and other alcohols), a trace of ethers, of volatile oil, of acid, and of a flavoring matter derived from the malt. On keeping, the fusel oil disappears, and a further development of ethers takes place. Whisky should be kept at least two years before being drunk. When well kept, it is the purest form of alcohol commonly in use. In good distilleries its strength is uniformly about 50 per cent. Properly diluted, it has little tendency to derange the stomach or to induce gout or lithiasis. New whisky speedily produces cerebral intoxication, tending to a furious character, and the habitual use of it is liable to lead to serious nervous disorders.

Brandy is, properly speaking, distilled from wine. It contains the vinous ethers as well as the alcohol. Its color is due to the oak casks in which it is kept, from which it derives also a trace of tannin. The darker kinds are colored with caramel. Inferior kinds of brandy are distilled from the lees of wine. Brandy contains no fusel oil. The presence of the ethers renders brandy a ready stimulant to the stomach, circulation, and brain, and therefore especially useful in cases of syncope, spasm, shock, arrested digestion, or diarrhea. It is the form of alcoholic liquor commonly preferred in the treatment of fever. The cerebral intoxication it produces tends to the furious type, and its habitual excessive use is especially liable to induce delirium tremens. Brandy-drinkers are also subject to relaxation of the throat and larynx, due probably to the ethers eliminated in the breath. Imitations of brandy are obtained by the fermentation of potato starch and subsequent distillation. They contain, unless very carefully prepared, a large amount of fusel oil, and are exceedingly deleterious.

Gin is distilled from fermented grain and flavored with oil of juniper and other aromatic substances. It is sold sweet-

ened or unsweetened. The oil of juniper has a diuretic action. The alcoholic strength of gin is usually below 50 per cent.

Rum is distilled from molasses. It is a very strong spirit, ranging to 75 per cent. of alcohol or higher. It contains a large quantity of butyric ether, to which its peculiar flavor is due.

Spirits have no tonic or nutritive effects beyond those of alcohol.

Liqueurs are strong spirits, sweetened with sugar and flavored with various aromatic substances. Ethers are developed in some kinds by keeping. They can hardly be considered medicinal agents, and their pathological effects are mainly those of strong alcohol. The "absinthe" so extensively consumed in France, which is highly flavored with oils of wormwood and anise, produces a stupefying species of intoxication and, when habitually used, giddiness, tinnitus, illusions of sight and hearing, numbness, paresis, epileptic fits, and dementia, besides the symptoms due to the alcohol.

Ciders are made by fermenting the juice of apples. In the natural state they contain less than 5 per cent. of alcohol, some sugar, and a large amount of free acid, chiefly malic. Notwithstanding the acid and sugar, their low alcoholicity renders them permissible drinks for the gouty, but they are apt to produce derangements of the stomach and bowels. They are sometimes found to be contaminated with lead from the presses employed, and to give rise to all the symptoms and lesions of saturnism.

Perry is a similar drink, of very low alcoholicity, obtained from pears. It contains much less free acid but more tannin than cider, is rather sweet, and is a harmless beverage.

Bottled cider and perry are usually more or less fortified with spirit.

ISAMBARD OWEN.

ALCOHOLISM. — *Ætiology.* — The immoderate use of alcoholic liquors, especially of the stronger kinds, induces a disorder of the general nervous system, the symptoms of which in the acute stage are well known. They are the result of its direct irritant action; of its influence on the vaso-motor nerves; of the circulation of its own poisonous elements, or of those derived from its decomposition, through the various organs and tissues;

and of its interference with tissue metamorphosis, oxygenation, and nutrition. The exact effects will depend on the nature, quantity, and the strength of the stimulant indulged in. Spirits do by far the greatest harm, especially when taken in frequent drams, strong and on an empty stomach. Alcoholism is most frequent in males, and in those who from their occupation are exposed to intemperance, such as draymen, potmen, or cabmen, or whose calling is a lonely or a sedentary one. It is also predisposed to by various conditions which depress the nervous energy, such as working or sleeping in a hot and vitiated atmosphere, excessive mental work, anxiety or worry, or excessive venery. Persons who suffer severe pain and hysterical individuals are very likely subjects to drink to excess. In not a few instances there seems to be a hereditary tendency to alcoholism, or to some neurosis, such as epilepsy or mania.

The craving is partly gastric, partly to both sources. The condition of the stomach and bowels must be carefully looked to, and the power of will assisted by maintaining the general vigor and sense of *bien-être* as much as possible. Nourishment must be given in abundance if the stomach is capable of dealing with it, and, to supply as far as may be the place of the accustomed stimulus, it should consist largely of meat and soup; beef-tea or diluted fluid extracts of meat being used as drinks. The local stimulant to the stomach may be replaced to some extent by the use of condiments, or the administration of tincture of capsicum in 10 to 20 minim doses. Ammonia will supply both a local and a general stimulant action. Alcoholic liquors should as a rule be discontinued entirely from the outset of the treatment, but at times the substitution of some light liquor, especially German beer, which is brisk and stimulating to the palate without containing much alcohol, will answer better. Perchloride of iron (20 to 25 minims of the tincture three times a day), arsenic (3 to 5 minims of liquor arsenicalis), and liq. strychninæ (5 to 10 minims), have also been found of service. In men, especially in such as are engaged in active employments, treatment is often efficacious; in women it is doubtful whether the drink craving is ever completely overcome.

Chronic Alcoholism.—Besides the craving, a train of symptoms assignable jointly to the nervous and digestive systems results from habitual intemperance. This includes sluggishness of intellect, loss of alertness, irritability, depression of spirits, perversion of the moral tone (particularly as regards truthfulness and honor), enfeeblement of will, "nervousness," a liability to be startled, and a slight muscular tremor observable in the hands, tongue, and lips, coupled with loss of appetite, nausea, vomiting of clear fluid on rising in the morning, and looseness of the bowels, four or five semi-fluid motions being passed daily without pain. The tongue becomes thickly coated and the breath offensive. The eyes are dull, bloodshot, and watery, and the face, especially the nose, is usually congested, the alcoholic dilatation of the vessels having become permanent. Spots of a sluggish acne, vulgarly called "grog-blossoms," are often present. If the indulgence have been chiefly in spirits, the voice is frequently hoarse from irritation of the larynx by the alcohol and accompanying ethers excreted in the breath, and an irritable cough may be present from a similar affection of the pharynx and soft palate, which will be seen to be red and "velvety." More definite forms of cerebral or nerve disturbance are occasionally added—subjective sensations in the trunk or limbs, illusions of the senses, definite delusions, or transitory maniacal attacks. The symptoms may be complicated with those of the more serious alcoholic affections, commencing mania, dementia, peripheral neuritis, cirrhosis, or gout.

The first object in the *treatment* of such a case is to obtain the assimilation of food. The stomach should at the outset be cleared from adherent mucus by a brisk emetic, a table-spoonful of mustard stirred up in a pint of lukewarm water, or a scruple of ipecacuanha in powder. Five grains of blue-pill, followed by a black draught, may be given as soon as the patient recovers from the effects of the emetic, unless there be much diarrhea. Then, without waiting further, a diet chiefly of meat, fish, eggs, and strong soups should be commenced and pushed to the limit of the gastric powers, tolerance being obtained, if necessary, by the use of bismuth and hydrocyanic acid.

Liquor strychninæ, in doses of 3 to 5 minims, or quinine in 2-grain doses, or salicin in 10-grain doses, should be commenced as soon as the stomach will bear it. An equivalent dose of tincture of nuxvomica or of liquid extract of cinchona may be substituted if borne better, and an infusion of gentian, calumba, or cascarrilla used as the vehicle. If the stomach remains irritable, a powder of the carbonates of bismuth and magnesium, 10 grains of each, should be given after each meal; or, if vomiting be present, they may be made into a mixture with a little mucilage, and 3 to 4 minims of dilute hydrocyanic acid added. Should looseness of the bowels persist, astringents will be found of less service than arsenic, which may be given in the form of liq. arsenicalis, 3 to 4 minims, three times a day, just after meals. Sleeplessness, if present, must be combated with a dose or two of chloral hydrate, or a full dose of bromide of potassium, at bedtime, or with sulphonal in doses of 15 to 30 grains. Morphine is best avoided.

The supervention of **Delirium Tremens** is the most prominent danger in a case of chronic alcoholism. In such a case, the shock of an injury or operation, or an unusual demand on the system from overwork, sleeplessness, acute illness, or inability to take food, may induce an attack of delirium tremens.

The tremor and gastric symptoms increase, a sense of depression and dread becomes paramount, the patient grows restless, excited, and extremely irritable, and ultimately mental disturbance, varying from slight delusions to wild delirium, sets in. The delusions are in accord with the state of restlessness and apprehension from which they start. The patient is anxious to get away from wherever he may happen to be, to go and do something somewhere else, or to escape from something or somebody. He is suspicious of those around him, fancying they want to do him some injury. If in bed, he perpetually tries to get at his clothes, to be up and off. He talks incessantly and incoherently, his delusions being seldom fixed. Objects of horror and loathing appear about him, from which he tries to flee. In less materialistic days they often assumed the forms of demons, now they are more commonly rats, snakes, spiders, and monkeys. Objective sensations are sometimes present.

If the delirium increase, whole scenes of restless activity may be enacted in the patient's mind and made known to his attendants by his perpetual flood of rambling talk. Usually they are dominated by the master-sense of dread, and interrupted by wild fits of terror and fury, in which, if not restrained, he will attack his attendants and try to escape at all hazards, jumping, it may be, out of a window or over the balusters. Occasionally, however, the visions partake of a cheerful and even humorous character.

The tremor is constant; the surface is pale and usually moist and clammy, the pulse large and soft or small and weak. The patient sleeps little or not at all, the tongue is coated thickly, the breath foul, and appetite is absent. The temperature is usually only slightly raised; but pyrexia, and even hyperpyrexia, may set in. The pupils are generally dilated.

If the disease be not checked, death usually takes place from exhaustion, the patient sinking into the "typhoid" state, Occasionally fatal syncope ensues.

No special post-mortem appearances, beyond those proper to alcoholism generally, are found.

Delirium tremens has been known to develop suddenly in persons previously temperate, as the consequence of a single debauch.

The *prognosis* is usually favorable, especially in first attacks; but the affection is liable to recur on comparatively slight provocation.

The indications for *treatment* are three: to restrain the patient from injuring himself or others, to procure sleep, and to support strength by the administration of food.

The patient must be put to bed and constantly watched, his efforts to get up being restrained by the commands, and, if necessary, by the hands, of his attendant. In severe cases the mechanical restraint of bandages or shackles may cause less exhaustion than the attendant's efforts, or a padded room may be made use of during the most violent stage. The medical treatment should be commenced, as in the case of "chronic alcoholism," by an emetic and a mercurial purge, unless there be much diarrhea or the patient greatly exhausted. In any case solid food must be pressed upon the patient as far as the stomach will bear it, tolerance being procured, if

necessary, by hydrocyanic acid, of which 4 minims may be given with a scruple of sodium bicarbonate three or four times a day, about half an hour before food is offered. If solid food cannot be borne, strong soups and eggs beaten up in milk should be substituted, and, if vomiting persists, rectal alimentation must be resorted to.

A draught, containing 15 grains of chloral hydrate and a scruple of potassium bromide, should be given every four hours, or even oftener, till sleep is procured. A dram of tincture of hyoscyamus is sometimes added with advantage, and cannabis indica, to the extent of a grain of the extract or 20 minims of the tincture, if the chloral and bromide fail by themselves. Sulphonal in doses of 15 to 30 grains has lately proved of service. Should no improvement ensue and sleep be still absent, an injection of $\frac{1}{8}$ to $\frac{1}{4}$ grain of morphine should be substituted for the bromide and chloral treatment, and repeated as required. But the use of morphine in such cases is not without risk, especially if chronic Bright's disease be present. In case of great weakness, ammonia, brandy, and ether must be given freely. The cautious inhalation of chloroform may be of service if the delirium be violent.

Except in the event of extreme weakness alcohol is better avoided altogether in the treatment of most cases of delirium tremens. In some instances, however, a moderate amount of malt liquor—*e. g.*, a pint of porter daily—seems to be beneficial.

ISAMBARD OWEN.

Symptomatic Indications.—The most frequently indicated remedy is *nuxvomica*, proving useful in both recent and chronic cases. In chronic cases, for nervous degeneration, trembling of the limbs, and spasmodic twitching in different parts of the body. Incapable of thinking correctly; makes frequent mistakes in talking. Delirium, with frightful visions and desire to escape. Constipation, with large difficult stools. For the delirium, *belladonna* is the most valuable remedy. The delirium is worse at night, with illusion of the senses on closing the eyes: boisterous delirium, with desire to escape; tears the clothes, strikes, bites and shrieks in rage. Sudden starting and jumping while sleeping. For the nervous excitement resulting from excessive indulgence, threatening delirium, *gelsemium* is an efficient remedy.

For delirium with much gastric disorder, or delirium tremens from beer, *antimonium tart.* is the principal medicine. When there is much vomiting, particularly in the morning, with restlessness, anxiety and constant thirst but drinking only small quantities, *arsenicum* will prove efficacious. Delirium, with coma; loud stertorous breathing; eyes half open: complete loss of consciousness and sensation; delirious talking, with eyes wide open, is indicative of *opium*.

Stramonium or *hyoscyamus* may be indicated in cases of furious delirium. When *stramonium* is indicated there is coma vigil.; complete insomnia. The patient is disposed to talk continually, and sings and prays devoutly. Awakens with a shrinking look, as if afraid of the first object seen. With *hyoscyamus* there is much twitching and jerking of the muscles; convulsive movements; grasping at imaginary objects; muttering.

Camphor acts favorably in severe cases with distorted features, sunken eyes, and icy cold hands and feet. There is maniacal delirium, convulsions, frothing at the mouth, and insensibility. Retention of urine, with constant pressure on the bladder. For delirium, with exaltation of ideas, exaggeration of emotions and sensations, *cannabis indica* may be given.

The more remote effects of alcoholism may require *phosphorus* as a nutritive of the nerve centers, *cimicifuga* to restore the nervous tone: or *capsicum* for the atonic dyspepsia. *Asarum Europæum* has a good reputation in Russia as a remedy for the effects of excessive drinking.

ALOPECIA (Calvities) signifies baldness, whether congenital or acquired, local or general, partial or complete. There are various clinical types of the disease, but they are not separated from one another by hard-and-fast lines. The following are those most generally recognized:

Alopecia universalis congenita, a very rare condition, in which there is absence or arrested development of the hair follicles; the teeth, nails and, more rarely, the nipples, are badly developed. After some months or years a small quantity of hair usually appears. Congenital bald spots on persons otherwise healthy persist as such throughout life.

Alopecia universalis acquisita affects young adults of either sex after nervous shock or without ascertainable cause.

The hair of the scalp, eyebrows, beard, and other hairy regions falls simultaneously. Recovery, or even improvement, is quite exceptional. For treatment, *see* ALOPECIA AREATA.

Alopecia senilis is a frequent but not necessary concomitant of old age, when the skin becomes generally atrophied and the arterioles sclerosed. The hairs usually turn gray, become dry and shriveled, and their bulbs atrophy and fall out. Baldness, as a rule, extends from the forehead backward, or may begin at the vertex. The beard is not generally affected to the same extent as the scalp. The condition is comparatively uncommon in women, and is frequently hereditary. Treatment is unavailing.

Alopecia prematura idiopathica has clinical characters similar to alopecia senilis, but appears at an earlier period of life. The changes in the hair follicles appear to be secondary to a sclerotic process originating in the corium.

Alopecia prematura symptomatica may be (1) the result of febrile affections, especially the exanthemata; (2) the result of disordered innervation—*e. g.*, after grief, shock, debauchery. In both forms the prognosis is hopeful; stimulating ointments or lotions materially assist constitutional treatment in hastening recovery; (3) secondary to other diseases of the scalp which impair the nutrition of the hair bulbs or destroy them by producing scars. Among the former may be cited: seborrhea (alopecia furfuracea vel pityrôdes), secondary syphilis, eczema, psoriasis, and tinea; baldness from such causes being partial and temporary. Among the latter, lupus erythematosus, kerion, favus, leprosy, and tertiary syphilis must be mentioned; baldness thus produced is complete and permanent, although generally patchy.

Alopecia areata, vel circumscripta (Arenæ Celsi) is pretty clearly demarcated from the previously described forms, although it has many points in common with *A. universalis acquisita*. It is characterized by the rapid formation of circumscribed, smooth, bald patches on the scalp or any other hairy part of the body, usually circular in shape and whitish in color. The disease is very common, especially among anæmic, overworked and underfed children. Adults are also frequently affected, the eyebrows and beard being chiefly affected. The

prognosis is then less favorable. The patches are commonly met with in the occipital region, behind the ears and over the parietal eminences; they often show a roughly symmetrical arrangement; their appearance is not generally preceded by any symptoms; in a considerable number of cases they are slightly pink at first, puffy, and apparently infiltrated; they are usually sharply demarcated. The presence of stunted hairs at the edge, or of loose hairs outside the patch, should awaken suspicions of the case being one of tinea tonsurans, which may, under conditions of which we have no accurate knowledge, produce patches exactly like alopecia areata. Hence probably arise the differences of opinion with regard to the pathology of alopecia areata, many able observers maintaining that it is due to the presence of a vegetable parasite, of which very various forms are figured.

The following arguments may be advanced in favor of its origin as a tropho-neurosis, the result of disordered innervation: It is sudden in its onset; it is not contagious; sensibility of the patches is sometimes markedly diminished; it may result from traumatism, or be associated with morphœa, neuralgia, megrim, or other distinctly neurotic disorders; similar patches have been known to follow the experimental division of nerves; the hair bulbs are wasted and the hairs slender at their points of exit from the follicles, not swollen and infiltrated as in parasitic diseases; anti-parasitic remedies are not more efficacious than other irritants. In all doubtful cases the microscope must be used.

The great majority of cases, especially in young persons, recover after a variable time. Downy hairs first appear, but these frequently fall off several times before permanent recovery sets in, and the new hairs are often white; relapses are common after intervals of months, or even years.

The disease must be differentiated from tinea tonsurans, morphœa, and diseases which cause scarring of the scalp.

Treatment. — (1) *Constitutional.* — Freedom from worry or anxiety, fresh air and exercise, with nourishing food, are to be recommended. Cod-liver oil, arsenic, iron, quinine, phosphorus, and strychnine are all of value.

(2) *Local.* — Cantharides is probably

the most efficacious local remedy for stimulating the growth of hair and expediting its pigmentation. The tincture may be painted over the patches night and morning, or the following lotion applied: \mathcal{R} Aceti cantharidis $\frac{3}{4}$ ss, glycerini 3 ij, spiritum rosmarini ad 3 viij. Corrosive sublimate in alcoholic solution, sufficiently strong to produce a rube-facient effect, may be dabbed on twice daily; *e. g.*, \mathcal{R} Hydrargyri perchloridi grs. iv-viij, eau de Cologne et aquæ destillatæ aa $\frac{3}{4}$ ss. Ammonia is also useful, the liquor ammonii fortioris being sometimes employed, but the following formula, which we owe to Erasmus Wilson, will be found more convenient: \mathcal{R} Liquoris ammonii fortioris 3 j-3 ij, tincturæ cantharidis et tincturæ rosmarini aa 3 ij, spiritus vini rectificati 3 iv, olei amygdalæ et olei olivæ aa $\frac{3}{4}$ j.

The officinal ointments of chrysarobin, sulphur, and tar all have their partisans, especially as they meet both theories—parasitic and non-parasitic—of the causation of the disease.

Galvanism or the faradic brush is useful in some cases in which the neurotic origin is obvious, and where anæsthesia or other nerve disturbance is present. In any case it is as well to explain to the patient or his friends the tedious nature of the complaint, and the tendency to repeated relapses.

J. J. PRINGLE.

Symptomatic Indications.—In non-syphilitic cases *arsenicum* is usually sufficient; cases of syphilitic origin require *acid fluoric*. When resulting from general debility, or following severe illnesses, *acidum phosphoricum* will be indicated, *kali carb.* being indicated for alopecia after nervous fevers; great dryness of the hair.

ALTERATIVES are substances which promote tissue change—*i. e.*, increase the metabolism of the tissues. They appear to make the tissues do more work, and that this may go on satisfactorily, a due supply of food and air is necessary, a fact always to be borne in mind when prescribing this class of remedies. The most important of the alteratives are mercury, iodine, phosphorus, arsenic, and antimony. Certain vegetable alteratives—*e. g.*, sarsaparilla, sassafras, guaiacum, etc., are of exceedingly doubtful action.

AMAUROSIS.—This affection is characterized by certain organic changes in the optic nerve and retina, or other parts of the nervous system essential to vision, causing an inability to perceive objects which lie in certain portions of the visual field, with a distinctness corresponding to the amount of illumination and size of the visual angle. In bad cases the objects cannot be seen at all, when the condition is known as amblyopia; and when light cannot be distinguished from darkness it is known as amaurosis.

The conditions under which amaurosis has been brought about may best indicate its pathology. These may be summed up under the following heads. (1) Mechanical injuries, solution of continuity or sudden contraction of the space of the optic nerve or retina. Hemorrhagic extravasations are found which notably break up the nerve elements, causing them permanently to lose their conductive power. If they are only pressed upon, and no inflammation follow, with progressive absorption of the extravasation, a partial or complete restoration of vision may follow. These extravasations are not unfrequent in the retina as a result of hypertrophy of the left cardiac ventricle, coughing, or lifting heavy weights. Extravasation causing amaurosis has also been found in the optic chiasma. Double amaurosis may result from apoplectic extravasation in the thalamus. (2) Sudden interruption to blood supply, as by embolus, with sudden and marked contraction of some or all the branches of the arteria centralis retinæ. Such a form of amaurosis is oftenest seen in anæmic conditions, as in the later stages of diabetes, albuminuria, syphilis, lead poisoning, uterine hemorrhages, hematemesis; and the blindness is generally in both eyes. (3) The influence of material which poisons the blood and acts upon the brain, or affects the optic nerve and retina, as atropia, acts on the ciliary nerves. The most marked cases of this kind are from uræmia and lead poisoning; opium, Calabar bean, nux vomica, and tobacco. The extreme use of quinine and abuse of alcohol have also been known to produce amaurosis. (4) Congestion and hyperæmia of the eye. (5) Intracranial changes of tissue (cerebral or central amaurosis). In such cases the impairment of vision is generally due to lesion on the optic nerve

at the base of the brain, such as gray atrophy; which may not affect any part of the cranial cavity. Basilar meningitis, or periostitic affections of the basilar bones affecting the optic nerves, may induce hemiopia of the same side in both eyes, or total blindness of one or both eyes. Tumors at the base of the brain, involving the nerve directly or by pressure in or by the morbid growth, are also intracranial causes of amaurosis. They are usually found at the base, especially about the sella turcica and neighborhood of cerebellum. Actual disease of the brain itself may also be a cause, such as encephalitis, abscess, softening, tubercle, gummy tumors, hydatids, hemorrhages; but their relations to amaurosis are very complicated. Generally they cause amaurosis through exciting meningitis, which, spreading rapidly, extends to the intracranial portion of the optic nerve, or influences the optic cavities.

Thus the causes may be either ocular in the retina, choroid, or optic nerve; or extra-ocular, but orbital; or cerebral or spinal.

The symptoms vary greatly in each individual case and stage of its course. Impairment of vision is the most prominent symptom, which may be irregularly distributed upon the various parts of the visual field. The field of vision must therefore be carefully and repeatedly examined in all cases of amaurosis; and a record kept from time to time, in order to gain a clear idea as to the amount of impairment of function, and as to the progress of the case. The following points must be especially determined: (*a*) Size of the whole field of vision; (*b*) central acuteness of vision and definition; (*c*) manner in which distinction of perception diminishes in each sector of the field of vision toward the periphery.

Treatment must vary in accordance with the ascertained cause; and hence, we must look to the nature of the several diseases and their management, which are associated with amaurosis.

WILLIAM AITKEN.

Symptomatic Indications.—Amaurosis from excessive use of the eyes usually yields to *arnica*, although *ruta graveolens* may be required when it is the result of steady looking or over-straining of the eyes, as in doing fine sewing. Pain from steady looking, with sensation of a gauze before the eyes or a green circle around

the light points to *ruta*. Inflammation or congestion to the eyes, yellow sclerotic, sharp, salty tears, objects appear red or wrong side up, aversion to light, indicate *belladonna*. When the eyes water all the time, with pain in the ball from a bright light, smarting, burning tears, especially in the wind, *euphrasia* is the remedy.

Amaurosis from anæmia in the young may be met by *ferrum*. Organic changes may be mitigated by *mercurius corrosivus*. Amaurosis from excessive mental labor, or over-indulgence in stimulants, optical illusions in bright colors, point to *nux vomica*. Half vision, cannot distinguish the right half of anything, *lithium carb.* Amaurosis after diphtheria, *gelsemium*.

AMENORRHŒA.—Absence of menstruation. It is physiological during pregnancy and lactation. At other times it may be the result of one of two conditions: either the menstrual bleeding does not take place—**suppression of menses**; or the blood does not escape externally—**retention of menses**.

Suppression of menses may be the result of:

(1) Constitutional disease. (*a*) Anæmia, and all conditions which cause anæmia, and (*b*) all wasting diseases, usually prevent the occurrence of the menstrual hemorrhage. (*c*) Nervous conditions may suppress it, such as mental shock, anxiety, mental depression, melancholia. Probably, with these should be ranged change of residence. In all these conditions there is reason to think that suppression of menses is beneficial. The only *treatment* that should be employed is that required by the general condition causing the menstrual suppression. (*d*) Menstruation may also be suddenly arrested by exposure to wet or cold at the menstrual period, and the stoppage of the flow is often accompanied by pelvic pain. The *treatment* should be hot hip or foot baths, followed by rest in a warm bed; hot poultices may be applied to the hypogastrium, and, if the patient be full-blooded, leeches to the groins or round the anus, or, in the case of a married woman, to the cervix uteri.

(2) The non-appearance of menstruation may be due to local conditions—*e.g.*, imperfect development of ovaries or uterus.

Imperfect development or absence of the ovaries is extremely rare, and its diagnosis so difficult as to be practically impossible. The uterus may be absent or imperfectly developed. Imperfect development of the uterus may be the result (*a*) of disease preventing the proper growth of the body, such as idiocy, cretinism, or wasting disease during adolescence. (*b*) But it may also be present in strong, well-grown women, who in all other respects enjoy perfect health. (*c*) After delivery, the involution of the uterus which then takes place may go on to atrophy. This is called superinvolution or puerperal atrophy of uterus. Imperfect development or atrophy of the uterus is recognized by shortness or smallness of the body of the organ. By examining with one hand on the abdomen, and a finger of the other hand in the rectum, the uterus can be felt between the two hands. The cervix is usually normal as to size, or nearly so, while the body may be of the normal length, but not broader or thicker than the cervix, or the body may be so short that the length of the whole organ does not exceed two inches.

The *treatment* of these cases should be limited to remedying any disorder of the general health that may be present. It must be remembered that in some cases the menstrual function is established late, and that if the patient be seventeen, eighteen, nineteen, or even twenty, the uterus may yet develop. Even if it do not, the absence of menstruation is in no way detrimental to health, and the only way in which imperfect development of the uterus is injurious to the patient is in case of marriage, by the sterility which it entails. This applies also to puerperal atrophy of the uterus. The best advice that can be given the patient is to do without treatment, as by no possibility can it cause the uterus to develop. Galvanism, intra-uterine pessaries, and other irritants, have been employed for this purpose, and it is easy by such means to make the uterus bleed; but such bleeding is not menstruation, and it usually ceases with the irritation. It is true that there have been cases recorded in which treatment of this kind has been followed by the desired result; but they are so outnumbered by the failures, that it may be presumed that they were cases in which the event

would have been the same had no treatment been employed. Marriage is sometimes in such cases followed by the establishment of menstruation; but bearing in mind the lifelong unhappiness that may result from marrying in haste, marriage ought never to be recommended solely on account of its expected influence on health.

Retention of menses is the result of closure of some part of the genital passage below the body of the uterus. This may be due either to (1) congenital malformation or to (2) cicatrization.

(1) Congenital atresia most commonly affects the vagina, generally in its lower part, a transverse septum forming across the canal. This septum may be in the situation of the hymen, but is usually above it. There may be more than one septum at different parts of the canal, or the vagina may be absent either entirely or through part of its extent. Congenital closure of the cervix uteri is exceedingly rare.

(2) Acquired atresia of the cervix most frequently occurs either from the use of caustics, or after amputation of the cervix. Atresia of the vagina may result from sloughing and ulceration occurring in the course of fevers, scarlatina, enteric fever, smallpox, measles, etc., or from sloughing after difficult labor, or from venereal ulceration. When, the passage being closed, menstruation has taken place, the menstrual blood accumulates behind the obstruction. During its retention changes occur in it which make it thicker and darker in color. If the occlusion be low down in the vagina, this canal becomes distended and may form a tumor rising into the abdomen, and on the top of this tumor the uterus may be felt, the body of this organ not sharing in the dilatation. But if the atresia be situated higher up, the uterus and fallopian tubes may become distended also. The distension of the parts usually produces pain, which occurs when fresh blood is added to that already retained—viz., at every menstrual epoch. Retention of menses is to be suspected when, together with amenorrhœa, we have a history of gradually increasing pain at the times when menstruation ought to have occurred. A history such as this should call for examination, first of the abdomen, in which, if the retention be of long standing, a tumor will be felt, then of the genital canal, to see if it be

pervious. If there be a membranous vaginal septum, it will be felt as a bulging, elastic, convex swelling, which the retained blood behind it will probably make bluish in color. If the vagina be wholly or partly absent, it will be felt to end in a cul-de-sac, and above it, by bimanual rectal examination, the tumor formed by the distended uterus will be perceived.

The *treatment* of this condition is to let out the retained blood. If the septum be membranous, this is best done by cutting through it with the Paquelin cautery-knife. If the vagina be wholly or partly absent, a new canal must be made. A sound must be passed into the urethra and a finger into the rectum. Then, with scissors or scalpel, the mucous membrane forming the bottom of the vaginal cul-de-sac must be cut through.

When the cellular tissue beneath the mucous membrane has been reached, the dissection must be carried on between the rectum and urethra with the handle of the scalpel, a spatula, or the finger-nail until the distended uterus has been reached. This must then be punctured and the fluid let out. Afterward the opening must be prevented from closing, this is best done by a glass stem, and the new vagina must be kept patent by a vaginal rest or a glass drainage-tube. The opening by which the retained fluid is let out should always be a free one, but no pressure on the abdomen should be made to hasten the outflow. Strict antiseptic precautions should be taken. The cavity should not be washed out. The escaping fluid should be received by a large pad of dry absorbent wool applied to the vulva. This operation is not quite free from danger. The dangers are—(1) reflux of retained blood through a fallopian tube into the abdominal cavity; (2) rupture of a fallopian tube; (3) endometritis and the spread of inflammation along the fallopian tube to the peritoneum; (4) decomposition of the retained fluid and septicæmia. These are best guarded against in the manner described, the important points being antiseptic care, a free opening, no pressure, no washing out. But should, subsequently, the discharge become foul, and symptoms of septic poisoning appear, the offensive discharge may then be washed away with advantage.

G. E. HERMAN.

Symptomatic Indications.—Amenorrhœa as a consequence of anæmic condi-

tion may require *arsenicum*, *cinchona*, *ferrum*, *calcareæ carb.*, *natrum muriaticum*, *phosphorus* or *causticum*. The indications for *arsenicum* are pale waxen color of the face; great prostration of strength from least exertion; sadness and melancholy; fear of death and of being left alone. Chilliness predominates. Constant thirst, but drinks only in small quantities. For *ferrum*, delay of the first menses; general anæmic conditions. For *calcareæ carb.*, amenorrhœa with incipient tuberculosis; scrofulous rickety subjects. The menstrual period is preceded by swelling and soreness of the breasts, headache, colic, shiverings, and leucorrhœa. Cold, damp feet and swelling at the pit of the stomach. For *causticum*, epileptic fits at the time of the menses. Weakly scrofulous subjects with glandular swellings. Melancholy mood, looking on the dark side of everything. For *cinchona*, weakness of digestion; fullness and distension of the abdomen, particularly after eating. Debility from loss of animal fluids. For *natrum muriaticum*, age of puberty, constipation, frequent fluttering of the heart. For *phosphorus*, delicate constitutions, with tendency to chest diseases. Chronic diarrhea.

Amenorrhœa from mental emotions will require *colocynth* or *ignatia*. *Ignatia*, if from deep grief. *Colocynth*, if from anger or deep silent grief. With *colocynth* there are also severe colicky pains, which compel the patient to bend double.

Amenorrhœa from cold may indicate *aconite*, *dulcamara* or *pulsatilla*. *Aconite* is suited to full-blooded persons, with symptoms of disturbed circulation. Delay of first menses. Amenorrhœa from exposure to wet or similar rheumatic causes. Suppression from getting the feet wet points to *pulsatilla*, there is constant chilliness even in a warm room and an inclination to melancholy and crying. Amenorrhœa from exposure to cold, from getting wet, calls for *dulcamara*, particularly when at each menstrual period a rash shows itself upon the skin. Every time she takes cold she has *urticaria* or some other eruption of the skin.

Amenorrhœa from torpor of the sexual system points to *cimicifuga* or *cocculus*. With *cimicifuga* there is torpor of the ovaries, with hysteria; pain in the left breast and side, rheumatic tendency. *Cocculus* has leucorrhœa instead of the

menses. The patient is extremely weak during the menstrual period. Sometimes a few drops of black blood are discharged. Nervous, hysterical subjects.

Amenorrhœa in connection with diseases of the skin indicate *sulphur* or *graphites*. *Sulphur*, persons of a scrofulous diathesis; pale, sickly complexion; eruption upon the skin. Frequent weak, faint spells through the day. *Graphites*, delayed, scanty, suppressed menses, with sense of weight in the arms and lower extremities. An occasional show of menses, the discharge being very pale and scant. Eruptions on the skin oozing out a sticky fluid.

Other conditions may require *bella-donna*; as symptoms of cerebral irritation. Throbbing headache at the approach of each menstrual period. Bearing down pains in the hypogastrium as if the menses would appear. *Chamomilla*, pressure toward the genital organs, like labor pains. Cutting colic and drawing in the thighs previous to a menstrual period; passes large quantities of colorless urine. *Crocus sativa*, sensation as if the menses would appear, with colic and dragging down in the direction of the pudendum. Sensation as of something alive in the abdomen. *Sepia*, frequent paroxysms of hysteric or nervous headache. Much leucorrhœa; chlorosis; hemorrhoids; constipation. Chronic cases. Nervous debility and great disposition to sweat. Painful sense of emptiness at the pit of the stomach.

AMPUTATION (when through a joint it is termed *Disarticulation*).—

When required.—For incurable and disabling disease, deformity, or injury of the part; for disease which would take too long time in recovery; to save life when nature would find it easier to heal the amputation wound than to cure the disease or injury; for aneurism below or even above the site of operation; for secondary hemorrhage.

General principles.—1. Remove no more of a limb than is necessary; 2, obtain sufficient coverings for the stump; 3, arrange that the cicatrix shall not lie on the end of the bone; 4, do not take hopelessly unsound tissue into the flaps; 5, take every precaution to check hemorrhage and to prevent its recurrence; 6, cut the large blood vessels transversely; 7, remember the paramount impor-

tance of dressings and after-treatment.

Instruments.—1, Knives appropriate to each case; 2, saw; 3, bone-forceps; 4, lion-forceps; 5, common scalpels; 6, artery-forceps; 7, dissecting-forceps; 8, ligatures; 9, needles and sutures; 10, dressings, sponges, retractors, towels, water, etc.

Assistants.—1, Chief, who sponges, secures arteries, etc., usually stands opposite operator; 2, holds part to be removed; 3, secures main artery, unless tourniquet be used; 4, hands instruments when wanted; 5, chloroformist. Number of assistants of course depends greatly on supply accessible.

Methods.—1, Circular; 2, oval; 3, flap; 4, mixed of skin-flaps and circular cut through muscles.

Steps.—1, Divide soft part; 2, saw bone (avoid splintering, cut off spiculæ); 3, tie vessels and trim soft tissue; 4, adjust flaps and insert sutures; 5, apply first dressings.

Circular Amputation.—1, Sweep through skin and fat and dissect up for half-diameter of limb, turning edge of knife slightly away from skin to avoid scoring the vessels which supply the skin-flap; 2, sweep through muscles, "retracting" all the time; 3, still having the muscles well retracted, one or two inches, and having divided the periosteum by a sweep of the knife, saw through bone. Finish as directed above.

Oval Amputation.—See amputation of finger at metacarpo-phalangeal joint.

Flap Amputation.—Three varieties; 1, Double flap; 2, rectangular (Teale's); 3, one long flap.

Double flap, may be lateral, antero-posterior, or oblique. Cut thin flaps from without inward, but thick and fleshy ones by transfixion. Flap containing vessels to be cut last, and vessels cut long.

Rectangular flaps (Teale's).—All the soft tissues down to the bone included in the flaps. Main artery to be in short flap. End of flaps square. Long flap; its length and breadth each equal half the circumference of the limb. Short flap; its length equals one-fourth that of long flap. Bones sawn exactly at angle of union of flaps, without any retraction.

Spence's operation (a modification of Teale's).—No posterior flap; retraction instead. Anterior flap simply hangs down over bone.

Lister cuts an anterior rounded flap two-thirds diameter of limb in length; skin and enough muscle to cover bone. Posterior rounded flap (one-third limb's diameter), all skin. Posterior muscles cut as short as possible (to free laps from effects of their contraction). Retract soft parts for two inches, and saw bone.

Single-flap amputation. *Vide* amputation at phalangeal joints of fingers.

Skin-Flaps and Circular Incision through Muscles.—Cut two skin-flaps by dissecting from without inward. Then finish as in circular amputation.

Hemorrhage during amputation to be prevented temporarily by digital pressure on main artery, by tourniquet, or by Esmarch's bandage. Afterward ligature by silk, hemp, or catgut—torsion or acupressure is to be employed. Sponging with cold or with hot water to stop oozing. Actual cautery to check obstinate bleeding from bone.

Muscles retract greatly in traumatic cases, but very little in limbs affected with old disease. Knife to be used with a free sawing motion. Parts to be relaxed during transfixion. Commence sawing the bone by drawing the saw back to make a groove.

Mortality after amputation.—Chief causes: 1, shock; 2, secondary hemorrhage; 3, pyæmia (in nearly half the fatal cases); 4, erysipelas; 5, phlebitis; 6, congestive pneumonia. Besides which, 7, hospital gangrene; 8, sloughing of stump, and, 9, tetanus, occasionally carry off patient. Pyæmia most common after traumatic, rare after chronic disease cases.

Circumstances affecting patient's chance of recovery.—Two classes: 1, constitutional conditions; 2, circumstances of operation itself. Class 1: age, general health, and hygienic conditions. Child's twice as good as a young man's, three times as good as an old man's. Class 2: seat of amputation, structure of bone sawn through; whether amputation is for injury or disease; nature of the affection; time after the injury. Diseased kidneys, town life, amputation high up a limb, amputation for injury, or through much cancellous tissue of bone—all these darken the prognosis. Nature of disease; after chronic disease, prognosis good; malignant or tuberculous disease bad; acute suppurative disease of joints, very bad; amputation of expediency, very bad. Time after injury;

primary or secondary. Primary are such as are done within thirty hours of the injury. Secondary are amputations done after suppuration has occurred. Primary always more dangerous than secondary, except in amputations of the upper extremity done in civil practice. Death after primary amputation usually caused by shock, hemorrhage, or exhaustion; after secondary, by erysipelas, pyæmia, etc.

Amputation at Ankle.—*Pirogoff's*.—Resembles Syme's. But the lower incision extends from one malleolus to the other across the sole of the foot, and inclines forward and downward; while the os calcis is sawn through obliquely, downward and forward, just behind the articular surfaces of the astragalus. The posterior piece of the os calcis is then placed in apposition with the tibia, whose articular surface is previously sliced off. The resulting stump is longer than Syme's; but if the tarsus is diseased there is a liability to return of the disease in the os calcis.

Syme's amputation.—Inner angle of incisions is three-quarters of an inch below and behind inner malleolus; outer angle exactly opposite outer malleolus. Upper incision has an angle of 45° to sole of foot; lower incision inclines downward and somewhat backward. Os calcis may be dissected from heel-flap either before or after disarticulation at ankle, *i. e.*, either from below or from above. Syme dissected out os calcis from below, and disarticulated afterward. Avoid scoring flap. The anterior tibial and both plantar arteries, and not the posterior tibial, are divided.

Arm, Amputation of.—*Upper arm.*—Double flap by transfixion often employed. Also circular and mixed operation. Arteries divided: brachial, superior profunda and inferior profunda.

Fore arm.—In upper and lower thirds prefer skin-flaps and circular through muscles (T. Smith). Arm to be held either supine or midway between supination and pronation. Arteries: radial, ulnar, anterior, and posterior interosseous.

Elbow-Joint, Disarticulation at.—Seldom done. Best to cut a large anterior flap (Lister).

Fingers, Amputation of.—Usually done by disarticulation. To remove the second or third phalanx, cut a single palmar or double (palmar and dorsal) flaps: As

the heads of the bones form the knuckles, the articulations are just in front of the knuckles. In case of injury here, as elsewhere, "cut according to your cloth."

Metacarpo-phalangeal disarticulation.—So-called "oval," really "pyriform," incision. Commence half an inch posterior to head of metacarpo-phalangeal joint, carry incision right round palmar surface of base of finger and back again. Divide lateral ligaments, twist the bone out of its place and remove it. Extensor tendon should be cut by first incision. Removal of head of metacarpal makes hand more sightly, but much weaker.

Foot, Amputations through.—*Chopart's.*—Between scaphoid and cuboid on the one hand, and astragalus and calcis on the other. Long plantar flap, reaching to roots of toes; very short dorsal flap. Incisions commence, on inner side, just behind prominence of scaphoid; on outer side, one inch behind base of fifth metatarsal bone. Beware of opening ankle-joint. Disarticulate before cutting plantar flap. Plantar flap to be longer on inner than outer side. Arteries: dorsalis pedis, plantar, and digital.

De Lignorolles'.—Removes all the bones of the tarsus, except the astragalus. Heel and dorsal flaps.

Hancock's.—Leaves the astragalus and posterior end of os calcis, on the principle of Pirogoff's.

Lisfranc's (commonly called Hey's).—Between tarsus and metatarsus. Long plantar flap, reaching to roots of toes, longer on inner than outer side. Dorsal incision nearly transverse, with only slight convexity forward. Ends of incisions, on inner side, one inch before tubercle of scaphoid, on outer side just behind base of fifth metatarsal. In disarticulating, remember dove-tailing of second metatarsal bone into cuneiform bones, and the obliquity of cuboido-metatarsal joint. Cut plantar flap from behind forward after disarticulation, but cut its borders deeply down to bone when commencing operation. Arteries: dorsalis pedis, plantar, and digital.

Hand, Amputation through.—Not a single bone should be unnecessarily removed. The flaps have usually to be taken from where soft tissues are most available.

Hip-Joint, Amputation at.—Three ways: 1, long anterior flap; 2, double

flap, anterior and posterior; 3, lateral flaps. Use Lister's tourniquet for aorta, or Davy's lever per rectum; let patient's buttocks project beyond edge of table, tie body and sound limb to table, have three assistants and stand on left side of limb. Assistants: 1, takes charge of flap and pays greatest attention to instantly stopping all hemorrhage; 2, manipulates limb; he has mainly to prevent locking of operating-knife, especially by keeping great trochanter out of the way; 3, controls tourniquet.

Long anterior flap operation.—Left hip: transfix from a point midway between antero-superior spine of ilium and great trochanter to another point just in front of tuberosity of ischium. Knife should pass behind femoral vessels and lay open hip-joint. Right hip: transfix in the same way, but in the opposite direction. Other operative procedures same for both right and left limb. Length of flap, 8 or 10 inches. Next, draw knife across capsule of joint, opening it freely. Divide ligamentum teres and external rotators. Cut vertically downward through the remaining soft parts.

Manipulations by assistant having charge of limb.—1, Whilst anterior flap is being formed, flex slightly, adduct, and rotate inward. Then extend and rotate outward, till, the ligaments being divided, head of femur leaves its socket with a sucking noise. Then, again slightly flex, adduct, and extend forcibly. Absence of posterior flap favors drainage. Arteries: femoral, profunda, obturator, sciatic, and minor branches.

Double-flap amputation.—Manipulations and proceedings resemble preceding; but there are two flaps, anterior, five inches, posterior, four inches long. In cutting posterior flap, have limb rotated inward to clear great trochanter.

Lateral flaps.—External is composed of skin. Internal, of skin and muscle, is cut from within outward. Angles, where flaps join, are: in front, just outside femoral vessels, behind, close to tuberosity of ischium.

When done for injury, amputation at hip-joint is almost always fatal; when for disease, three recover out of five.

Knee-Joint, Disarticulation at.—Chief methods: 1, anterior skin-flap; 2, antero-posterior double flaps, either the anterior or the posterior being the longer; 3, long posterior flap (usually including

flesh); 4, lateral skin-flaps; 5, anterior and posterior skin-flaps, with circular incision through muscles. The patella is generally left; then the tendon of the quadriceps extensor may be divided. Incisions in lateral-flap method begin one inch below tubercle of tibia. Flaps to be somewhat square. Cartilage to be left, unless diseased. *Mortality*.—For disease, one in three.

Leg, Amputation of.—Any one of the ordinary methods can be used; but double-skin flaps and circular through muscles are very good. Care should be taken not to lock the knife between the two bones, and not to turn its edge upward in cleaning between the bones. The sharp anterior edge of the tibia should be beveled off with the saw. Sawing through the fibula should always be completed before the division of the tibia. *Mortality*.—For disease, one in twelve; for injury, 60 per cent.

Penis, Amputation of.—Clover's clamp or tape to check hemorrhage. Corpus spongiosum to be cut half an inch longer than C. cavernosa. Value of galvanic cautery ecraseur. Urethra to be split into three and sewn to skin. Skin to be divided higher up than the "corpora," *i. e.*, the very reverse of the principle adopted in amputating a limb.

Shoulder-Joint, Amputation of.—Three chief methods, viz., 1, lateral flaps; 2, anterior and posterior flaps; 3, oval incision. But in cases of extensive injury to upper arm, almost any operation may be expected to give a satisfactory stump.

Lateral flaps.—Transfix in cases of injury. Cut from without inward when for disease. Knife, narrow-bladed. Three assistants: 1, holds the limb; 2, raises the flap; 3, follows the knife as it cuts behind the humerus, and grasps the inner flap with the axillary artery. Subclavian may be compressed. Position of operator: for right limb, stand before; for left limb stand behind. Right side; enter knife midway between acromion and coracoid process. Left side, enter well behind spine of scapula, at posterior border of axilla. Outer flap should contain most of deltoid. Secondly, open capsule, divide muscles attached to great tuberosity (arm rotated inward) and subscapularis (arm rotated outward). Thirdly, having dislocated head of humerus, pass knife behind it and cut down for a distance of three inches, keeping

close to inner side of bone (so as not to divide artery too soon). Then complete inner flap by turning edge of knife inward and cutting through. Arteries: axillary, circumflex, subscapular, etc.

Oval amputation.—When uncertain whether to resect joint or amputate, perpendicular incision may be made as for resection (*quod vide*), and the joint examined. Then, if desirable, the limb can after all be removed by cutting obliquely right round the limb from and to the lower end of the longitudinal incision. This is Spence's plan.

Mortality.—For disease, one in two; for accident, one in three.

Thigh, Amputation of.—*Methods.*—1, Gritti's; 2, Carden's; 3, Spence's; 4, lateral flaps (Vermale's); 5, circular; 6, double flap by transfixion; 7, mixed; 8, Teale's.

Gritti's.—Done "just above condyles with an anterior flap, in which the patella is preserved, its surface being sawn and applied to the cut surface of the femur." Incision extends from upper end of fibula to inner side of joint, reaching downward below patella.

Carden's.—Through the condyles. Single anterior flap. Circular cut through deeper parts. Slight retraction of them before sawing bone. Advantages: the medullary canal not being opened, there is less risk of pyæmia. The skin of knee is accustomed to bear weight of body in kneeling, etc. Arteries: popliteal and some of its branches.

Spence's.—Long anterior; no posterior flap; circular cut through muscles; retract two inches and saw bone.

Lateral flaps.—Not to be recommended. This operation and the other modes of amputating thigh all done in the ordinary way. Arteries: femoral profunda, external circumflex, anastomotica magna if flap reaches low down, muscular branches.

Mortality of amputation of thigh.—After injury, three in five (much more in military practice); after disease, one in three. But for chronic knee-joint disease it is particularly safe.

Thumb, Amputation of.—1, *At carpo-metacarpal joint.*—Incision along dorsum of metacarpal bone, commencing at palmar side of trapezio-metacarpal joint and ending at web of thumb. Flap from ball of thumb, by transfixion. Right thumb: transfix first. Left thumb:

transfix after making dorsal incision. Operator should stand beside the hand or forearm, not in front of it; otherwise his own left hand will get in his way. Beware of locking knife under sesamoid bones; and keep close to metacarpal bone, to avoid wounding radial artery. Arteries: dorsals and arteria magna pollicis.

2. *Thumb at metacarpo-phalangeal joint.*—Oval amputation.

Toe, Great. — *At tarso-metatarsal joint.*—Two methods, flap and oval.

1. *Flap.*—Cut a flap from whole length of inner side of metacarpal bone. Better not transfix for this. Then transfix between first and second metacarpals, and cut downward right through web of toes. If possible, save base of metacarpal bone; otherwise divide tendon of peroneus longus and disarticulate. Beware of sesamoid bones, and of dividing communicating branch between dorsalis pedis and external plantar artery at base of interosseous space. Artery divided always: first digital.

2. *Oval amputation.*—Commence incision half-an-inch posterior to where the bone is to be divided or disarticulated.

Toes.—Amputated same way as fingers. C. B. KEETLEY.

See GENERAL PRINCIPLES OF OPERATIVE SURGERY.

ANÆMIA.—This term denotes the condition of a part or of the whole organism when the blood is either deficient in quantity or below the normal standard in quality—*i. e.*, as regards its hemoglobin.

Anæmia implies an alteration in the composition of the blood, due either to a diminution in its bulk or in its most important constituent—the coloring matter. The same condition—*viz.*, a lowered proportion of hemoglobin and therefore of the functional value of the blood as the great nutrient medium—results in either case, for in diminution of the quantity of blood (*e. g.*, from sudden and severe hemorrhage) the actual amount of fluid is rapidly made up by absorption of water from the tissues (hydræmia), and the quality of the blood is thereby materially altered.

Forms of anæmia may be dealt with under the heads of primary (essential or idiopathic) and secondary (or symptomatic). Such idiopathic forms include

chlorosis, pernicious anæmia, and the allied blood states of leucocythæmia and Hodgkin's disease (*quod vide*).

Causes of anæmia.—Excluding the “idiopathic” class, we may consider the ætiology of anæmia under the two heads of (1) deficient nutrient supply and (2) undue blood waste. Under the first head would be included any cause which interferes with a due supply of food material or of oxygen. The subject may be placed under circumstances of living or occupation which may deprive him of these necessities of life, and in consequence his blood composition will be lowered; or he may be the victim of derangements of the organs of digestion and assimilation, which lead to the same result. Anæmia, in its most extreme degree, is to be seen in cases of gastric cancer—a disease which may be quite latent, and in which no hemorrhages may have occurred adequate to explain the anæmic state. Similarly, but less strikingly, it is shown in all cases of impaired digestion, functional or organic, and in diseases of the absorbent system. As regards oxygenation, there is ample evidence that exclusion from pure air (and light) is productive of a state of anæmia and debility. More obvious, and perhaps more frequent, are the causes which induce excessive loss of blood or of its essential components. Actual loss of blood from external or internal hemorrhage is the most striking of such causes. Repeated small hemorrhages have eventually the same effect as a single severe loss. Indeed, owing to the reparative powers, the latter may be quickly recovered from, whereas the former constitutes a more or less permanent drain and induces a chronic state of anæmia. Such latter instances are to be found in repeated attacks of intestinal hemorrhage as from piles, or of uterine hemorrhage as in fibroid of the uterus, or in the repeated bleedings of the hemophilic or scorbutic, or the insidious blood-loss due to the parasite—*anchylostomum duodenale*. Again, long-continued suppuration and chronic albuminuria are fruitful causes of anæmia; chronic diarrhea, continued fevers, malignant disease, tubercle, or blood poisons, as syphilis and malaria; or mineral poisons, as lead and mercury—all of which probably operate by destroying the corpuscular elements of the blood. Even

excessive neuro-muscular activity will do the same; in fact, anything which makes a great demand on the vital powers, quickening metabolism without the compensating balance of increased nutrition. Lastly, the effects of natural evolution of the body, in its growth and decline, exhibit on each hand the operation of either insufficient supply of material to the needs of the growing organism, or a decadence and waste not made up for by the waning vital powers.

Effects of anæmia.—When long continued, anæmia necessarily produces profound alteration in the organism, as evidenced by clinical and pathological signs. Many of these are referable to the cardiac debility induced by the effect on the heart-muscle of the impoverished blood. Experimentally, fatty degeneration of the heart has been brought about by repeated blood-lettings; and fatty degeneration—a retrograde metamorphosis of the protoplasmic elements—is a common consequence of anæmia, whether it may be brought about by defective metabolism due to the want of sufficient oxidation of tissue, or by incomplete conversion of albuminoid material. As indications of this cardiac weakness may be mentioned such symptoms as palpitation, tendency to syncope, and dyspnœa, together with the cardiac bruits and the evidence of enlargement of the left ventricle. The deficiency in hemoglobin, and consequently lessened oxygen-holding power of the blood, accounts for the dyspnœa and probably for other symptoms also. The tendency to dropsical effusions may be mainly due to the hydræmic state of the blood. On the side of the nervous system, headache, vertigo, tinnitus, and—in cases of acute anæmia—convulsions mark the effect of impoverished blood on the cerebral circulation and nutrition. Digestion is impaired and enfeebled, and all the functions of the body are deranged. (*vide* CHLOROSIS).

Treatment of anæmia.—The removal of the cause of the anæmic state is the first object. The arrest of hemorrhage, subdual of fever, etc., and removal into pure air are thus essential. But when the cause cannot be removed, then measures have to be directed to maintain the strength and to treat the primary disease. Food should be peptonized, and if the stomach is intolerant, nutrient

enemata or suppositories may be resorted to. Medicinally, iron and arsenic are the chief hematinic remedies. In acute cases the best results are obtained from transfusion, either direct of blood or indirect of defibrinated blood, or by Nussbaum's plan of "auto-transfusion." Very good results have been gained by the injection of saline fluid into the veins, in saving from impending death. Transfusion of milk or of lamb's blood has been shown to have had injurious effects, and has been consequently abandoned.

SIDNEY COUPLAND.

ANÆMIA, PERNICIOUS.—A severe and almost invariably fatal form of progressive anæmia, the pathology of which has still to be determined.

It is still a moot point whether the condition can be regarded as a distinct disease or only as the final and most serious grade of anæmia no matter how arising. For it must be borne in mind that, in certain diseases of which anæmia forms the most prominent symptom, the clinical phenomena are closely paralleled by those of this so-called "idiopathic affection—*e. g.*, latent cancer of the stomach; and the post-mortem evidences (except those strictly due to the local and primary malady) are attributable to the persistent and progressive anæmia.

At one time much attention was paid to certain changes in the bone marrow which are undoubtedly present in many cases. It was found to be red, and full of immature forms of corpuscular elements. Then the spleen and liver were found to contain an excess of iron in their composition, and iron was even found in the urine. This character seems to be the most common in all cases of pernicious anæmia, especially as regards the liver, for the condition is largely one of excessive hemolysis; and its pronounced seat in the liver suggested the further not unreasonable hypothesis that the process is initiated by the absorption into the portal blood of ptomaines generated in the intestinal tract. It would seem as if, pathologically speaking, chlorosis were mainly due to defective blood formation (hemogenesis), pernicious anæmia to excessive blood destruction (hemolysis).

The use of the term "pernicious" as descriptive of this disease (or condition) is unfortunate, but has been sanctioned

by usage. It implies a malignant or invariably lethal course. Happily, there are cases which are undoubtedly of this category that do recover, not only temporarily, but even permanently. The alternative titles of "essential anæmia" and "idiopathic anæmia" are, however, quite as much open to criticism, since they do not discriminate between this affection and chlorosis.

Each sex would appear to be about equally liable to pernicious anæmia, although in the experience of the writer the males far outnumber the females. But abroad, especially in Zürich, the number of cases among pregnant or puerperal women seems unusually high, whereas in this country such a relationship is not common. It may be that other factors, especially the mode of life and diet, play some part in accounting for this discrepancy. It is a disease of early adult life, most cases occurring between thirty and forty, but it is not unknown in youth before puberty, or in the aged.

Pernicious anæmia is for the most part insidious in onset, although there are cases where it has immediately followed a violent emotional influence or shock; and occasionally a sudden profuse hemorrhage will leave behind it an anæmia that progressively advances in all respects like the idiopathic disease. Usually, however, its course is rather chronic than subacute, extending over months or even years, and the subject may or may not have been previously anæmic.

Symptoms.—Those of intense anæmia. Frequently, vomiting and diarrhea are early symptoms, and there may be slight icterus, not to be confounded with the faintly icteroid tint of skin due to the profound anæmia. There is breathlessness, which in time becomes marked, even when the patient is at rest. Palpitation, vertigo, tinnitus, tendency to syncope, and other symptoms referable to the anæmic state are prominent. There is frequently marked œdema, especially in dependent parts, but the general nutrition of the body is maintained. Indeed, there is mostly a fair amount of subcutaneous fat. The cardio-vascular signs of anæmia are well marked, bruits in the precordial region being often very loud, and the jugular hum intense. Hemorrhages, especially retinal, are common, and fairly diagnostic; they may also occur subcutaneously, while occasionally there is bleeding from

mucous surfaces—as epistaxis, hematemesis, monorrhagia. These hemorrhages, which serve to intensify the anæmia, are doubtless due to the altered composition of the blood and the defective nutrition of the vessel walls. The blood is markedly altered. Besides pronounced oligo-cythæmia—to 20 or 15 per cent. of the normal, with a proportionate reduction in the hemoglobin—the red corpuscles are much altered. Not only do they not form rouleaux, but they exhibit numerous microcytes and misshapen forms (poikilocytes) to a degree not exhibited in any other condition. The urine is usually pale, and deficient in normal pigment, but it has been found to contain iron and an excess of indican. Albuminuria is occasionally present. There is often marked pyrexia of irregular type.

Death occurs from exhaustion, being sometimes preceded by obstinate vomiting or by severe dyspnoea with irregular breathing of the Cheyne-Stokes type.

The *post-mortem appearances*—beyond the striking pallor of all the organs and an excess of thin limpid effusion in the serous sacs—are mainly those of fatty degeneration. This is seen to its best marked degree in the heart, of which the muscle is pale and the muscoli-papillares exhibit the "tabby-cat" striation due to extreme fatty change. Similar fatty patches are to be seen in the lining membrane of the aorta and other vessels. The spleen is mostly small and bloodless; in a few cases (which have been distinguished as splenic anæmia) it may be soft, swollen, and the Malpighian bodies prominent. The liver is rather large, and exhibits often undue pigmentation combined with fatty degeneration. Its excessive contents in iron have been already noted. The kidneys are pale but otherwise normal; the lungs pale and œdematous. Petechial hemorrhages may be seen beneath the pleura and pericardium, and in the substance of the liver and kidneys, as well as in the retinae.

The *treatment* of pernicious anæmia is not hopeful; yet undoubtedly there are cases which have presented all the symptoms of the disease, including even retinal hemorrhages, which have been apparently cured. It may often be doubted whether the cure is permanent, for it is not an unusual feature of the affection for a temporary improvement to take place. The signs of improvement consist not

only in the disappearance of pallor and of the subjective phenomena, but in the gain in corpuscular richness and fading of the hæmic bruits. Besides absolute rest in bed and the administration of easily digested foods (where there is vomiting and other dyspeptic signs the food should be peptonized), the most reliance is to be placed on the administration of arsenic. This remedy may be given as Fowler's solution or in a pill of arseniate of iron by the mouth, or by means of subcutaneous injection of the former. Arsenic is the only drug that has been known to have exerted any good effect, for iron almost invariably fails. A case has been recorded of idiopathic anæmia in the adult where iron succeeded after the failure of arsenic, but this is quite exceptional. In this respect pernicious anæmia contrasts with chlorosis. It constitutes the most notable difference between the two affections. Transfusion of blood or of saline fluid has been tried with variable result, the best results being those recorded by Quincke.

SIDNEY COUPLAND.

Symptomatic Indications.—The most important remedy in the treatment of anæmia is *arsenicum*, being especially valuable in idiopathic or progressive pernicious anæmia. It covers the rapid prostration, fear of death, and the great emaciation found in this disease. A particular indication for *arsenicum* is found in the intense thirst constantly present, but the patient drinks only in small quantities. Next to arsenicum *cinchona* is the most useful remedy, particularly in anæmia from loss of blood or other vital fluids. Excessive irritability of the nervous system. Following *cinchona ferrum* may be used, especially in weak and debilitated persons, in whom the least emotion or pain produces a red, flushed face; ashy pale or greenish color of the face. *Acidum phosphoricum* is indicated in anæmia from self-abuse or excessive sexual indulgence; there is usually debility without erithism; apathy, indifference. Anæmia from growing fast, with malnutrition and defective cell-growth is best treated with *calcareæ phosphorica*, which is also indicated in anæmia consequent on rapid child-bearing, prolonged suckling, or excessive menstruation. Anæmia, with disordered menstruation, points to *pulsatilla*. There is predominant chilliness, with melancholy and

weeping. *Helonias* may be required for general torpor, with great mental and physical depression; better while doing something.

Anæmia of chlorotic origin indicates *aconite*. The special symptoms are anxiety, with fear of death; predicts the day she will die. *Argentum nitricum* is somewhat more rarely indicated. It is valuable when the anæmia is the result of innutrition. There is shortness of breath, without heart or lung affection; sallowness rather than pallor of complexion. Patient can't think, can't talk, can't walk. Life seems too short; it seems to take hours for what takes but a few minutes.

ANÆSTHESIA.—Anæsthesia is artificially induced: 1. To prevent pain, as in ordinary surgical operations, and during labor. 2. To produce relaxation of muscles, as in reducing dislocations and herniæ, or setting fractured bones. 3. To assist in making a diagnosis, as in cases of obscure abdominal tumor and supposed malingering.

At one time it was thought that anæsthetics, especially chloroform, were inadmissible in cases of heart-disease; but the only affection of the heart which contra-indicates them is fatty degeneration, which is very difficult to diagnose. And if it be necessary for a patient with fatty disease to undergo an operation, he would be as likely to die of shock from the operation without an anæsthetic as from the anæsthetic properly administered.

Preparation of the patient.—Too much stress cannot be laid on the importance of having a patient properly prepared before an anæsthetic is given; this is, of course, out of the question in accidents or cases of emergency. If the bowels are not acting properly a purgative should be given a day or two beforehand; no food should be taken for four or five hours before the time fixed for operation; should this be early morning, it is best to give nothing after awakening unless the patient is in such a state as to require constant feeding, when a little beef-tea with some brandy or champagne may be given three hours before the operation. It is very important that the stomach be empty at the time an anæsthetic is taken, not only on account of the danger of some food being vomited into the pharynx and causing asphyxia, but also on account of the faintness

which accompanies vomiting. This syncope is generally most marked before the vomiting, after which it frequently passes off, though it may continue for some hours. Vomiting is almost sure to occur if the stomach contains food, and it sometimes occurs even when proper preparation has been made. In the former case it lasts much longer, and is accompanied by greater syncope, than in the latter.

The administrator should always be provided with a pair of forceps suitable for drawing out the tongue; ordinary dressing forceps answer the purpose admirably.

Artificial teeth should be removed, as in some cases, becoming detached during anæsthesia, they have fallen into the pharynx. No anæsthetic should ever be given except in the presence of a third person, for assistance may be required in restraining any struggling or in restoring animation; and because, owing to dreams which sometimes occur during anæsthesia, women have been induced to bring serious accusations against medical men which might easily have been disproved by a third person.

The patient should be in the recumbent position, and should wear none but light garments, which must be loose about the neck and abdomen. The head should not be much raised; as a rule one pillow is better than two, but if two are used, the lower one should be placed partly under the shoulders so as to make a gradual incline, and to prevent the head being tilted forward and thus obstructing the respiration.

The anæsthetics employed.—The anæsthetics commonly in use are nitrous oxide gas, ether, chloroform, and bichloride of methylene; nitrous oxide being suitable for short operations only, the choice for ordinary surgical cases rests between ether and chloroform or methylene.

Chloroform and ether.—Chloroform is regarded as superior to ether, in that, a less quantity being required, it is more portable and less expensive: its inhalation and influence are more agreeable and pleasant; its perfume is not unpleasant; its odor does not remain attached to the clothes of the attendant, or exhale in a disagreeable form from the lungs of the patient; no special kind of inhaler is required, and its action is more rapid and complete, and generally more persistent;

and it does not so greatly irritate the air passages. But ether possesses over chloroform one advantage so great as to more than turn the balance in its favor; for whereas ether stimulates, chloroform is apt to depress the heart's action. During the administration of chloroform there is sometimes very alarming syncope, which rarely occurs with ether; and it appears, from experiments on animals, that the heart may be paralyzed by the former and not by the latter. Then, again, the vomiting, which frequently accompanies the administration of an anæsthetic, as a rule lasts longer after chloroform than after ether.

When ether is not to be given.—Ether then seems to be the safer, and so should be used in all suitable cases; but, in the following cases, for the reasons mentioned below, ether is not recommended:

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| 1. Children. | 9. Obstructed respiration. |
| 2. Old people. | Laryngitis. |
| 3. Midwifery. | Bronchitis. |
| 4. Operations on mouth or nose. | Emphysema. |
| 5. Operations on the eye. | Phthisis. |
| 6. Ligature of large arteries. | Empyema. |
| 7. Abdominal section. | Patients under opium. |
| 8. Setting of fractures. | Advanced kidney disease. |

1. Children under ten or twelve years take chloroform well; but are readily asphyxiated by ether, and are frightened by the apparatus.

2. People over sixty or sixty-five years take chloroform well, with little, if any, struggling; but are greatly irritated by ether, especially if, as is frequently the case, there is a tendency to bronchitis.

3. As the first stages of the inhalation of ether are far more unpleasant than those of chloroform, and as these only are requisite during the pains of labor, chloroform, which is exceedingly well borne in these cases, is preferable.

4. As the influence of chloroform lasts longer than that of ether, it is preferable for operations on the mouth and nose. In these cases it also possesses other advantages, in that it may readily be given on a piece of lint, or better still, through a tube inserted into the mouth or nostril, without obstructing the operator; moreover, its administration is not so likely to be accompanied by coughing, it does not occasion such a flow of viscid saliva, and does not produce so much hemorrhage. These, in operations such as that for cleft palate, are important considerations.

5. In operations on the eye, chloroform may be given on lint without obstructing the light or impeding the operator's hands, as sometimes happens with an ether inhaler; and as its administration does not cause so much congestion and hemorrhage, it is generally preferred.

6. For the ligature of large arteries such as the subclavian, chloroform is preferable, because the veins are so distended during the administration of ether as to render the operation more difficult and more dangerous.

7. Some ovariologists are of opinion that ether, by causing much oozing of blood into the peritoneal cavity, adds to the danger of abdominal sections, and therefore prefer chloroform for these operations.

8. In cases of fracture, which require an anæsthetic while the parts are being placed in apposition during the time the muscles are relaxed, chloroform is preferable, because patients recover from its effects quietly, the inhalation of ether being sometimes followed by a state of delirium and struggling which would be likely to displace the fractured ends of the bone and necessitate their readjustment.

9. Patients who are suffering from difficulty in breathing from any cause whatever, and patients under the influence of opium, and those suffering from advanced kidney disease, not only take the ether badly, but its inhalation in some of these cases is likely to be followed by bronchitis or hemoptysis, in others by a drowsy state, in which the patient may gradually die.

Administration of chloroform.—The pure chloroform only should be used. No inhaler is better than a piece of lint about twelve by six inches, folded so as to form a square of about six inches, on to which the chloroform may be sprinkled from a small drop bottle. It is well to commence with about five drops of chloroform on the lint, which should be held about two inches from the patient's face, just to allow him to become accustomed to the vapor. In a few seconds, without removal of the lint, a little more chloroform may be added, and the lint turned so that the wet side may be toward the face. The quantity of chloroform sprinkled should be slightly increased each time. Care should be taken that the part of the lint which is wet with the chloro-

form does not touch the face, as it is apt to blister.

At first it is unadvisable for the patient to be held, but when excitement is produced he should be restrained sufficiently to allow the administration to be continued, and to prevent his doing any damage with his arms or legs; but it is not necessary, as a rule, to keep him absolutely still, for in most cases the greater the restraint the greater the struggling. Adults struggle most, and men more than women; the subjects of delirium tremens and drunkards always give great trouble during this stage; but in any case the struggling is least when the administration is regular and gradual. This being the most dangerous stage (the stage during which death is most likely to occur), demands in all cases the utmost care and attention. When an unusual amount of excitement occurs the administration should be continued unless the respiration be impeded, in which case it should be discontinued for a few inspirations. If a sufficient quantity of chloroform be not given at this period, either the struggling will be unnecessarily prolonged, or, some recovery from the effects having taken place, perhaps two or three of these stages will be induced in the one administration. While struggling the respiration is often very deep; care must, therefore, be taken that the vapor be not given too strong. The muscular excitement generally subsides gradually, and the patient passes into a state of slumber, with more or less snoring, after from five to seven minutes' inhalation. It is well to stop the administration for a few seconds as soon as the patient is under the influence, especially when there has been much struggling, because, owing to the cumulative property of chloroform, its effects often become more intense after its administration has ceased.

A patient is generally said to be ready for the operation to be commenced, when touching the inner border of the eyelids or ocular conjunctiva with the finger produces no reflex action. In some cases it is necessary that touching the cornea, which is far more sensitive than the conjunctival covering of the sclerotic, should produce no reflex. But the eye is by no means a certain test, as its sensibility varies so much in different people; and the patient cannot usually be said to be "ready" unless, in addition to loss of re-

flex action of the conjunctiva, there be also general relaxation and more or less snoring.

After induction, anæsthesia should be maintained by small quantities of chloroform frequently applied, rather than by larger amounts applied only on the re-appearance of reflex action. If at any time reflex action be observed, a small quantity of chloroform is sufficient to very soon produce a more profound anæsthesia; but a larger dose is both unnecessary and dangerous, on account of the deeper inspirations which accompany the other reflex movements.

During the struggling stage the pupil sometimes becomes a little dilated, but when fully under the influence it is slightly contracted, and acts with light. In very deep narcosis only—such as is sometimes necessary in operations on the more sensitive parts, as the eye, genitals, or anus—does it fail to act with light. Dilatation occurring during thorough narcosis should be regarded as a signal of danger, and the administration should be stopped. Lividity and extreme pallor of the face are each signals for stopping the administration.

The pulse often gives the first warning of approaching danger, and is, therefore, to be carefully watched from the beginning to the end of the administration; should it become feeble, irregular, or intermittent, the chloroform must be immediately stopped, and preparation made to apply restorative means.

With regard to the respiration, it is not sufficient to watch the chest walls and abdomen, the movements of which often continue when no air is entering the lungs; but it is necessary also to listen to the breathing, especially when there is any doubt as to its efficiency. Obstruction may take place in the bronchi, trachea, larynx, or pharynx, from blood or vomit. Most frequently it is in the pharynx, and is caused by the falling back of the tongue; or the approximation of the glottis to the back of the pharynx, from the head being tilted forward with the chin too near the sternum. It may generally be remedied by a change of position of the head, by drawing the chin forcibly from the sternum, or turning the face to one side to prevent the tongue falling back. If the obstruction be not at once removed by these means, there should be no delay in seizing the tongue

with forceps and dragging it out of the mouth, and sponging out the fauces; should this not have the desired effect, artificial respiration must be resorted to; and if the entrance of the air be still obstructed, tracheotomy must be performed without delay.

In some patients who are not able to breathe freely through the nostrils, it may be noticed that when under an anæsthetic the lips become pursed up, or flap together like a valve, entirely preventing the entrance of air; it is, of course, easily remedied by separating the lips, though the lividity produced by it has been known to cause alarm. Infants, after the completion of operation for hare-lips, very often are unable to breathe properly unless the lower lip be drawn down by the finger; they, therefore, require careful watching during recovery from chloroform.

The greatest danger which attends the administration of chloroform is *syncope*.

This may be produced by giving too large a percentage of chloroform to air, or by an overdose, or by shock from the operation. Shock is most often noticed when, in the operation for strabismus, the internal rectus is divided, the pulse sometimes intermitting and remaining feeble for some minutes. Syncope may also be caused by the loss of blood during the operation, or it may accompany vomiting.

When the face becomes pale and bedewed with a cold sweat, the pulse weak, slow, or irregular, and the respiration slow and shallow, no matter what the cause of these symptoms may be, the chloroform must be immediately stopped and the administrator must be prepared to apply restorative means. Sudden stoppage of the circulation and respiration have been said to occur simultaneously under chloroform without the slightest warning; but there is no doubt that, before stopping, the pulse often becomes more and more feeble and then imperceptible; the respiration for a few seconds continues and, becoming more and more shallow, ceases also.

The following directions for *restoring animation in cases of extreme syncope* will be found useful.

Seize the tongue with forceps and draw it forward. Compress the sternum forcibly, allowing the chest of its own elasticity to expand; do not wait for the respiration to cease before doing this, for by making

respiration forcible by artificial means in this early stage the heart may be stimulated.

The pillow should be removed from beneath the patient's head; and if, after two or three compressions of the chest, matters are improved by this treatment, continue it; if not, the patient should be suspended head downward, and the respiration continued by placing one hand on the back and the other on the sternum. There is no doubt that in practice Nélaton's method of total inversion of the body, combined with artificial respiration, is the most efficacious remedy for severe chloroform syncope. As a rule the pulse and respiration are immediately improved by this plan, and it frequently happens, when the patient is replaced in the recumbent position, that pulse and respiration again fail; it is advisable, therefore, to be prepared, if necessary, to invert the patient a second time.

The inversion of a heavy patient is not always practicable unless a chair or table (such as the Perfection), having the anæsthetic narcosis position, is used, which should always be the case when possible. Sylvester's method of artificial respiration has proved successful on many occasions. If this does not at once succeed, it, or Howard's plan, should be continued, and, if necessary, persevered with for half an hour, or as long as there is any hope of recovery. Ether may be injected subcutaneously. The faradic current may be applied, one pole to the epigastrium, the other to the right side of the neck, to try to induce the diaphragm to act. A hot-water bottle may be applied to the feet and friction to the legs; fresh air may be admitted by opening the windows and doors; warm blankets should be thrown over the patient, and an enema of brandy may be given.

Holding nitrite of amyl or ammonia to the nostrils, and dashing cold water on the face and chest, are remedies which may be useful for slight syncope, but are not to be relied on in the more alarming cases, when the administrator should not for one moment neglect the artificial respiration for any less efficacious remedy.

Bichloride of methylene, or **methylene**, as it is now called, is preferred to chloroform by Sir Spencer Wells, who thinks it is followed by less sickness. It is said by some to be merely a mixture of alcohol and chloroform, in the proportion of 1 to 4.

Its action is similar to that of chloroform, but it is much more expensive.

It may be given in a felt or leather mask; but the best inhaler is Junker's, which is equally suited for the administration of chloroform.

Junker's Inhaler consists of a graduated bottle capable of holding about two ozs., closed by an air-tight fitting top, through which two tubes are made to pass, a long one communicating with hand-bellows, and extending to the bottom of the bottle, and a short one commencing at the top of the bottle, and connected by a flexible tube with a vulcanite face-piece. In using the apparatus, about six drams of the anæsthetic should be poured into the bottle, which is to be hooked on to the administrator's coat (if more than six or seven drams be put in, some of the fluid is likely, on forcible pressure of the bellows, to overflow into the face-piece). The face-piece should be held quite lightly over the patient's face, and very gentle pressure of the bellows may be made at each inspiration. The quantity of the vapor is regulated by the frequency and amount of pressure on the bellows.

For maintaining anæsthesia throughout long operations on the mouth and nose, it will be found useful, after the induction, to substitute for the face-piece a flexible metallic tube or gum-elastic catheter, which may be inserted into the mouth or nostril; by this means anæsthesia may be kept up for an indefinite time without in any way obstructing the operator.

Administration of ether.—*The ether* which should be used for inhalation is that which in the Pharmacopœia is described as pure ether, sp. gr. 720; or, what is much cheaper, and apparently quite as good, is the anhydrous ether, made from methylated spirit. Owing to its very volatile and inflammable nature, care should be taken that a lighted candle be not held too near. It may be given in a towel folded into a conical shape, to fit the face, or in a felt or leather mask; but when used in this way it is very disagreeable, takes a long time to produce sleep, causes considerable excitement, is very extravagant, and saturates everyone in the room with its vapor.

The simplest and best way of giving it is either by Clover's or Ormsby's ether inhaler. The principle on which these two act, in making the respiration pass

to and from an india rubber bag over the ether, is the same, though the means employed differ. Clover's, which, though the more expensive, is generally preferred, contains fluid ether, and has a dial for regulating the amount of ether vapor; while Ormsby's contains a sponge, to be saturated with an ounce of ether, and has a valve for regulating the amount of air.

Clover's Ether Inhaler.—"The object of this instrument is to induce anæsthesia, in part by the diminution of oxygen respired, and to regulate the strength of the ether vapor, so that it may with certainty produce the degree of quietude wanted, and yet may not cause coughing or great difficulty of respiration."

The inhaler consists of a face-piece with an indicator, which by rotation may be made to point to O, 1, 2, 3, or F, on the circumference of the metallic vessel containing fluid ether; and of a bag, into and from which the patient breathes. It is so constructed that when the indicator is at O, the expired and inspired air passes to and from the bag, without in any way communicating with the ether chamber. If the indicator stand at F, the whole of the expired air must pass through the ether vessel to the bag, and at inspiration return from the bag through the ether vessel. When the indicator is at 2, half of the respired air passes to and from the bag direct; the other half passes through the ether vessel; and so on for the other numbers. The air does not pass through the ether, but simply through the vessel containing it, and this is sufficient to carry off a large amount of its vapor.

Not more than an ounce and a half of ether, or two-thirds of the quantity which the measure supplied with the instrument is capable of holding, should be poured into it, or some is likely to be splashed over on to the patient's face. With the indicator at O, the inhaler should be applied lightly to the patient's face; it should be raised a little during each inspiration, and held more firmly during expiration, until the bag is moderately distended, when it is no longer necessary to raise it. After a few respirations the ether vessel may be rotated so as to bring the indicator nearer to either of the figures 1. Let us suppose each of the intervals between O, 1, 2, etc., to be divided into six *spaces*. It will be found sufficient to rotate the vessel one *space* at a time. The rotation may be continued

during every second or third expiration, unless the patient show any signs of discomfort, when it is advisable to turn it back a little. The ether must be turned on very gradually to enable it to be freely inhaled. Allowance must be made for the degree of tolerance of the vapor which exists in different individuals; if the respirations are shallow, it is well not to increase the vapor so frequently as when they are full and forcible, which shows that no irritation is being produced.

Should the bag become empty, as often occurs if the face-piece be not applied sufficiently firmly during expiration, it should be raised for one inspiration and reapplied in time to catch the expiration. While the inhaler is applied to the face, there being no communication with the external atmosphere, the same air is respired over and over again, so that it is necessary to frequently remove it for an inspiration of fresh air. As a rule, while anæsthesia is being induced, an inspiration of air should be given every half-minute, and after it has been induced, every three or four inspirations from the inhaler should be followed by one of air.

If the patient at the commencement of the administration show any signs of intolerance (by swallowing, coughing, or endeavoring to remove the inhaler), it is advisable to admit one inspiration of air, and for a time give the vapor less strong; omission of this will give rise to struggling, which by the beginner is often mistaken for ether intoxication, which immediately precedes anæsthesia. It should be remembered, therefore, that struggling (which really ought not to occur at all with proper administration) may be from two causes requiring different treatment; that at the commencement is due to intolerance, and may be stopped by giving one inspiration of air, and then recommencing a more gradual administration; the other is due to intoxication, and may be cut short, after admitting one inspiration of air, by keeping the inhaler firmly applied, and increasing the vapor by rotating two *spaces* at a time instead of one. In warm weather it is rarely necessary to go much beyond figure 2, or in cold weather beyond figure 3. After two or three minutes, anæsthesia is complete. There is at first considerable congestion of the face, sometimes slight lividity, which soon passes off on admission of a little air.

The sensibility of the conjunctiva is impaired, but not destroyed.

The chief indication of complete anæsthesia is the deep snoring. There is sometimes a slight spasmodic twitching of the muscles, which is apt to lead the inexperienced to imagine that the patient is not fully under. By giving the vapor more strongly this twitching will be found to increase; but if, on its occurrence, air be admitted more frequently, these spasmodic movements will soon pass off. A very much smaller quantity of ether is required to maintain than to produce anæsthesia, and the longer it is continued, the less ether and the more air may be given. After about ten minutes another half-measure of ether will probably be required. Any disturbance of the pulse or respiration may generally be remedied by diminution or discontinuance of the vapor; the respiration may often be improved, during profound anæsthesia, by drawing the chin away from the sternum.

To avoid the discomfort of the commencement of the inhalation of ether, it is useful to begin with nitrous oxide gas. The addition to the above apparatus of a stopcock, to which may be attached a tube for the admission, and of a valve for the exit of the gas, will enable it to be used for this purpose. Better still is Clover's gas and ether inhaler, which may be used for gas or ether alone, or the two combined. Another plan is to begin with any gas apparatus, and then substitute a Clover's or Ormsby's ether inhaler. Or it may sometimes be found useful to use chloroform until the air passages become less sensitive.

Nitrous oxide gas is the safest anæsthetic to give, and the most pleasant to inhale. Its administration is never accompanied or followed by sickness, nausea, or headache, and it is not necessary to make much alteration in diet before or after its inhalation.

It may be obtained, compressed into the liquid form, in iron bottles of various sizes, those which contain fifty gallons being the most useful. As the label on each bottle shows its weight when full and when empty, the quantity contained in a bottle may at any time readily be ascertained by weighing it. The weight of fifty gallons is fifteen ounces, and this is generally sufficient for about ten administrations, so that on an average each

patient takes about five gallons by measure or an ounce and a half by weight.

For the successful administration of gas it is of the utmost importance to exclude all air: this is insured by a well-constructed apparatus with good valves, and above all things by a well-fitting face-piece. It is a good plan, especially with nervous patients, to allow them to breathe air through the face-piece before turning on the gas. After inhaling for about one minute the breathing becomes stertorous, the face congested, and there is total anæsthesia; but if the nature of the operation be such that the administration cannot be continued during its performance, it should not be commenced until after three or four stertorous inspirations. If continued beyond this without admission of air there is great lividity, spasmodic twitching of the muscles, dilatation of the pupils, and probably opisthotonos, and in women paralysis of the sphincter of the urethra.

In dental operations it is necessary, before commencing the administration, that a prop attached to a string be placed between teeth at a distance from those to be extracted, to keep the mouth wide open. In addition to this the administrator should be provided with a more powerful gag with which he can quickly open the mouth during anæsthesia, in case the prop from any cause be displaced.

Any difficulty with the respiration is generally at once relieved by one or two compressions of the chest. Faintness is best treated by the recumbent position, and ammonia or nitrite of amyl.

The A. C. E. Mixture.—To do away with the depressing effect of chloroform and the irritation of the air passages by ether, many combinations have been employed, the favorite being that commonly known by the name of the A. C. E. or 1. 2. 3. mixture, which consists of alcohol 1, chloroform 2, and ether 3 parts.

It must be borne in mind that this is merely a mechanical mixture, no new chemical compound being formed; and it is a mixture of liquids of different specific gravities, boiling points, and rates of volatility. It follows, therefore, that in its employment care must be taken (1) that it be quite fresh, (2) that no form of inhaler be used which will allow of the accumulation of the heavier fluids after the evaporation of the more volatile.

Treatment during recovery.—When a patient is recovering from anæsthesia, perfect quiet should be observed, in the hope that natural sleep may ensue, the awakening from which is more agreeable and less likely to be followed by sickness. Nothing, but perhaps small pieces of ice to suck, should be given for at least two hours, and then only a little soda-water and milk or a cup of tea; even when no vomiting has occurred, it may sometimes be induced by feeding too soon after recovery.

Local anæsthesia may be produced by cold, either by the application of a freezing mixture of ice and salt, or more perfectly by ether spray; but the objections to this are that frozen tissues are difficult to operate on, and that the thawing is sometimes accompanied by acute pain. Carbolic acid, painted on the surface of the skin, will diminish its sensibility sufficiently for opening a superficial abscess.

Muriate of cocaine in solution produces complete local anæsthesia of mucous surfaces. Two or three applications, at intervals of five minutes, will in about ten minutes produce local anæsthesia of the part to which it is applied, and lasts for a quarter of an hour. In ophthalmic surgery, for which it has been most successfully employed, a two per cent. solution is sufficient for the removal of foreign bodies, but for operating on the cornea a four per cent. solution is necessary. For operations on other mucous membranes, a ten or even a twenty per cent. solution is advisable.

Its action is unsatisfactory on inflamed tissues, they being apparently incapable of absorbing it. It has also been employed, but with varying success, subcutaneously injected.

JOSEPH MILLS.

Sensory Paralysis.—Sensation may be more or less impaired—hypæsthesia, or completely lost—anæsthesia. Generally it involves the whole thickness of the tissues of the part affected, but may be confined either to the skin or to the muscles. Anæsthesia may be gradually established, sensation becoming more and more impaired, or it may occur suddenly. When this condition exists, the patient is wholly insensible as regards tactile sensations, and may be pinched, pricked, cut or injured in any other way without being aware of it. In hypæsthesia the sense of touch is more

or less indistinct, and the patient feels as if a thick layer of some soft and yielding material, such as cotton-wool or flannel, intervened between the skin and anything brought into contact with it. This is especially noticed in connection with the hands and feet, when the patient grasps anything or stands. In this condition also, as well as during the development of anæsthesia, various unusual sensations or paræsthesiæ are often experienced, such as numbness, formication, tingling, or pins and needles. In some cases, even of complete anæsthesia to objective impressions, neuralgic pains of a subjective character are complained of in the affected part. It is a curious fact that in exceptional cases, although tactile sensation is lost, the power is retained of distinguishing differences in temperature, or of feeling painful impressions. Occasionally, in connection with marked hypæsthesia, the impression of anything brought into contact with the affected surface seems to be delayed in its passage to the nerve-center, so that it may be some seconds before the patient is conscious of it. There is often in this condition great difficulty in distinguishing different sensations from each other. With regard to muscular sensibility, when this is lost there is almost always loss of muscular contractility, but in exceptional instances this is unimpaired. In cases of cutaneous anæsthesia reflex irritability may be destroyed, normal, or increased, according to the cause of the loss of sensibility. The distribution of sensory paralysis presents the same variations as in the case of motor paralysis. Thus it may be: 1. General. 2. Unilateral—Hemianæsthesia. 3. Bilateral, but affecting only the legs and the lower part of the body. 4. Disseminated. 5. Local. The etiology of the two kinds of paralysis is also very similar, and it will only be necessary to allude briefly to the more frequent varieties of sensory paralysis, but it may be remarked that all forms are not uncommonly associated with functional diseases, especially hysteria.

1. Hemianæsthesia, when present, is usually the result of some cerebral lesion, but in a large number of cases of hemiplegia from this cause sensation is intact, or it may be impaired at first, but is speedily restored. Moreover, in cerebral hemianæsthesia sensation is not as a rule completely lost, or it may be retained in

certain parts, or the anæsthesia may be irregularly distributed. The lesion generally implicates the optic thalamus or the white substance in its immediate vicinity, but may be situated in the posterior portion of the cerebral convolutions. In rare instances hemianæsthesia results from disease of one lateral half of the spinal cord, the loss of sensation being on the side opposite the lesion.

2. Bilateral anæsthesia, involving the legs and the lower part of the body, is almost invariably associated with paraplegia, and is due to disease or injury of the spinal cord. Sensation is, however, more or less retained in many cases where the power of motion is completely lost.

3. Local anæsthesia is generally due to disease of some special nerve, or of its nucleus of origin, its seat varying accordingly. It might possibly be associated with localized disease affecting certain of the posterior convolutions of the brain. When a particular nerve is paralyzed, if it is a compound one, sensation and motion will be equally impaired. One of the best illustrations of paralysis of a purely sensory nerve is that of the superior maxillary, or of its continuation the infraorbital; sensation is then lost in the parts to which this nerve is distributed, and when the patient attempts to drink out of a glass or cup, a very curious feeling is experienced, as if the vessel was broken opposite the middle of the upper lip. Nutrition and secretion are frequently seriously interfered with when sensory nerves are paralyzed.

Treatment.—The general remarks made as to the treatment of paralysis of motion apply equally to that of sensation. Local warmth, friction, and electricity are often useful. The latter must not be resorted to for some time in cases of anæsthesia or hypæsthesia from cerebral causes, and even then only very cautiously; it does not lead to much improvement in most of these cases. Faradization with a brush acts best. Electricity is often very beneficial in various forms of sensory paralysis met with in hysteria, either faradization or Franklinic electricity being employed, the latter by directing sparks on to the affected parts; changing this part and then drawing sparks from it; or applying a small charge from a Leyden vial. If sensibility is lost locally from destruction of a nerve, no benefit can be anticipated from electricity. When motor and sen-

sory paralysis are combined, electrical treatment directed to the former may improve the latter at the same time. Particular care is necessary in cases of sensory paralysis as regards cleanliness and avoidance of pressure.

FREDERICK T. ROBERTS.

For *Symptomatic Indications* see PARALYSIS.

ANASARCA signifies the presence of serous fluid in the subcutaneous areolar tissues. When present throughout the body the person is said to have general anasarca, or if, as is probable in such circumstances, there is also effusion into the great serous cavities—*e. g.*, the peritoneum and picuræ—he is said to have general dropsy. The commonest cause of general anasarca is some form of nephritis, either acute or chronic, in which case it is generally first seen and is always most marked in those parts where the skin is very loose, as beneath the eyes and in the scrotum; but general anasarca may also be met with in cases of heart disease, when it commences in the most dependent parts of the body—in the legs if the person is up, in the lower part of the back if he is confined to bed. Chronic lung diseases are sometimes attended with anasarca; in such cases there will generally be found some dilatation of the heart. In anæmia, scurvy, and after long continued diarrhea in children anasarca is not infrequently seen, while sometimes no definite cause can be found. Various views are held as to the cause of the anasarca in renal disease: (1) That it is due to the impoverishment of the blood by the loss of albumen; (2) that the deficient excretion of water by the kidneys is the main fact in its production; (3) that the vessels of the skin and subcutaneous tissues become altered by the same cause which induces the disease of the kidneys. Further researches are necessary in order to determine the question. In heart disease it is, in great part at any rate, due to mechanical causes. A part affected with anasarca is always swollen; the skin is often tense and shiny, and always pits, on pressure, a condition for which the term *œdema* is now reserved. Local anasarca is generally mechanical and due to obstruction to the return of blood from the part affected. Phlegmasia alba dolens, the white leg seen after parturition, and in other condi-

tions, is the most common instance of local anasarca, and is due to thrombosis of the femoral vein. In gouty subjects patches of anasarca (local œdema) are not infrequently met with, and are probably due to some vasomotor disturbance, to which cause also may be attributed the swelling of the hands and feet seen in tetany and some other forms of nervous disease.

Symptomatic Indications.—Anasarca from cardiac disease is relieved by *arsenicum*, particularly when debility, emaciation, depression, and burning thirst are present. *Apis* is useful in anasarca when the disease is dependent upon kidney disease; absence of thirst and suddenness of the œdema are valuable indications. *Apocynum cann.* is useful in many forms, particularly when the urinary secretion is deficient. Anasarca following exhausting diseases or losses of vital fluids is met by *cinchona*.

ANEURISM.—An aneurism is a blood tumor communicating with an artery. Such a tumor may develop as the direct result of an injury (*traumatic aneurism*), or follow upon previous disease of the vessel wall (spontaneous or *idiopathic aneurism*). These two great classes of aneurisms differ very materially in their origin, their nature, and in their appropriate treatment.

I. Idiopathic or spontaneous aneurism.—*Ætiology.*—A spontaneous aneurism is formed when from any cause an artery permanently yields under the blood pressure to which it is subjected. Healthy arteries have such a reserve of resistance that simple increase of blood pressure from plethora, over-action of the heart, or resistance to the capillary circulation, never by itself causes aneurism. When, however, the resisting power of an artery is lessened, it may yield under the normal blood pressure, and still more readily if that is exaggerated. The causes of spontaneous aneurism are therefore to be grouped under two heads: (*a*) Conditions which weaken the arterial walls; (*b*) conditions which increase the arterial blood pressure. Of these the first is essential and the second only accessory.

a. Conditions weakening the arterial walls.—By far the most important of these is atheroma with fatty degeneration of the inflammatory products. The formation of calcareous plates in arteries

preserves them from aneurismal dilatation, although, as we shall see, such plates may sometimes be found in aneurisms.

Embolic arteritis.—The impaction of an embolus in an artery may excite inflammation of the vessel wall, and so soften the vessel as to make it yield under the pressure of the blood.

Loss of support by absorption of the surrounding tissues. Examples of this are chiefly met with in the branches of the pulmonary artery lying in the walls of phthisical cavities. In such cases, and particularly when the cavities are contracting, aneurisms not unfrequently develop, and their rupture is a frequent cause of fatal hæmoptysis.

b. Conditions increasing the blood pressure.—Of these the most important is *effort* or *strain*, particularly when sudden, intermittent, or unwonted.

Increased cardiac action, either from hypertrophy, or the stimulus of alcohol, or mental or moral excitement, is another similar condition.

Plethora and resistance in the arterioles also increase the arterial blood pressure. The mere maintenance of the power of the heart at its normal level in association with degeneration of arteries may be sufficient to produce aneurismal dilatation. The greater frequency of aneurism of the aorta than of any other artery is due to the greater pressure of the blood in this vessel.

II. Certain secondary causes must be further mentioned. *Age.*—Aneurism is most common between the ages of thirty and fifty; at the time when degenerative changes occur in arteries, and before the force of the heart is diminished, and when persons are still exposed to strains and injuries. When occurring in children and young adults, it is generally, perhaps always, the result of embolism. *Sex.*—Dissecting aneurism is more common in women than in men. Carotid aneurism is equally common in the two sexes; but other forms of aneurism are much (thirteen times) more common in men than women, because they are more exposed to the exciting causes of the disease.

Occupations which expose to sudden effort, such as that of soldiers and sailors, predispose to aneurism by the sudden increase of the blood pressure, and laborious occupations which constantly throw a strain upon the circulation predispose to atheroma. Thus it is that aneurism

is most common in cold and temperate regions, and especially in Great Britain.

Injury and strain.—A local injury not uncommonly precedes the development of an aneurism, for it may excite the inflammatory changes of atheroma, or burst an atheromatous abscess, or cause a partial rupture of the arterial coats and their consequent yielding. Strain acts in several ways: (1) By increasing the heart's action; (2) by increasing the capillary resistance in the muscles; (3) by stretching or compressing an artery, and so exciting atheroma in it, strains at the knee thus act upon the popliteal artery. *Alcoholism* causes aneurism by inducing atheroma and recurrent cardiac excitement.

Diathesis.—The extent of the influence of syphilis is doubtful (*see* ATHEROMA); that of gout and rheumatism is more certain; cachexy may predispose to atheroma, but to the extent to which it lessens the heart's power it protects from aneurism. Aneurisms are sometimes multiple, and the patient is then said to exhibit the "aneurismal diathesis." Such cases are, however, to be explained by the fact that the causes of aneurism are to a large extent general rather than local, and in view of this the frequent occurrence of one aneurism only is that which specially demands explanation.

Development.—When a given portion of an artery yields, the whole circumference of the tube may be affected, or merely some limited part of it. In the first case the vessel expands both longitudinally and laterally, generally in a more or less fusiform manner. All three coats of the artery yield; but dissection shows that, while the outer coat is stretched and thickened by newly formed fibrous tissue, and the inner coat is thickened and uneven from atheroma, the middle coat shows no similar change, but the muscular fibers are separated as the result of the stretching, and often undergo fatty degeneration. In such a case the whole circumference of the vessel is uniformly diseased, although in different parts it may show various degrees of atheroma, and calcareous plates may be found in places. As this uniform disease of arteries is mainly met with in the aorta and largest arteries, this form of aneurism, called tubular or fusiform, is met with there only. When any part of the wall of a fusiform aneurism is specially weakened,

it may yield quite out of proportion to the rest, and develop a sacculated aneurism; this combination of the two varieties is not uncommon in the aorta. Localized yielding of an artery is due to the weakening of the artery being limited to or much greater in one particular spot in the wall. This may be a patch of atheroma that has undergone fatty degeneration; the weakened part of the vessel yields and bulges externally, all the coats participating at first, as in "fusiform" aneurism. As the aneurism increases, however, the middle coat becomes more and more scanty in its walls, until it disappears, and after a time the internal coat ceases to expand, and then the sac is formed by the thickened adventitia only. In other cases the aneurism commences in an "atheromatous abscess" which bursts, or an "atheromatous ulcer." The part of the artery thus weakened yields and expands, but in this instance the intima, and most of the media, are absent from the sac, which resembles from the first the later stage of the previously described variety. As aneurisms grow, their wall is formed more and more of new fibrous tissue produced by inflammation of and around the sac, until at length none of the adventitia can be definitely detected. With yet further growth of the aneurism, the sac may be replaced in parts by surrounding tissues (muscles and bones) matted together, and even this may be overpassed, and a breach be made in it; such aneurisms have usually a more or less globular form; they are also possessed of a sac or wall which is more or less distinct from the artery from which they spring, and they are known as globular or sacculated aneurisms. In some cases, however, it happens that when an "atheromatous ulcer" forms, the arterial coats forming its floor and edge are not matted together, and the middle coat in particular is softened. The blood then finds its way in among the softened media, separating it into two layers, one adhering to the adventitia, and one to the intima; such an aneurism is called "dissecting."

CLASSIFICATION.

1. Fusiform aneurism.
2. Sacculated aneurism { *a.* Circumscribed.
 b. Diffused.
3. Dissecting aneurism.

A **fusiform aneurism** is one formed by the dilatation of the entire circumference of an artery, a dilatation both in length and breadth.

A **sacculated aneurism** is the result of the dilatation of a part only of the circumference of an artery. So long as the tumor is closed in by a wall or sac it is called *circumscribed*, but when the sac is incomplete, or the aneurism has ruptured, it is called *diffused*. Other terms in use are "*true*" and "*false*." By a "*true aneurism*" is meant one the sac of which is formed by all three coats of the artery; a "*false aneurism*" is one in which the sac is formed by a part of the coats of the vessel only, by newly formed fibrous tissue, or by condensed surrounding structures. The "*diffusion*" of an aneurism is better spoken of as its "*rupture*," and should be regarded as a complication or accident in the course of an aneurism.

A **dissecting aneurism** is one in which the blood is contained in a space between the coats of the artery; this may become "*diffuse*."

Where two of these forms of aneurism coexist it should be called a "*mixed aneurism*."

Fusiform Aneurism.—Fusiform aneurism is mostly met with in the arch of the aorta, but also occurs in any part of the aorta, innominate, carotid, or iliac arteries, and occasionally in the femoral and popliteal trunks. The shape and extent vary, and more than one such dilatation may be met with in the aorta. The sac is thicker than the healthy artery, and is formed by all three coats of the vessel; the inner surface of it is irregular, from atheroma; the adventitia is much thickened. The sac rarely contains any clot, and seldom undergoes spontaneous cure. The development and progress of this form of the disease are slow, and it may not give rise to any symptoms; on the other hand, it may cause death by pressure on important organs, such as the trachea and esophagus. The bruit in fusiform aneurism is often very loud and rough. Occasionally a softened patch in its wall may entirely give way, and the aneurism rupture; this is most liable to happen in the ascending aorta, the blood escaping into the pericardium.

Surgical treatment is not undertaken for this condition.

Sacculated Aneurism.—The sac.—At

first, when small, it may be simply a dilatation of a part of a vessel, but very quickly it is added to by new tissue, and is the combined result of growth and stretching. The development of new tissue takes place chiefly in the outer coat. Aneurisms of large size are never "*true*." "*True*" aneurisms are only met with in connection with large arteries; they are of small size, and being formed by the expansion of a large area of the vessel wall, have a wide communication with the artery; they can often be recognized by detecting atheromatous changes on the intima; in "*false*" aneurisms, where the intima and media are absent, atheromatous patches are never seen. In "*false*" aneurisms, the middle coat may be seen to terminate abruptly in a well-marked ring around the mouth of the tumor; the sac grows by fibrous tissue being formed on its outer surface, which more and more replaces the distended adventitia, until in large sacs there is little or none of the original vessel wall preserved. When the aneurism comes into contact with muscles, fasciæ, and bones, these are incorporated in the sac, being condensed and bound together by fibrous tissue.

Contents.—A part at least of the contents of all uncured aneurisms consists of ordinary arterial blood, which is found, post mortem, in the form of soft black clot. In most aneurisms a certain amount of clot is deposited during life, which is the resultant of two opposing forces, the tendency to coagulation on such an abnormal surface as the sac of an aneurism or a layer of fibrin, and the rapid movement of the blood; and as the one or the other preponderates differences are observed. The white corpuscles, however, have a tendency to adhere to the sac, inasmuch as it differs from normal intima; then they disintegrate and fibrin is deposited. Owing to the rapid motion of the blood, few, if any red corpuscles are entangled in the clot, which is, as it were, whipped out from the blood; the centrifugal pressure keeps the clot closely in contact with the inner surface of the sac. The process may then be repeated; white corpuscles adhere to the fibrin, disintegrate and excite still further coagulation, and a second layer of clot lines the first; and so the clot may grow; successive layers forming from the sac toward the vessel. The

fibrin is always deposited in layers, which are concentric, but no one of which will be found to line the whole of the sac. Such a clot is called *laminated fibrin, or clot*, and it is the *active clot* of Broca. Owing to variations in the shape of the sac, and in the position and size of its mouth, the condition of the blood in aneurisms varies in different cases; and when from any cause the flow of blood through the aneurism is slackened, red corpuscles become entangled in the meshes of the fibrin, and if the blood stagnates a clot like that formed by shed blood is produced; this is known as the *passive clot* of Broca. All degrees between the two extremes may be met with, and they cause variations in color and density of the clots. Fibrinous clots in aneurisms are not coated over with a layer of endothelium, as may occur in arteries or veins, and so they are ever-active causes of coagulation. These clots are extremely important, for three reasons: (1) by their gradual or rapid increase the aneurism may be permanently occluded; (2) they strengthen the sac and add greatly to the resistance it offers to the centrifugal force of the blood; (3) by partly filling up the aneurism they serve to lessen the pressure upon the sac, and therefore to diminish its rate of expansion; for by the law illustrated by the hydrostatic bellows, every diminution in the cavity of an aneurism greatly lessens the total pressure of the fluid upon its walls. The changes in the clots are also important. Laminated fibrin is very stable; by constant pressure it becomes dry and firm, and the leucocytes within it, or between its layers, undergo fatty degeneration. When the aneurism is cured it may be slowly absorbed, but it forms by its density rather an impediment to organization. When red corpuscles are inclosed they disintegrate and break down into dark granules. Soft or passive clot is, on the other hand, unstable; it may soften down, or it may "organize," or if compressed by the blood again entering the sac it may be flattened out into a thin layer, lining a fibrinous clot.

Effects.—The effects of an aneurism are partly those caused by the development and growth of a tumor (pressure effects) and partly those due to interference with the arterial circulation.

1. *Pressure effects.*—The first and

most constant result of the pressure of an aneurism is to excite inflammation in the immediately adjacent tissues; this thickens the outer part of the sac, and mats the tissues together; when more severe it is attended with all the signs of acute inflammation, and ends in suppuration. The reason why the growth of an aneurism has this effect so much more constantly than any other tumor, is to be found in the fact that the expansile pressure of an aneurism, especially when large, is of far greater intensity than even that of the most rapidly growing tumor. The tissues and structures adjacent to aneurisms are compressed, matted together, blended with the sac, and then "ulcerated" or removed by interstitial absorption. From their proximity to arteries, veins are very often compressed, and more or less obstruction is offered to the venous circulation, leading to cyanosis and œdema of the part beyond, and dilatation of the smaller veins. A vein may ultimately be obliterated, or its wall ulcerated and a communication opened between it and the aneurism. Similarly an aortic aneurism may form a communication with the pulmonary artery. Nerves are stretched and flattened out, causing neuralgic pain and spasms and paralysis of muscles. Bones are absorbed, being hollowed out or perforated, without any signs of inflammation in the bone around; this is most often seen in the sternum and spine. Cartilages, whether costal or intervertebral, have much greater power of resistance, and often are unaltered, when bone and fasciæ have disappeared. In certain situations special organs are compressed, as the esophagus, thoracic duct, trachea, or a bronchus.

2. *Effects on the circulation.*—(a) The force with which blood is propelled into an aneurismal sac is so much lost to the pressure with which the blood is propelled onward, for only a trifling amount is returned in the form of elastic recoil; this *loss of force* is the most constant and characteristic effect of an aneurism. As a direct result of it, we have the artery beyond less full of blood than it should be, and it therefore contracts, and the nourishment of the tissues supplied by it is *pro tanto* impaired. But nature, as it were, responds to the call of the impoverished tissues and partly filled arteries in two ways: (1) by hypertrophy of the left ventricle, and (2) by an enlargement of

the collateral arteries above the aneurism, so that blood is poured into the vessels below partly by the main trunk and partly by the anastomosing vessels. When the condition of the patient is such that compensatory hypertrophy of the heart cannot take place, and the anastomosing vessels are so diseased that they cannot dilate sufficiently, the impairment of nutrition of the tissues beyond an aneurism becomes marked. In many cases the cardiac hypertrophy associated with aneurism is to a large extent due to the general loss of elasticity of the diseased arteries.

(b) *Interruption of the pulse wave* by the dilatation of the artery causes the pulse in the vessels beyond to be delayed in time and lessened in force. A sphygmographic tracing of the pulse in the artery below shows a loss of the impulse and dicrotic waves, and a diminution of the force and rapidity of the tidal wave.

(c) *Obstruction to an artery* may occur in one of three ways: (1) the clot in the aneurism may extend into and block up the artery, or a portion of it may be broken off and carried into the artery as an embolus; (2) the mouth of a branch may be involved in the sac, and first stretched and then obliterated; (3) the sac of an aneurism may by its enlargement compress the vessel from which it springs. This occurrence is less well established than the two others.

(d) *Syncope* is a not infrequent effect of large aortic aneurisms; it may be caused (1) by the failure of the heart to overcome the great resistance offered by the blood in the enormously distended vessel, or (2) by the aneurism or a portion of clot obstructing the orifice of one or both coronary arteries, or (3) by the failure of the elastic recoil of the aorta to send blood into these vessels.

(e) *Gangrene* of parts beyond an aneurism may result from embolism, or from the more direct interference of the aneurism with the arterial supply to and the venous return from the tissues.

Course and terminations.—When the forces tending to enlarge an aneurism are exactly balanced by those tending to its cure it remains *stationary*, and this is occasionally observed even over a period of many years. More often this balance is not maintained, but the aneurism undergoes continuous enlargement or spontaneous cure.

1. *Spontaneous cure* may be brought about in one of three ways: (1) gradually, by a filling up of the sac with *laminated clot*; the clot may then extend into the artery and occlude it; this may happen (a) from the tendency to coagulation being in excess of the hindrances to it; it is favored by a uniform and not too strong action of the heart, and by development of the collateral vessels; (b) from the sac of the aneurism compressing the artery above its mouth, and lessening the force with which blood is sent to it (?); (c) from the development of an aneurism higher up on the same trunk, leading to a lessening of the force with which blood is sent into the lower. (2) Suddenly, by *embolism*. A portion of clot from the aneurism, or from one higher up on the same trunk, may be washed into the artery below and plug it; by the diversion of the circulation the blood pressure is so lessened in the aneurism that coagulation occurs. Or a portion of clot may lodge in the mouth of the aneurism and shut it off from the artery; the blood in the sac then coagulates. (3) *Plastic arteritis* may be excited by inflammation around the sac and seal the artery both above and below the tumor; this is a rare event.

2. *Spontaneous enlargement.*—The spontaneous growth of an aneurism may be fatal from its pressure effects or from syncope, as is often seen in thoracic aneurism; but if not it ends either in *rupture* or in *suppuration*, and these may be called its natural lethal terminations.

(1) *Rupture* results either from the aneurism extending through the skin or into some cavity of the body, or from the blood forcing its way through the sac into the surrounding tissues. If it burst externally, or into a serous or mucous cavity, fatal hemorrhage occurs, unless by some chance, as in the case of Liston, the orifice be effectually plugged with a clot; into a joint the hemorrhage is less extensive. The aperture through a serous or synovial membrane is a slit or stellate opening, and the hemorrhage through it is sudden and profuse; the aperture through a mucous surface is smaller, and often becomes blocked temporarily with clot, so that the hemorrhage is at first slight, is repeated, and is finally profuse; the aperture through skin is formed by the separation of a slough

of corium, and the hemorrhage is at once fatal unless controlled by surgical means. When the blood is extravasated into the tissues one of two results may follow : it may diffuse itself widely along the cellular tissue of the part, or after a certain amount has escaped from the sac it may coagulate, and the clot thus formed, together with the fasciæ and the products of the inflammation excited by the extravasated blood, may form another sac ; in such a case, this secondary sac usually quickly yields again ; these facts explain the variations met with in cases of *diffused aneurism*.

(2) *Suppuration*.—The inflammation excited by aneurism may become acute and end in suppuration of the tissues adjacent to the sac ; this is most often seen where, as in the axilla, the aneurism is surrounded by loose cellular tissue, and where a slow rupture of the sac has occurred. The pus thus formed tends to reach the surface and to burst externally like that of any acute abscess. Two special effects of the suppuration, however, must be noticed : (a) The sac is deprived of all nourishment conveyed to it by the vessels on its exterior ; it therefore sloughs ; this sloughing is the effect and not the cause of the surrounding suppuration ; (b) the inflammation extends along the sac to the artery and excites arteritis ; if this assumes the plastic form it seals the vessel, and when the sac separates the aneurism is quite cured ; but if it is suppurative such a closure of the vessel does not occur, and either before or after the abscess around the aneurism has burst, the artery opens into it and then fatal hemorrhage occurs. This latter is the more frequent event of the two.

Signs and diagnosis.—A. *Signs and diagnosis of an ordinary sacculated aneurism*.—The primary phenomenon is the presence of a *tumor* over and fixed to an artery ; it may vary in shape, but is usually more or less globular ; in size it ranges between that of a small nut and a cocoanut. If placed deeply or containing much clot it is firm, but if superficial, or containing little clot, it is softer, and may even fluctuate. This tumor *pulsates*, being expanded and rendered more tense with each beat of the heart. The force of the pulsation depends partly upon that of the cardiac contraction, but more upon the proxim-

ity of the aneurism to the heart, the size of the sac, and the amount of clot which lines it. It may be more marked in some situations than others, owing to irregularity in the thickness of the clot, but so long as the aneurism has a cavity into which blood is forced with each systole, the pulsation is of an *expansile character*. If the limb is depressed, the force of the pulsation and the tension of the aneurism may be noticed to be increased, while, if it is raised, both are diminished ; this is owing to the expansion and contraction of arteries which take place in dependent and raised limbs. If the main artery of the part is compressed above the aneurism, so as to arrest the arterial flow, the pulsation in the aneurism ceases, and the tumor shrinks and becomes less tense ; by gentle pressure the surgeon may then be able to empty the sac still more ; if now the finger is raised from the main artery the tumor rapidly fills out again, and in two or three beats resumes its former size and tension. This shrinking of the tumor when the circulation is arrested is due to the elastic recoil of the stretched sac and adjacent tissues, and the degree to which the tumor can be emptied is a measure of the amount of fluid blood it contains. Compression of an artery just beyond an aneurism is said to cause the tumor to become more tense. In nearly all cases of aneurism a *bruit* is heard on listening over the tumor ; it varies much in different cases, but is most often systolic in time and blowing in character ; it is heard equally well all over the tumor, and is not increased by moderate pressure ; occasionally it is diastolic as well as systolic. The bruit is due to vibrations caused by the blood rushing into or out of the aneurism, and churning in the sac ; it varies, therefore, with the position, size, and shape of the mouth, and the disposition of the sac and clot within it. The rush of blood into the aneurism may also cause a *thrill* in the sac with each heart-beat ; such a thrill is only felt over the tumor. The *pulse* in the artery below, when compared with that on the opposite side of the body, is delayed in time, and usually lessened in force ; sometimes it is absent, owing to obliteration of the artery.

The *veins* below the aneurism may be distended and varicose, and the subcutaneous tissue œdematous, owing to venous obstruction. *Muscular weakness* and *wasting* are frequently noticed, owing

to defective nutrition and to paralysis of the stretched nerves, similarly areas of the skin may be found *numb*. The *pain* of aneurism may be very severe, or only slight; it is of two kinds, a constant boring, aching, or burning pain, caused by the peri-aneurismal inflammation, the tension of the parts, and especially by the absorption of bone, and a sharp, lancinating pain, shooting down along the branches of compressed nerves. *Muscular spasm* and *paralysis* are due to irritation and destruction of motor nerves, and the most familiar instance of each is the dilatation of the pupil or paralysis of the vocal cord, from pressure upon the cervical sympathetic or the recurrent laryngeal nerve. The *heart* is usually hypertrophied, and the *arteries* are often found to be atheromatous. There is no means of distinguishing a "*true*" from a "*false*" aneurism without careful dissection.

B. *Signs and diagnosis of a cured aneurism*.—When an aneurism is undergoing the process of gradual occlusion with laminated clot, the tumor becomes smaller and harder, with less pulsation, its compressibility when the circulation is arrested diminishes, and the bruit and thrill are modified or lost. When the aneurism is completely occluded, but the artery on which it lies is still patent, the tumor has a heaving pulsation, is quite incompressible, and if a bruit be heard over it, it is increased in intensity by gentle pressure. The fixidity of such a tumor to the artery, and its previous condition when known, serve to distinguish it from a gland or other solid tumor over an artery. When the artery also is occluded, as usually happens, pulsation disappears, and the collaterals may be felt to be enlarged. When the cure takes place more rapidly it is often marked by a sudden pain in the part, a sudden failure in the circulation beyond, with abrupt cessation of the pulsation, bruit, and thrill in the tumor; this then quickly consolidates and gradually shrinks, while meanwhile the anastomotic vessels may be felt to enlarge, and the circulation beyond is restored.

C. *Signs and diagnosis of diffused aneurism*.—When subcutaneous rupture of an aneurism occurs, and the blood is freely extravasated in the cellular tissue, sudden pain, which may be very intense, is experienced, and the patient becomes

cold, pale, and faint; the parts about the aneurism become very greatly swelled, livid, and cold; the pulse is arrested in the arteries beyond, and these parts become œdematous, livid, and then gangrenous, from the effused blood entirely obstructing the venous circulation. In the more common cases, in which the rupture is less extensive, and the blood is, at any rate for a time, surrounded by dense tissues and blood clot, the patient experiences a sharp pain in the part, and becomes pallid and faint; the aneurismal tumor is found to have suddenly increased in size, but to have lost its distinct outline, the pulsation is lessened or lost, and the bruit and thrill are altered in character, diminished, or entirely lost. The coagulation of the effused blood makes the tumor harder than it was before. Such an aneurism extends rapidly, and when it reaches the skin it points, and often fluctuates before bursting, just like an abscess. The circulation in the parts below is more or less interfered with; the pulse in the arteries is usually still more weakened, and may be lost; the veins are distended, and the tissues œdematous; the pressure on the nerves makes the parts affected numb, heavy, and motionless. There are still other cases in which the "diffusion" is much slower, and that may be called "*leaking aneurisms*." They are characterized by continuous growth of the aneurism, together with diminished pulsation, indistinctness of outline, and an increase in the pressure signs. Such a tumor may at any time become more completely "diffused." These three varieties might be distinguished as "ruptured," "diffused," and "leaking" aneurisms.

D. *Signs and diagnosis of suppuration of an aneurism*.—Suppuration around an aneurism causes an increase in the swelling which obscures the outline of the tumor, the part is hot, red, painful, and tender, and pits readily on pressure, and there are also a high temperature and the other phenomena of marked pyrexia. When pus forms the swelling fluctuates and "points," and when it is evacuated, chocolate-colored pus, mixed with fibrinous coagula, are discharged, and subsequently free arterial hemorrhage may occur. If, before the abscess bursts, the artery opens into it, there will be a sudden increase of the swelling, with great increase in the force and superficiality of

the pulsations. The signs of "*suppuration*" and "*diffusion*" are closely alike; both are attended with increased swelling, diminished clearness of outline of the tumor, and lessened pulsation. In *diffusion*" the part is cold, and there is no fever; in "*suppuration*" there is fever, and the part is hot, while the circulation in the arteries beyond may be but little interfered with.

Treatment.—In treating an aneurism the surgeon endeavors, as far as possible, to imitate the natural cure of the disease, and to bring about the occlusion of the sac, with or without the adjoining portion of the artery, by blood clot. There are three known ways of doing this: (1) *by lessening the force of the circulation through the aneurism*; (2) *by increasing the coagulability of the blood*; (3) and *by directly causing the blood in the sac to coagulate*. In the large majority of cases the natural tendency to coagulation in an aneurism exerts itself as soon as the special hindrance to it (the rapid and forcible circulation) is removed. Coagulation can only be *excited* in an aneurism by local means; but direct interference with an aneurism is always dangerous, and is never to be resorted to when other measures succeed. On the other hand, the plasticity of the blood can only be increased by constitutional treatment, while the force of the circulation in an aneurism can be lessened by either constitutional or local means. It follows from this that the treatment of every case of aneurism must be first *constitutional*, and then *local*, for local measures are only resorted to as adjuvants of general measures, where the aneurism is so placed as to permit of it; in some cases constitutional treatment alone succeeds, and in many it is the only course open to the surgeon to adopt. Still more to emphasize the importance of the constitutional treatment of aneurism, and the necessity for carrying it out with scrupulous attention to all details, even where the local treatment of the disease is difficult and prolonged, I shall describe it first, and then deal with the varieties of local treatment, and I shall endeavor to view each in relation to the three possible factors in the artificial obliteration of an aneurism.

Constitutional treatment.—A. The first thing to aim at is to *reduce the arterial tension to a minimum, by lessen-*

ing the force of the heart, and by diminishing the total quantity of the blood.

1. *To lessen the force of the heart* the patient should be placed in the horizontal position, unless this be specially contra-indicated, and everything be done to insure his keeping at *perfect rest*; he should not be allowed to move, all his wants must be attended to by others, and he must be guarded against every source of mental and emotional excitement. In cases where the heart's action is unduly excited some benefit may be obtained by aconite or belladonna internally, or by wearing a belladonna plaster over the præcordia. Opium may be of considerable service in allaying physical and mental restlessness.

2. *To reduce the quantity of the blood* it is generally sufficient to place the patient on a very *restricted diet*, such as the following: 6 oz. of bread, 2 oz. of meat, a little butter, and 6 oz. of milk or water, *per diem*. When the patient is plethoric and the arterial tension very high, *repeated saline purges* or *venesection* may be resorted to. If a patient is already anæmic when he comes under treatment, of course no further reduction of the blood volume is required.

B. *To increase the plasticity of the blood* is the second aim of constitutional treatment, but so little is definitely known of hemapoiesis and the means of influencing it, that this branch of the subject is involved in uncertainty. It is believed that such a dry restricted diet as mentioned above increases the proportion of fibrin in the blood; with the same view, iron and a richly nitrogenous fare have been prescribed to anæmic patients. Iodide of potassium in full physiological doses has been much recommended; perhaps the relation of syphilis to aneurism has created some prejudice in its favor; its value is questionable. Acetate of lead has also been given to quiet the circulation and to modify the blood's composition, but its efficacy has not been demonstrated. The increase in the quantity of fibrin in blood must be distinguished from the readiness with which it coagulates.

Local treatment.—The simplest of all local treatments is to raise the part, if a limb, and to bandage it, applying gentle pressure over the tumor. By these means the arteries of the part are made to contract, the supply of blood to the aneurism

is lessened, the sac is supported, and the contractility of it and the surrounding tissues is favored. Unless there are special conditions of urgency, these local means, together with careful constitutional treatment, should in all cases be patiently tried before any more active measures are resorted to. The other local measures will be grouped into those modifying the circulation in the aneurism, and those exciting the coagulation of the blood.

A. To modify the circulation of the aneurism two procedures are adopted, the ligature and compression, each of which is susceptible of various modifications. The ligature, as the older method, will be considered first.

THE LIGATURE.

1. Double ligature.
2. Proximal ligature { *a.* Anel's method.
 b. Hunter's method.
3. Distal ligature { *c.* Brasdor's method.
 d. Wardrop's method.

This classification of the varieties of ligature is not only convenient, but expresses the order in which each method was introduced.

1. The double ligature is often known as the "old" operation for aneurism, or the operation of Antyllus. It consists in making a free incision into the sac, turning out all the coagula, introducing a probe into each end of the artery, and then cleaning and tying it, as well as any other branches opening out of the sac. Even when the part is previously rendered bloodless, the operation is one of extreme difficulty, and, before the introduction of the bloodless method, was so formidable that surgeons could rarely be prevailed upon to undertake it. The first danger of such an operation is *primary hemorrhage*. If that is obviated, the vessel is tied in a part of its course where it is certainly diseased, and where there is a serious risk of a *secondary hemorrhage*. Should the extensive wound suppurate, and this used to be invariable, *gangrene* is liable to ensue upon the obstruction to the venous return and the development of the anastomotic circulation thus produced. Owing also to the great success of other treatment, this operation is now only very rarely undertaken for spontaneous aneurism.

2. (a) Anel's operation is to apply a

ligature to the affected artery close above the aneurism, but without interfering with the sac itself. It has the serious disadvantage of operating upon a part of the vessel which is almost certainly diseased, and, in addition, the proximity of the wound to the aneurism is liable to excite inflammation in and around the sac. This operation is only done where the Hunterian operation is impracticable.

2. (b) Hunter's operation consists in ligaturing the affected artery at some distance on the cardiac side of the aneurism. It has two main advantages, in that a part of the artery tied is probably healthy or less diseased than close to the aneurism, and the sac is not directly interfered with. Very often branches arise from the artery between the ligature and the sac. This operation has been by far the most successful of any proposed for aneurism, and its details must be fully considered.

Effects.—The immediate effects of tightening the ligature is to occlude the artery, and to shut off the force of the heart from the aneurism. The blood in the aneurism may now at once coagulate. More often, however, when the anastomotic circulation is established, blood again flows through the artery and the aneurism, but either in a continuous current or with gentle pulsation only, and, under this influence, more and more coagulum is deposited within the tumor until it is quite filled, and then, as a rule, the clot projects into the artery and grows until it has obstructed it as far as the next branches above and below. When this is the case the aneurism gradually shrinks and is absorbed, and the artery is converted into a fibrous cord as if it had been ligatured. This second obstruction in the artery sometimes necessitates the development of a second series of anastomosing vessels from the artery between the two obstructions to the vessels beyond the aneurism. When the ligature is so placed that no large branch intervenes between it and the aneurism, the clot is continuous from one to the other, and only a single set of anastomosing vessels enlarge.

Symptoms.—At the moment of tightening the ligature the aneurism ceases to pulsate and shrinks; it may then quickly become firmer, and no change beyond that and its general shrinkage may be observed, until it disappears altogether.

Very often, in eighteen to thirty hours, when the anastomosing vessels are fully dilated, and the limb is warm, a faint pulsation or a trembling sensation is detected in the tumor, which may last for hours or days, and then pass off, or become permanent. At a later period also temporary pulsation may be observed. If the aneurism is occluded, and the artery patent, a heaving impulse is conveyed to it from the vessel.

Dangers.—The first danger attending this operation is *secondary hemorrhage* at the seat of ligature. The next danger is *gangrene*. We have already seen that an aneurism impedes the circulation in a limb or other part, and when to this impediment that of ligature of the main artery is added, and to that occlusion of the vessel at the seat of the aneurism, it is easy to understand how this danger arises. The gangrene is generally of the “moist” variety, for venous obstruction is a marked element in the case. A less common accident is *inflammation* and *suppuration* around the sac; this most often occurs in the axilla and groin, where aneurisms are not well supported, and in cases of very large sacs, or where the aneurism is becoming diffused. The causes that have been assigned are the handling to which the tumor is subjected before and after treatment, and the presence of large masses of fibrin in the sac.

Failure to cure the aneurism results, in a certain number of cases, from the anastomotic circulation being too free. This recurrent pulsation may come on about a day after the operation and persist, or about a month later, when the anastomotic circulation is thoroughly established. Occasionally a second aneurism develops in the site of one that has been cured, not from yielding of the aneurismal cicatrix, but from a second aneurism springing from the artery close to the original tumor. Another accident that sometimes happens is for the tumor to enlarge without any pulsation, the blood welling into the sac from the distal side, but flowing in without any pulsation.

Treatment.—Immediately after ligature, the limb, covered up with a thick layer of cotton-wool, should be slightly raised and supported evenly on pillows. Should pulsation recur the surgeon must have patience, as it will probably pass off; but if after some months the expansile pulsation continues, compression of the

main artery should be tried, combined with pressure upon the tumor, or, if the aneurism is in the ham, flexion is likely to succeed. If these means fail, the artery should, when practicable, be ligatured at a higher spot than before; but when this is impossible, as in carotid and axillary aneurisms, the sac must be laid open, and all the vessels opening into it tied. If after ligature the part beyond the aneurism swells, remains cold, and becomes livid, gangrene is threatened; should the aneurism be a large one, or diffused, the obstruction may be sufficiently relieved by laying open the tumor, removing the clots, and tying any bleeding vessels. If gangrene has set in there is no remedy but amputation above the aneurism. Where the sac suppurates the same alternative is present, *i. e.*, the “old” operation or amputation; the danger of the former is hemorrhage. Where hemorrhage has already occurred it is certainly safer to amputate at once; but when suppuration is only threatening an antiseptic incision might succeed in cutting short the inflammation; until the wound heals a tourniquet should be kept on the main artery ready to be screwed down at the first appearance of bleeding. A singular accident has been known to occur when catgut is used for the ligature: the gut has softened too soon, and the channel of the vessel has been at once restored; in such a case the operation must be repeated, the second ligature being tied close above the first.

3. (*c*) **Brasdor's distal ligature** consists in tying the diseased artery beyond the aneurism, as, for instance, where the upper end of the carotid artery is ligatured for an aneurism close to its origin. It resembles in its mode of action the plugging of an artery by an embolus washed out of an aneurism, and it depends for its success upon the diversion of the stream of blood into a collateral artery or arteries coming off on the cardiac side of the aneurism. Thus, in the case mentioned, the diversion of the blood into the subclavian artery so diminishes the pressure in the carotid artery that the vessel shrinks, and clotting occurs in the aneurism; coagulation may also extend directly from the ligature back to the aneurism.

3. (*d*) **Wardrop's operation** is a modification of Brasdor's, in which one or more of the branches coming off beyond

the aneurism are tied. In mode of action it is like Brasdor's, but, inasmuch as the diversion of the blood stream is less complete, and a current is still permitted to flow through the artery, its effects are less good. The distal ligature is only used where it is impossible to employ the proximal, and even in these cases the success attending it has not been great. In some cases, after a temporary improvement, the sac has rapidly enlarged, or has become inflamed and suppurated.

Compression.—Compression aims at curing an aneurism by the temporary interruption of the blood current through the main artery; with this exception, the principle of its action is closely like that of the ligature, and its varieties may be classified precisely like those of the ligature; for Reid's treatment and flexion resemble the double ligature, and simple compression of the artery may be proximal or distal.

1. **Digital compression** is placed first because it is the best means yet adopted for controlling the flow of blood through an artery. It is necessary that the vessel be not too deeply placed and be well supported by bone, so that the pressure of the thumb can readily control the circulation through it. Sufficient force is used just to stop all pulsation in the aneurism, but it is not necessary completely to occlude the artery, and still less is it right to use such force as to light up arteritis. The hand quickly wearies unless the muscles be relieved by resting upon the thumb a weight of about six to eight pounds; pressure can then be maintained for about half an hour; the need for relays of assistants to keep up the compression is the chief drawback to this treatment. Three men should be in attendance together, one compressing the artery, one with his hand on the aneurism to regulate the amount of compression, and the third resting and ready to relieve the compressor when tired. When the change is made care must be taken to have the artery controlled by the second man before the first removes his thumb. Attention to this not only protects the aneurism from a sudden return of pulsation in it, but it provides for a slight alteration in the part of the vessel compressed. The merits of digital pressure are, that it is *less painful* than instrumental, and, at the same time, it is *more exact*, for the pressure can, in many cases,

be brought to bear upon the artery alone without involving the companion vein and nerves; the force required can be *better regulated*; the thumb is also less liable to cause *galling of the skin* than any other compressor, and it can be applied to *certain situations* where instrumental compression cannot, *e. g.*, the common carotid artery.

2. **Instrumental compression** is carried out by various forms of tourniquets and compressors which replace the thumb more or less efficiently. The best are Carte's, in which the compressing force is elastic, and a simple weight. In using any form of instrumental compression three objects must be kept steadily in view: (1) So to adjust the instrument as to compress the artery only, and with not too much force; (2) to exert the pressure on two parts of the vessel alternately, using two instruments, one of which is adjusted before the other is raised; and (3) to prevent galling of the skin by shaving the part and applying French chalk, fuller's earth, or violet powder. Instrumental compression can be carried out by an intelligent nurse, or in some cases by the patient himself, and it can be applied to the abdominal arteries, where the pressure of the thumb is of no avail.

The *effects of compression* vary in different cases. When the blood still flows through the aneurism in a pulseless stream, the fibrin is whipped out of it, and is gradually deposited, layer by layer, slowly obliterating the tumor; but when the compression causes the blood to stagnate in the aneurism it may clot *en masse*, and quickly or suddenly occlude it. Between these extremes there are all grades of rapidity of cure, and of the extent to which the clot formed contains red corpuscles.

The difference between fibrin and blood clot is very important; while fibrin forms slowly, it is very persistent, and the cure thus brought about is permanent; on the other hand, blood clot quickly consolidates an aneurism, but is less resistant, being easily disintegrated by the force of the uncontrolled circulation, and, therefore, unless protected until it has consolidated and organization has commenced in it, the clot is apt to disappear. The rapidity with which the sac becomes pulseless and unyielding is the guide to the kind of clot that has filled it. As in all other modes of cure, obliteration of

the aneurism is in nearly all cases attended with occlusion of the adjoining portion of artery. When long continued, compression leads to the enlargement of the collateral arteries, and to adhesion of the artery to the vein and its sheath.

The *mode* of practicing compression may be varied considerably. Wherever possible it should be proximal rather than distal; the disadvantages of the latter being the same as of distal ligature. It may be continuous or interrupted; the former being by far the better where the patient can bear it, and arrangements for carrying it out can be made. Or digital compression may alternate with the use of a compressor, or the amount of compression may be diminished to allow the patient to sleep. Opium is often of use to keep the patient quiet, to dull his sensibilities, and to procure sleep; and when considerable pressure has to be used, especially for controlling the abdominal arteries, the patient may be kept under the influence of anæsthetics while the compression is applied.

The arrest of pulsation, and the consolidation of the tumor, are the signs that the treatment has succeeded. When this is noticed the compression is to be moderated, but still continued for about forty-eight hours. To discontinue it at once imperils the softer clot, and may entail failure.

Where compression fails, ligature may often be successfully practiced, but it influences the result of the operation in several ways. A ligature should never, if possible, be placed exactly where an artery has been subjected to long compression, on account of the matting together of the parts increasing the danger of injury or occluding the vein. The enlargement of the collaterals diminishes the risk of gangrene after ligature, but, at the same time, it lessens the prospect of cure, owing to the freedom with which blood at once enters the sac.

3. Flexion.—Aneurisms in the ham or at the bend of the elbow can often be rapidly cured by fully flexing the joint for several hours. By this means the sac of the aneurism is compressed, and the artery itself is occluded, partly by pressure, partly by the bend in its course. In this way the blood in the sac is left stagnant, and it may coagulate *en masse*. If the flexion is less acute, the flow of blood through the aneurism is only mod-

erated, and then the sac may be gradually filled with laminated fibrin. The limb should first of all be evenly bandaged from the fingers or toes as high as the joint; it should then be fully flexed and fixed by a bandage, a strap and buckle, or heavy sand-bags. Every twelve hours the flexion may be carefully lessened, so as to allow the surgeon to examine the part, and, as soon as the sac is found to be consolidated, it is to be protected from the full force of the blood either by moderate flexion or some form of compression of the artery above. This treatment has the merits of simplicity, safety, and rapidity, and it is attended with a minimum of discomfort. It is especially adapted to small slowly growing aneurisms, and should never be employed when the tumor is of large size, rapidly growing, or threatening to become diffused.

4. Esmarch's bandage (Reid's treatment) has been used to secure stasis of the blood in an aneurism and its coagulation *en masse*. The elastic bandage is usually applied firmly from the fingers or toes up to the tumor; it should then be carried lightly over the aneurism so as slightly to compress the sac, and perhaps also empty the companion vein, and then continue firmly for a short distance higher. It is better to leave the bandage on than to encircle the limb above it with the elastic cord and remove the bandage. The bandage should be left on for an hour and a half, and, before its removal, the main artery above should be compressed by the finger or tourniquet for twelve to forty-eight hours, to moderate the force of the blood in the artery. When successful, the stagnant blood coagulates in the aneurism under the influence of the sac or the fibrin lining it, and the clot extends into the adjoining portion of the artery. Here, if protected from the full force of the heart, it readily organizes and obliterates the vessel. In the aneurism the clot may be absorbed, or may organize, or may long remain as a dry, friable mass, these results depending upon the nature of the structure immediately surrounding it. This treatment may fail either because the blood does not coagulate at all, because the clot does not extend into the artery, or because the clot is disintegrated under the full force of the circulation. The advantages of the methods are its simplicity and rapid-

ity. Its disadvantages are, that it is so painful as usually to require anæsthesia during the application of the bandage; that it may modify the general blood pressure to a serious extent; that by causing rupture or thrombosis of the arteries around the sac, it may interfere with the anastomotic circulation and cause gangrene, and that it may rupture the sac. In many cases it has failed to cure, but it has not in any way lessened the prospect of success by the ligature.

Two other modes of applying compression require a brief notice. *Acupressure*, by means of a long, stout, curved needle, passed well beneath both artery and vein, and a pad fastened over the artery by a thread tied around the ends of the needle, has been suggested, but the plan has nothing whatever to recommend it. Dr. Dix has practiced *compression by a wire* passed beneath the artery as for its ligature; the ends of the wire are then passed out through the skin on one side of the wound, and about an inch apart; a piece of cork is laid over the artery, and the ends of the wire are twisted over it sufficiently tight to impede, but not to arrest, the flow of blood through it. If this degree of compression be insufficient, the wire can be tightened by inserting small plugs of wood beneath it. When the aneurism is consolidated the wire is untwisted, the ends straightened out, one of them cut short, and the remainder withdrawn. The advantages of the plan are that the wire can be placed anywhere in the course of the artery, that it does not obliterate the artery, and that the pressure on the vessel can be easily regulated; the disadvantages include those common to all cutting operations which expose large arteries.

B. To excite immediate coagulation in the aneurism.—The means used for this purpose are: *manipulation, introduction of foreign bodies, injections of coagulants, and galvano-puncture.*

(a) *Manipulation* was suggested by Sir Wm. Fergusson. His object was to displace the clot lining the sac into the mouth of the artery. The artery is compressed on the cardiac side, and then the sac is inverted by the thumbs until its contents are felt to be displaced. The method is very dangerous in aneurisms at the root of the neck, as fatal or serious embolism may occur; it is likely also to lead to rupture of the sac or to suppura-

tion around it. Much gentler manipulation, with the view of disarranging the laminated fibrin in a sac, and so of leading to more rapid coagulation, may be employed in conjunction with the ligature or compression, for aneurisms of the extremities.

(b) *Foreign bodies* such as iron wire, catgut, or horse-hair, have been introduced into the sac of an aneurism. The best material to employ is fine steel wire coiled small, and rendered aseptic by prolonged immersion in liquor potassæ, and then passed into the sac through a Southey's canula. This treatment is not generally viewed with favor, but one successful case and one other very encouraging one have recently occurred. *Acupuncture* needles passed into an aneurism and allowed to remain for a few days have succeeded in setting up coagulation in otherwise intractable cases.

(c) *Injection of coagulants*, such as perchloride of iron, has been practiced. It should never be undertaken unless the artery above and below is compressed during, and for some time after, the injection. Langenbeck has suggested the injection of a solution of ergotin around the sac with a view to excite contraction of the muscular fibers in its wall, but at present this treatment lacks both theoretical and practical sanction.

(d) *Galvano-puncture* is employed as follows: Two fine steel needles, carefully insulated to within one-third of an inch of their points, are introduced into the aneurism about one inch apart, having the whole of their bare points within the sac. They are then connected with the two poles of a constant-current battery, and the current of ten to twelve Leclanche cells is passed through them until some decided effect (hardening or diminished pulsation) is produced; the needles are then withdrawn, and the punctures sealed with collodion. When successful a firm clot is formed around the positive pole, consisting of fibrin, and coagulated albumen precipitated by the dissolved iron of the needle. Around the negative a soft, frothy clot is formed. The evolution of gas has been known to be so abundant as to render the percussion note resonant. The operation requires repetition. The current should be of low intensity, but of high tension, such as is obtained from several small cells.

These methods of inducing coagulation

by direct excitement are rarely, if ever, used in any but internal aneurisms, inaccessible to treatment by other surgical means. They are all dangerous from embolism and suppuration, and they often fail to cure. Galvano-puncture has, at present, had the greatest amount of success; acupuncture has proved useful, and has the merits of simplicity and comparative safety; manipulation and injection should be entirely abandoned; the improved method of introducing steel wire has been insufficiently tested; I recently saw it practiced, and practiced it myself in a case with imperfect, but yet very encouraging success.

AN ESTIMATE OF THE COMPARATIVE VALUE OF THE METHODS OF TREATMENT.—The old operation of the double ligature is rarely to be resorted to; it may be employed in embolic aneurism of the upper limb in young people, where the artery is healthy except just at the site of aneurism, in cases of recurrent pulsation, especially in aneurisms of the upper limb, and when, after ligature of the artery, the sac inflames and suppurates.

Direct coagulants are to be employed in *external aneurisms* only when other means have failed, and in conjunction with them; these cases are very rare.

Compression and ligature.—Wherever the surgeon has a choice, the proximal ligature or compression is to be preferred to the distal, and the pressure or ligature should be applied at some distance from the tumor. It will be well to compare the treatment by compression and the Hunterian ligature from several different points of view.

(a) *Effects on the artery.*—The ligature causes the permanent obliteration of the artery where it is tied, and the enlargement of anastomosing vessels above and below; it interrupts the direct and forcible flow of blood into the aneurism; it is attended with the danger of secondary hemorrhage, especially in the upper limb. Compression entails only a temporary obstruction of the artery, and it may be partial or complete, continuous, remittent, or intermittent, at the will of the surgeon. There is no danger of secondary hemorrhage.

(b) *Effects on the aneurism.*—These may or may not be precisely the same in the two cases. The ligature may so arrest the circulation as to cause clotting of the

entire quantity of blood in the aneurism, or the anastomotic circulation may be so free as to lead the blood to deposit layer upon layer of fibrin, as it tardily flows through the sac. The effects of compression depend not only upon the freedom of the anastomotic circulation, but also upon the completeness and persistency with which the flow through the artery is arrested.

(c) *Effects on the local circulation.*—The ligature usually entails the development of two sets of anastomosing vessels, *i. e.*, around the ligature and around the aneurism. Compression entails the development of one set of anastomosing channels only, that around the aneurism; and during the time that these vessels are called upon to carry on the circulation, the pressure upon the artery is relaxed or discontinued. Hence compression puts less strain upon the local circulation than the ligature, and does not expose the patient to the same risk of gangrene.

(d) *Effects on the general circulation.*—Compression, when not entirely obstructing the artery, or not continuous, does not tend to increase the general arterial tension, as the ligature may.

It is evident, therefore, that compression and ligature bring about the cure of aneurism in precisely the same way, and, roughly speaking, their effects are the same; but not only is compression free from all danger of hemorrhage and of gangrene, but it affords the surgeon the opportunity of regulating the effect upon the local or general circulation, in a way that is impossible when an artery is tied.

(e) *Safety.*—The introduction of aseptic ligatures which do not sever the vessel has reduced the danger of ligature very considerably. Could a fair comparison of statistics be made, it is probable that it would appear that the operation of ligature conducted with all proper precautions is only a little more dangerous than compression, the difference depending upon its greater liability to cause gangrene, and its more marked effect upon the general circulation.

(f) *Convenience.*—If my last statement is correct, the question of convenience of one or other method becomes important; here the balance is decidedly in favor of the ligature. Anæsthesia renders the operation of ligature painless, but there are undoubted disadvantages in keeping a

patient under the influence of ether, or in a stupor from morphia, for the many hours or longer that it may be necessary to employ compression.

(g) *Applicability*.—Compression of abdominal arteries is both difficult and dangerous, and in this situation the ligature is to be preferred, except in the case of the aorta. Where there is an internal aneurism present as well as an external, or the heart is incompetent from disease, the grave and continuous effects of a ligature may be fatal; whereas the slighter and temporary disturbance of moderate compression may be safely borne.

The conclusions we draw from all these considerations are as follows:

(1) Where there is any reason to fear that the effect of a ligature may embarrass the heart too much, cause the rupture or enlargement of an internal aneurism, or produce gangrene of the limb, moderated compression is to be employed.

(2) Where the artery affected is extensively diseased, compression is to be preferred.

(3) Where, in other cases, the patient is of an irritable or sensitive nature, and intolerant of restraint, or the aneurism is acute, of large size, rapidly growing, and full of fluid blood, and it is therefore necessary to obtain a rapid and marked effect, ligature is to be recommended.

(4) In other cases, in the absence of any of these special conditions, compression should first be tried, the effect being as closely as possible approximated to that of ligature; if it be not quickly successful, ligature should be practiced. Long-continued compression, when unsuccessful, diminishes the probable success of subsequent ligature.

Flexion is specially adapted for aneurisms of small size which contain some clot; it is a safe, simple, and rapid means of cure.

Esmarch's bandage should not be employed when there is evidence of considerable impediment to the circulation of a part, or in aneurisms of rapid growth, or where diffusion is threatened. It is ill-adapted for patients with disease of the heart or internal aneurism; in other circumstances it is a rapid and safe method of cure, if properly applied, and if the clot formed is carefully protected.

An inflamed aneurism is best treated by Hunterian ligature. The lessening of

the force of the blood in the sac, and of the supply of blood to the sac and surrounding tissues, may arrest the inflammation. If suppuration occurs, the danger of hemorrhage is lessened by the operation.

A suppurating aneurism should be freely opened, and if bleeding occurs, the limb should be amputated; if it does not, a tourniquet should be placed in position on the artery, and an attendant should always be at hand ready to screw it down should bleeding come on.

A diffused aneurism generally necessitates amputation. Where the escape of blood from the sac is slight and gradual (a mere leakage) Hunterian ligature is the best course, but at the first sign of gangrene the surgeon must be prepared to amputate.

Amputation is required in cases of gangrene, in diffused aneurism with threatened gangrene, in suppuration of an aneurism with hemorrhage; and in the case of an aneurism accidentally opened or complicated with disease of a bone or joint, the limb should be removed above the aneurism.

Dissecting aneurism.—This form of aneurism is more frequent in women than in men, and in cachectic than in robust persons. It occurs most often in the aorta, and may extend as far down as the femoral artery, or up to the bifurcation of the common carotid trunk. After extending a certain distance in the wall of the artery, the blood may burst through a softened patch of intima into the vessel again; or it may burst externally through the adventitia and become "diffused"; on the other hand, the passage of the blood may be arrested, the aneurism forming a kind of diverticulum in the artery; by projecting inward it may then seriously impede the passage of blood through the vessel. These cases are rarely diagnosed. At the time of their formation they cause a sudden severe pain shooting along the affected vessel, with enfeeblement of the pulse beyond, and syncope. There is no known treatment for this condition.

Traumatic aneurism. — *Ætiology.* — *Wound of an artery treated by inefficient compression.*—Arteries are often involved in stabs and punctured wounds, and the free arterial bleeding is arrested by a pad and bandage. If the pressure is sufficient and exact, the wound in the vessel

is closed by it and then cicatrizes. But if the pressure merely closes the wound in the skin and subjacent tissues, and allows blood still to flow from the artery, even in a small quantity, it collects about the wounded vessel and coagulates; around the coagulum lymph is thrown out, which organizes into fibro-cellular tissue and forms a sac; meanwhile fluid blood continues to force its way out of the artery and to expand the clot and sac, especially when all external pressure or support is removed. The aneurism thus originating has a sac of new formation, none of the coats of the artery participate in it, and as the tumor expands this sac not only stretches but grows; it is usually lined with blood clot or laminated fibrin. *The yielding of a cicatrix in an artery* is another but less common mode of origin; this occurs as a sequel to small wounds of large arteries, the cicatrix formed being unable to resist the pressure of the blood. *Wound of an artery by a fractured bone* may lead to the formation of an aneurism in the same way as a wound inflicted from without. *Subcutaneous rupture* of an artery, from severe strains or during the occurrence or reduction of a dislocation, may be followed by a circumscribed effusion of blood still communicating with the artery, and around which a more or less perfect sac may be developed by the matting together of parts or the organization of plastic lymph.

Varieties.—When the blood is encapsuled by a complete and distinct sac, the aneurism is called *circumscribed*. When, however, the sac is incomplete, the fluid blood being surrounded by little else than blood clot, which readily yields before the pressure of the circulation, it is called *diffused*. Where the escaped blood is freely diffused without any limitation at all either by sac or clot, it is best described as a case of *ruptured artery*, and not as an aneurism at all.

Terminations.—The aneurism may undergo *spontaneous cure* by the gradual coagulation of the blood in the sac; this tendency is more marked in traumatic than in idiopathic aneurism, the healthy state of the heart and arteries accounting in some measure for this fact. The aneurism may steadily grow, and then may cause *suppuration*; or it may *burst externally*, or the sac may rupture and the blood be extravasated in the part, and

cause *gangrene* by suppressing the vessels, and arresting the circulation in the parts beyond.

Signs.—Aneurisms formed by subcutaneous rupture are most common in the ham and the axilla; those following wounds are common in the scalp, hand, and foot. The signs of a *circumscribed traumatic aneurism* are like those of a sacculated aneurism, but, in addition, a scar in the skin or a distinct history of injury points to the nature of the case. The signs of a *diffused traumatic aneurism* are less definite. A swelling occurs in connection with an injury, situated over an artery, its outline is ill-defined; this swelling steadily, perhaps rapidly, increases and becomes tense, the skin over it being stretched and blue. There may be no pulsation in it, or only a feeble throb; a bruit is generally to be detected, and often a more or less distinct vibratory tremor or thrill. In the arteries beyond the swelling the pulse is weak or absent, the tissues become œdematous, and the surface is cold, benumbed, and feels heavy to the patient, who complains of more or less severe pain; the swelling may be so great as to prevent altogether an examination of the pulse. The pain is generally markedly relieved by proximal compression of the main artery of the part.

Treatment.—It is important to remember that many traumatic aneurisms undergo spontaneous cure, and, therefore, in the absence of special indications demanding instant operation, it is well to wait to see how far nature is able to cope with the case. For *circumscribed traumatic aneurism*, in addition to the general treatment already described, the part should be raised and direct pressure made upon the sac, either by the hand or by a pad and bandage. When this does not succeed, Esmarch's bandage (or, if at the knee or elbow, flexion) should be tried. Failing these means, the surgeon has a choice between the double ligature, proximal compression, or ligature. Where the aneurism and the artery from which it springs are superficial, the double ligature is not a very difficult operation, and if the vessel is healthy it is not dangerous. Where the aneurism is deep the operation is very difficult, and proximal compression or ligature should be practiced. The ligature is often preferred to compression on

account of its greater simplicity, and especially when the artery is healthy. Where *aneurism complicates fracture* the pressure of the splints and bandages used for the fracture generally suffices to cure the aneurism; if not, the main artery above should be compressed. In these cases the union of the fracture is generally delayed. For *diffused traumatic aneurism* the only satisfactory treatment is the double ligature of the wounded artery. This operation is one of considerable difficulty and danger from hemorrhage. When it is evident that the extravasation is rapidly extending, or gangrene threatens, no time should be lost; but where the tumor is not enlarging so fast, and the circulation is not dangerously interfered with, it is best to wait, with the hope that a sac may form around the blood clot, and that then the Hunterian ligature may be practiced with success.

Arterio-venous aneurism.—An abnormal communication between an artery and a vein constitutes an arterio-venous aneurism. When the artery and vein are adherent together, and the blood passes directly from the one to the other, the condition is known as *aneurismal varix*, because the essential feature of the case is an aneurism-like dilatation of the vein. When, however, between the two vessels an aneurism is developed, which communicates with both, the condition is known as a *varicose aneurism*, the existence of the aneurism being the most important fact.

Aneurismal varix.—*Ætiology.*—A direct communication between a vein and an artery may be congenital, more often it is traumatic, rarely is it idiopathic in origin. The common cause is a simultaneous wound of an artery and vein, as in careless phlebotomy, stabs, gunshot wounds, etc. The edges of the adjacent wounds in the vessels adhere, and then blood passes directly from the artery to the vein. It may be that there is a single wound in each vessel from a stab; more commonly the vein is pierced by a lancet in two places, then the superficial wound heals up, and the deep one adheres to that in the artery. A remarkable case is recorded in which the median basilic vein, one of the humeral veins, and the brachial artery, were simultaneously wounded; the result was that the brachial artery and vein adhered together, and the brachial and median

basilic veins, so that the blood passed from the artery first into its companion vein, and then into the superficial vein. More rarely a communication between adjacent vessels occurs spontaneously; in one case it was the result of long-continued compression of the femoral artery in the groin. In the days of bleeding this affection was much more common at the bend of the elbow; it has been observed in the neck, skull, axilla, abdomen, and thigh.

Pathology.—Whatever the original shape of the aperture between the two vessels, it soon becomes rounded, smooth, and thickened. The vein is thickened and dilated into a globular or fusiform pouch, and the dilatation spreads in both directions, affecting not only the trunk, but the collateral branches as well; below the wound the dilated veins are tortuous and pouched, above they are simply enlarged. The artery for some distance above is dilated, and its walls are thinned; below it is sometimes narrowed, but at others dilated; the dilatation is said not to affect the branches of the artery. The interior of the venous pouch may exhibit atheromatous changes. The blood pressure being much greater in the artery than the vein, blood is forced into the vein; this first dilates the vein opposite the aperture between the two, then causes obstruction to the return of blood through the vein, and dilatation of its branches below, and the vein above enlarges to accommodate the greater amount of blood returning to the heart.

Signs and Diagnosis.—The first sign is the presence of a soft, compressible, often ill-defined, tumor in the course of a vein, into which dilated veins can be traced both above and below. The tumor is the seat of forcible expansile pulsation, a very loud continuous rasping, purring, hissing or rushing bruit, and a continuous vibratory thrill. On raising the limb the tumor shrinks and the pulsation lessens; on depressing it the size of the tumor and the force of the pulsation increase. When the artery above is compressed, not only does the tumor lose its pulsation, but it shrinks and disappears. The pulsation, bruit, and thrill are most intense just opposite the opening between the two vessels, and there the bruit and thrill are continuous, but increase with each beat of the heart; if traced for some distance along the dilated veins in both

directions, they grow feebler and lose their continuous character and become intermittent. The bruit may be audible to the patient himself or even to bystanders. The dilated condition of the artery is at times very apparent. The limb below may be œdematous, cold, with feeble pulse; but in some cases the skin is hotter, and the part is hypertrophied; obstinate ulcers with a tendency to bleed sometimes occur. The patient may suffer acute pain in the tumor, or only a sense of numbness and weakness in the limb below. It is often noticed that the symptoms increase up to a certain point and then remain stationary. A scar over the swelling generally points to the nature of the case.

Treatment.—As a rule it suffices to apply some form of external support to the part, *i. e.*, a bandage or an elastic stocking. Should more active measures be required, the artery should be tied above and below the communication with the vein.

Varicose aneurism.—*Ætiology.*—This form of aneurism may be *idiopathic or traumatic*. In the former case a spontaneous aneurism opens into an adjacent vein; this has been observed in the thorax, abdomen, and groin. A simultaneous injury of an artery and vein is a more common cause. In place of the wounds in the two vessels being sealed up, or cohering together, a circumscribed aneurism develops between them, communicating with both; this most often happens in careless phlebotomy, stabs, or gunshot injuries. An aneurismal varix may develop into a varicose aneurism by the gradual yielding of the cicatrix uniting the two vessels.

Pathology.—The mode of production is that of circumscribed traumatic aneurism from a wounded artery with the addition of a wound in a vein. The relative position of the arterial and venous openings in the sac varies much; a case is recorded where two veins communicated with an aneurism, there being four venous openings in the sac. A more interesting case is one in which the deep wound in a transposed vein cohered to that in an artery, the superficial wound in the vein did not heal up, and the blood escaping from it formed an aneurismal tumor; the blood then flowed from the artery through the vein into the aneurism. The changes in the veins are like those in

aneurismal varix. Traumatic varicose aneurisms are usually of small size, and their sacs may contain very little, if any, fibrin, owing to the direct passage of blood through them. The venous communication may be shut off, and the case reduced to one of simple aneurism; spontaneous cure is very rare; on the other hand, the aneurism may steadily enlarge and rupture.

Signs and diagnosis.—The signs of a communication between an artery and a vein are the same as in aneurismal varix. In addition to the phenomena of that disease there are certain others. It may be possible to distinguish two tumors or two parts of one tumor, one formed by the dilated vein, soft and easily compressible, the other firmer, formed by the aneurism; this is rendered clearer if, when the artery above is compressed, the dilated vein collapses, but the aneurism can be felt as a distinct tumor. In addition to a continuous loud bruit, a systolic soft blowing aneurismal murmur may be detected. By careful examination it may be discovered that pressure on a certain point stops the thrill and the loud rasping bruit without arresting the pulsation in the aneurism itself. All these special signs point to the existence of an aneurism in addition to the arterio-venous communication. In other cases the existence of an aneurism is known, and the communication of it with a vein is recognized by the marked venous dilatation, not merely below the tumor, but over and above it; by the very marked thrill and pulsation in the veins, and by the peculiar character of the bruit that is developed.

Treatment.—For traumatic varicose aneurism, in addition to constitutional measures, direct pressure may be tried. If that fail, the treatment by Esmarch's bandage should be tried; if this does not succeed, the surgeon may try compression of the artery combined with digital pressure over the communication between the sac and the vein; and, as a last resource, a double ligature should be placed on the artery. To do this the limb is rendered bloodless, and the dilated vein is laid open; from that the surgeon lays open the sac of the aneurism, and then in the wall of this second cavity he will see the opening of the artery, and must tie the vessel above and below it.

SPECIAL ANEURISMS :

Aneurism of the aorta.—All varieties of spontaneous aneurism have been met with in the aorta, where the disease is more frequent than in any other artery.

Any part of the aorta may be implicated; aneurism is most common in the arch, especially in the ascending portion, and least common in the abdominal aorta. It is not uncommon to find a combination of fusiform and sacculated aneurism, and very rarely more than one aortic aneurism may be found. Below the diaphragm the favorite seats are opposite the celiac axis, and at the bifurcation. In the arch the tumor most often projects from the convex side, but it may spring from any part, and the aneurism may grow forward or backward, inward, outward, or upward.

Diagnosis of aneurisms at the root of the neck.—The surgeon having arrived at the conclusion that a given tumor at the root of the neck is an aneurism, must further determine from what artery it springs.

1. *Apparent origin.*—An *aortic aneurism* may sometimes be detected within the chest before it appears at the root of the neck; when this is not the case its first appearance in the neck may exactly resemble that of an innominate or carotid aneurism; an aneurism of the second part of the arch may project immediately above the episternal notch. An *innominate aneurism* first appears behind and above the inner end of the clavicle, and fills up the hollow between the two heads of the sterno-mastoid muscle. A *carotid aneurism* bulges forward beneath the inner head of the sterno-mastoid. A *subclavian aneurism* appears first in the posterior triangle, or beneath the outer head of the sterno-mastoid.

2. *Direction of growth.*—An *aortic aneurism* may extend in any direction; the detection of a considerable tumor within the thorax renders the diagnosis clear. An *innominate aneurism* may be of a globular shape and project forward, or it may extend along either of its branches. A *carotid aneurism* grows up the neck along the sterno-mastoid, while a *subclavian aneurism* usually extends horizontally along the upper border of the clavicle.

3. *Limits.*—No lower limit can ever be felt to an *aortic innominate aneurism*,

but the finger can often be dipped down below a *carotid* aneurism, or to the inner side of a *subclavian* tumor.

4. *Pressure effects.*—The pressure signs are closely similar in the different cases. Pressure upon the left recurrent laryngeal nerve would distinguish an aortic aneurism from one situated on the right vessels; pressure on the right nerve in a similar manner excludes an aortic aneurism. Pressure on the left innominate vein indicates aortic aneurism rather than innominate; compression of the internal jugular or subclavian vein only, points to carotid or subclavian aneurism.

5. *The pulse* in the branches of the great arteries is perhaps the most useful sign of all. Where the pulse in the two radial arteries is exactly similar, it shows that the aneurism is situated on the first part of the arch, and in such a case we should expect to find the dicrotic wave lost. But if the left radial pulse is aneurismal and the right is normal, it would point to an aneurism of the transverse part of the arch beyond the origin of the innominate trunk, or of the left subclavian, and the condition of the pulse in the branches of the left carotid artery would determine this. When the right radial and carotid pulses are aneurismal, and the left are normal, it indicates an innominate aneurism; where, of these, only one is aneurismal, it shows an aneurism of the corresponding branch of the innominate artery only. It must be remembered that the pulse may be lost in an artery by the sac of an aneurism of a neighboring trunk compressing it, or occluding it by displacement or by a plug of clot. The special characters of the "aneurismal pulse," and not the loss of pulsation, are the guide to the seat of an aneurism.

Aneurisms of the innominate artery are always *spontaneous*. They may be either fusiform or sacculated, and may affect the origin, the center, the termination, or the whole length of the artery. Aneurism of the origin of the artery is always associated with dilatation of the arch of the aorta. The tumor may extend forward, bulging the sternum, clavicle, and first rib; or upward into the neck over the carotid artery, where it has reached as high as the cricoid cartilage; or backward and inward toward the trachea and spine, or outward along the subclavian artery; or pouches of the sac may

extend in several or all of these directions; growth outward is most common. The tumor is usually first observed behind the sternal origin of the sternomastoid, and as it grows it displaces this muscle, or the sternum and clavicle, or the trachea. It may not project at all, but merely give rise to dullness over the sternum and beneath the inner end of the clavicle. There may be no bruit, but on auscultating the tumor the heart's sounds are heard with extreme distinctness. The special symptoms are an alteration of the pulse in the radial artery and the branches of the external carotid; dyspnœa and alteration in the voice from pressure upon the recurrent laryngeal nerve or the trachea, or both; dysphagia from pressure upon the esophagus; and cyanosis and œdema of the right hand and arm, and of the right side of the face, and neck, from pressure upon the innominate vein; the œdema may extend to the whole of the head and face. The patient often experiences pain down the arm and weakness in it, from pressure upon the brachial plexus, and also shooting pains in the neck and head from irritation of the superficial cervical plexus. Pressure upon the sympathetic nerve may cause permanent dilatation of the arteries of the same side of the hand and face, with abundant sweating. Spontaneous cure has been noted in one case only; the disease tends to cause death by asphyxia from pressure, or by bursting either externally or into the trachea, esophagus, or lung.

Treatment.—Careful constitutional treatment should first be well tried, and digital compression of the carotid artery may be combined with it. When these means fail, the simultaneous ligature of the common carotid and subclavian arteries should be practiced. It is not enough to tie one of these trunks, because the free current of blood still flowing through the parent vessel would prevent its success; even when both are tied, the flow of blood to the branches of the subclavian may be sufficient to prevent obliteration of the sac. Should the size of the aneurism prevent the ligature of one or both of these arteries, or the operation fail to cure, the careful introduction of steel wire into the sac, and galvanopuncture, are the only other means at the disposal of the surgeon.

Carotid Aneurisms.—**Spontaneous an-**

eurism of the common carotid artery.—Its most common seat is at the bifurcation of the trunk; next in frequency, it occurs at the origin of the right artery but never at the aortic end of the left artery. Commencing as a small tumor, the aneurism may grow very slowly and remain unaltered for years; or it may attain a large size, filling up the neck from the chin to the sternum. In addition to the usual signs of aneurism there may be great dyspnœa, with frequent spasmodic cough, which may end in asphyxia; hoarseness and loss of voice, dysphagia, tinnitus aurum, dimness or loss of sight, giddiness, stupor, hyperæsthesia of the scalp, and a sense of pulsation referred to the whole of the same side of the head. These symptoms are the result of compression of the larynx, trachea, pharynx, esophagus, jugular vein and recurrent laryngeal nerve, or of interference with the blood supply to the brain. The aneurism may undergo spontaneous cure, but much more often it ruptures externally or into the trachea, pharynx, or esophagus, with rapidly fatal hemorrhage.

The *diagnosis* of carotid aneurism often presents great difficulties, but careful attention to the points mentioned above will prevent mistake. *Tumors of the thyroid gland* are distinguished by their rising and falling with the trachea in deglutition, by their fixedness on their inner side, often by the implication of the isthmus, and by their mobility over the carotid artery. *Glandular tumors* are globular, ovoid, or lobulated in outline; often multiple, generally incompressible and freely movable away from the artery. When the artery passes through the middle of the tumor it may be somewhat compressible, and is not movable over the vessel; but in such a case the outline of the swelling, its history, and the presence of other enlarged glands, and of some obvious cause for the swelling, one or all, clear up the diagnosis. *Abscess* over the artery is distinguished by the usual signs of inflammation, by obvious fluctuation, and by the irreducibility of the swelling when the artery is compressed below. When the artery has opened into an abscess cavity, the signs of inflammation and the absence of the clearly defined outline of the swelling are the chief points in the diagnosis. *Varix* of the internal jugular vein is a soft, compressible tumor, which shrinks during deep inspiration,

and becomes fuller when expiratory efforts are made; the pulsation in it is not truly expansile. Other *solid tumors*, fatty or sarcomatous, must be distinguished by their outline, mode of growth, mobility from the artery, and incompressibility.

Treatment.—Digital compression of the artery below the aneurism has been successful in many cases, and should be tried wherever practicable; if possible the artery should be controlled without pressure upon the vagus nerve. Ligature of the artery, either below or above the tumor, is the other chief means of cure, the proximal ligature being preferred in all cases where there is room to apply the thread between the tumor and the sternum. Manipulation, and the introduction of foreign bodies, should not be employed; the danger of cerebral embolism is too great. Suppuration of the sac is liable to follow ligature of the artery; the pus should be evacuated by an early incision, and if hemorrhage occurs the sac must be freely opened and the bleeding point tied. The chief danger of the operation, however, is cerebral anæmia, followed by white softening, or by the passive congestion which may follow the ligature of an artery in any other situation. Immediately on tightening the thread there may be syncope, dimness of sight, tinnitus, and giddiness; and if softening occurs, convulsions, hemiplegia, and death may ensue. Another frequent complication is pulmonary congestion, which is liable to run on to hypostatic pneumonia; the probable explanation of this is the interference with the circulation in the brain and medulla caused by the operation. It is noteworthy that the effects of sudden closure of the carotid artery are much more grave than when the obstruction is gradual. A patient has lived for some time with both carotid and both vertebral arteries obstructed. Simultaneous ligature of the two carotid arteries is fatal from coma, but if an interval of two or three weeks be left between the ligature of the two vessels, the danger of cerebral disease is not greater than if one only is tied.

Spontaneous aneurism of the internal carotid artery in the neck is chiefly of importance from its great tendency to bulge into the pharynx, and even to simulate an abscess of the tonsil. It should be treated by digital compression or ligature of the common carotid artery.

Spontaneous aneurism of the external carotid artery may, by pressure upon the hypoglossal nerve, cause paralysis of the same side of the tongue. Owing to the number of branches arising close together from the trunk, recurrent pulsation is apt to occur. The disease should be treated by digital pressure on the common carotid artery, and that failing, by ligature. If possible the ligature should be placed around the external carotid artery, if not upon the parent trunk. Recurrent pulsation should first of all be treated with rest and careful direct pressure, and then by incision of the sac and ligature of the branches opening into it.

Traumatic carotid aneurism is very rare, because wounds of the artery are usually fatal; or, if recovered from, are generally combined with wound of the vein. They should be treated by pressure or ligature of the common carotid artery.

Aneurismal varix has, in one recorded case, arisen spontaneously between the common carotid artery and the internal jugular vein; more often it is caused by saber-cuts, etc., the weapon passing through the vein into the artery. The affected vessels may be, in order of frequency, the common carotid artery and the internal jugular vein; the internal carotid artery, and the internal jugular vein; the common carotid artery and the subclavian vein; and the external carotid artery and the internal jugular vein. At once after the injury there is a considerable effusion of blood in the cellular tissue of the whole side of the neck, which may threaten asphyxia; this is absorbed, and then the characteristic symptoms of the varix manifest themselves. The patients are liable to headache, giddiness, and other signs of cerebral congestion, and also to palpitation, perhaps from arterial blood in the right auricle. The bruit may interfere with sleep; treatment should be palliative only. Leeches may be applied to relieve the congestion of the brain when severe.

Varicose aneurism of the internal carotid artery close to the skull has occurred once.

Traumatic aneurism of the temporal artery may result from accidental or intentional wounds. It should be treated by laying open the tumor and tying each end of the artery.

Aneurism of the subclavian artery is much more common in men than in

women, and on the right side. It may arise from any part of the artery except the first part on the left side; usually it attains the size of a hen's egg, but may be much larger. Generally the tumor grows into the posterior triangle of the neck, but it may bulge forward the sternomastoid muscle, or even project above the clavicle; in other cases it grows downward and backward toward the pleura, which then becomes thickened and adherent to the lung, and the lung may blend in the sac of the aneurism. The radial pulse is weakened and delayed; there is often œdema of the arm (and in one case gangrene) and distension of the external jugular vein. From pressure upon the brachial plexus the patient may suffer from pain down the arm, numbness or muscular weakness, and pressure on the phrenic nerve may cause spasm of the diaphragm. This aneurism is very prone to undergo spontaneous cure; but it may steadily enlarge and burst externally or into the pleura.

Treatment.—Constitutional treatment should be most carefully tried; but if surgical means are demanded, the choice lies between compression and proximal and distal ligature and direct coagulants. If the case is such that the artery can be compressed with the finger on the cardiac side of the tumor, this is the best treatment; very often it is impossible to compress the artery in this way. In that case coagulants might be tried, or the introduction of aseptic wire into the sac. Where practicable, a proximal ligature should be placed upon the artery, but this is rarely possible. Ligature of the innominate has only once out of sixteen operations been successful, and in no one out of fourteen cases has ligature of the right subclavian in the first part of its course succeeded. This result is partly due to the inherent difficulty of the operation, and the great danger of secondary hemorrhage from the very free supply of blood to the part, and the proximity of large branches to the ligature. Distal ligature has not yielded any success. Where active surgical means are required, if possible a ligature should be placed on the vessel nearer the heart; but if from any course this is impossible or imperils the sac, or fails, the arm should be amputated at the shoulder-joint, and the vessel may be ligatured above the aneurism as the first step of the operation, if it can be

secured. By removing the limb the blood passing into the subclavian artery is greatly diminished, and there is no enlargement of the scapular branches arising from it; hence there is a good chance of the sac consolidating. It must be admitted that the surgical treatment of subclavian aneurism is very unsatisfactory.

Although strain and overuse of the right arm play an important part in causing spontaneous aneurism, there is no case recorded of true *traumatic aneurism* from wound of the vessel; such a wound is rare on account of the position of the vessel, and the hemorrhage is quickly fatal. There are, however, at least two cases recorded of *aneurismal varix* from stabs; the signs resemble those of aneurismal varix of the carotid artery. Gentle external support is all the treatment required.

Aneurism of the vertebral artery is always traumatic in origin. Galvanopuncture or the introduction of steel wire into the sac might be tried; if these fail to cure and the tumor threatened to burst, it should be laid open, and the orifice of the artery carefully and firmly plugged; the artery cannot be tied where it lies between the transverse processes of the vertebræ.

Aneurism of the axillary artery.—*Spontaneous.*—Injury plays a frequent and important part in the production of spontaneous axillary aneurism, owing to the free movement of the arm at the shoulder-joint, and the frequency of injuries to the shoulder and of displacements of the humerus. The disease is much more common in men than in women, and on the right than the left side. The tumor may form on any part of the axillary artery; owing to the laxity of the surrounding tissues it grows rapidly and attains a large size. Most often it projects forward between the clavicle and the pectoralis major muscle; it may grow up under the clavicle into the clavicular triangle; the strong axillary aponeurosis retards its downward progress. The tumor, if large, interferes with the movement of the arm, especially preventing its abduction; the head may be held inclined to the same side, and the outer end of the clavicle may be pushed upward. By pressure upon the axillary vein it causes blueness and œdema of the hand, forearm, and arm,

and afterward of the chest wall; there is often severe lancinating pain down the inner side of the arm to the elbow, and weakness, numbness, or even paralysis may result from the pressure on the brachial plexus. The aneurism may burst into the shoulder-joint, or erode the humerus, or extend in between the ribs and displace the lungs. From the great size of the sac and the looseness of its surroundings, it is specially liable to inflammation; when the venous obstruction is very great, gangrene may ensue. From the obstruction of the artery the brachial or radial pulse may be lost.

Treatment.—Cases of spontaneous cure are extremely rare. The surgeon should first of all treat the disease by digital pressure of the subclavian artery just above the clavicle, where it lies upon the first rib; and if necessary, the patient may be placed under an anæsthetic while continuous pressure is maintained. At the same time gentle direct compression of the sac may be of service in compensating for the absence of the compression by the tense tissue which usually surrounds an aneurism. Where the aneurism has so spread up into the neck, or so raised the clavicle that digital compression of the subclavian artery is impracticable, Esmarch's bandage may be applied to the limb up to the sac for one to two hours, with a view of leading to coagulation of the blood. Should these means fail, the subclavian artery should be tied in the third part of its course, or in the second part if the vessel is encroached upon by the tumor or is found very diseased. This operation may be rendered very difficult by the proximity of the sac or the displacement of the clavicle. Secondary hemorrhage may occur after this operation, and should be treated by a carefully applied compress; gangrene is rare owing to the freedom of the anastomotic circulation. Two special dangers attend it, inflammation of the aneurism, and inflammation of the thoracic contents. This last complication is the most frequent cause of death; it may take the form of pleurisy, pneumonia, or cellulitis in the anterior mediastinum with secondary pericarditis. The causes of these complications are wound of the pleura at the time of the operation, implication of the pleura in the wall of the aneurism, rupture of an inflamed aneurism into the pleura or lung, injury to or division of

the phrenic nerve, and the extension of septic inflammation along the cellular tissue between the scaleni muscles, which is continuous with that in the anterior mediastinum. Where the aneurism is situated low down, it has been recommended to tie the first part of the axillary artery, but it is much better to tie the subclavian. In the case of a very large axillary aneurism it has been advised to tie the subclavian artery and then at once to amputate at the shoulder-joint.

Inflamed axillary aneurism.—The inflammation may arise spontaneously or after ligature of the artery above; in the latter case, the inflammation may spread from the wound to the sac direct, or it may result from the sudden solidification of a large quantity of blood. The condition is recognized by the onset of pyrexia, with increasing swelling of the tumor, local heat, redness, and pain; then fluctuation may be detected, an abscess burst, and the escape of discolored pus and coagula be followed by free arterial bleeding. The abscess may, however, burst into the pleura, or into a bronchus, and the pus be coughed up. If suppuration occur after ligature of the subclavian artery, an early incision should be made into the fluctuating part, and if bleeding occur, an attempt should be made to tie the bleeding vessel, and failing this the limb should be amputated. When occurring spontaneously, amputation is usually indicated; but if the aneurism is small and the sac firm, the subclavian artery may be first tied.

Recurrent pulsation.—If ligature above the sac fail to cure the disease, careful direct pressure should be tried; and if that does not succeed, the surgeon has to choose between employing a direct coagulant such as acupuncture or electrolysis, laying open the sac and tying all vessels opening into it, and disarticulation of the limb. Laying open the sac has been successful, but the milder means should be first tried, and if the "old" operation be undertaken, the surgeon must be prepared to amputate if he be unable to complete it.

Diffused aneurism, or where gangrene is threatened, can only be treated by amputation at the shoulder-joint.

Traumatic aneurism is not unfrequent from stabs and other wounds of the part, or from the injury attending dis-

location of the shoulder and its reduction. Where the artery is ruptured, and the blood is extravasated without any limiting sac, the subclavian artery should be compressed, the swelling incised, and the artery ligatured above and below the wound; and should the surgeon fail to secure the vessel, he must proceed to disarticulate the limb.

For *sacculated traumatic aneurisms* digital compression of the subclavian artery with careful pressure on the tumor should be first tried, and failing that, this vessel should be tied in the third part of its course. If the sac is very thin, and the aneurism threatens to rupture, it would be better to lay it open, and tie the artery above and below.

Varicose aneurism has been met with in the axilla, but only rarely.

Aneurisms below the axilla are rare, except at the bend of the elbow, as a result of a wound of the artery; in other cases they are nearly always associated with cardiac disease and embolism. At the bend of the elbow an aneurism generally tends to grow upward along the brachial vessels, being limited by the biceps on the outer side, and by the internal intermuscular septum internally; it may extend under the biceps muscle and be flattened in shape. Owing to the proximity of the median nerve pain is often felt along the palmar surface of the thumb, forefinger, middle finger, and the outer side of the ring finger; if the aneurism attains a great size, the flexor and pronator muscles of the forearm may be paralyzed. The anastomotic circulation of the forearm is so very free that it may imperil the success of the ligature, owing to the rapidity and freedom with which blood returns to the aneurism; it also renders the danger of secondary hemorrhage greater in the arm than in the leg or thigh, while the danger of gangrene is very much less. For these reasons, and because the affection is so rarely due to disease of the arteries, when an aneurism is superficial, the "old" operation is much more frequently applied in the upper than in the lower limb.

Aneurisms at the elbow are nearly always traumatic, and this has been the most frequent seat of traumatic and arterio-venous aneurism.

Spontaneous aneurism should be treated by compression of the brachial trunk above, or flexion, or Esmarch's

bandage; and when these means fail, by ligature of the main artery.

Traumatic aneurism should be treated by compression in either of the ways just mentioned; if this fails a ligature should be applied to the brachial artery, either close above the sac, or at a distance (Anel's or Hunter's operation), and if pulsation still persists, the sac must be incised and the vessels opening into it tied.

Varicose aneurism must be treated by Esmarch's bandage, and that failing, by laying open the sac and tying all the vessels communicating with it.

Aneurismal varix will require only an elastic armlet.

Aneurisms of the forearm are to be treated by direct and indirect compression, flexion of the elbow being preferable to other means of compressing the brachial artery; Esmarch's bandage may be used. If these means fail, when the aneurism is superficial in the lower part of the forearm, it is easily treated by the double ligature; when, however, it is deep under the muscles of the upper part of the forearm the brachial artery should be tied. Spontaneous aneurisms below the elbow are usually embolic in origin, and they are, therefore, capable of successful treatment by the "old" operation.

Aneurisms of the hand are not common. If spontaneous, pressure upon the radial and ulnar arteries, together with pressure upon the tumor, should be tried; failing that, the brachial artery should be ligatured.

Small traumatic aneurisms of the digital arteries are to be treated by incising the sac and tying each end of the artery; when the palmar arch is the seat of aneurism, direct pressure may be combined with acute flexion of the elbow; if it fails, the brachial artery is to be ligatured.

Inguinal aneurism.—An aneurism in the inguinal region may be connected with the common or external iliac artery or commencement of the common femoral artery. It is most common at Poupart's ligament, and there often grows both up into the abdominal cavity and down into the thigh, the tumor presenting two lobes, with a constriction opposite the fold of the groin. Inguinal aneurism is commonly of slow growth, and may be long unobserved; but it may form a very large tumor in the iliac fossa; the part in the thigh expands less rapidly than that in the belly, owing to its being supported

by the strong fascia lata. By pressure on the femoral and internal saphena veins, the tumor causes œdema and lividity of the lower limb; and pain along the front of the thigh or down to the inner side of the knee and instep may be caused by irritation of the genito-crural or anterior crural nerve. The natural termination of inguinal aneurism is external rupture and death from hemorrhage.

Diagnosis.—Great care is often required in deciding the nature of a tumor in the groin; and when any special difficulty is met with, an examination should be made when the patient is under the influence of an anæsthetic, so that the abdominal muscles may be completely relaxed. The conditions which simulate aneurism are abscess, pulsating tumors, and enlarged glands; in several instances, inguinal aneurisms have been opened in mistake for abscesses. The directions already given will enable a correct diagnosis to be made. An aneurism of the aorta, even of its thoracic part, may extend down to Poupart's ligament, and then form an external swelling, at first sight like that of inguinal aneurism.

Treatment.—Constitutional treatment must be tried first; where that fails, compression, ligature, and coagulants may be resorted to. Proximal compression of the lower end of the aorta by Lister's tourniquet, the patient being under an anæsthetic, has been successful, and where it can be employed should always be tried; compression of the artery beyond the aneurism may be combined with it. Where there is no room for the pad of the aortic compressor above the aneurism, distal compression may be tried, or resort may be had to Davy's rectal lever. This instrument is not suited for cases of aneurism, because the long-continued pressure upon the rectal mucous membrane is likely to be injurious. Where the aneurism is low down in the groin, a ligature may be placed on the external or the common iliac artery, the former if possible, and this has proved very successful. Where the aneurism is situated too high to allow of this, the surgeon has to choose between ligature of the aorta, distal ligature, and the introduction of coagulants. In no case has ligature of the aorta been recovered from; distal ligature has not been known to cure, but is well worthy of a trial; where all these means fail or are inapplicable, galvano-puncture

may be tried. The "old" operation has been performed; it is difficult in execution, and dangerous from the liability to profuse hemorrhage; it may be employed in traumatic aneurism, or in cases of recurrent pulsation. Cure of an inguinal aneurism is liable to occasion suppuration around the sac, owing to the loose cellular tissue in which it lies. A single case of *varicose aneurism* has been recorded; they are not more common, because wounds of this great vessel are generally fatal.

Aneurism of the buttock may spring from gluteal or sciatic artery, and is about as often traumatic as spontaneous. These aneurisms are buried deep in the buttock, and, unless large, may long escape notice; those on the sciatic artery may grow also into the pelvis. The main symptoms are a limitation of the free movement of the lower limb, and pain from pressure upon the great sciatic nerve. At first the tumor is small, firm, and deep, and it may closely simulate a pulsating tumor of bone; later on in its course it may bear some resemblance to an abscess; to render certain the diagnosis between abscess and aneurism, an exploring needle should be passed into the swelling, when, if it is an uncured aneurism, bright red blood will escape. One case of spontaneous cure, at least, is recorded, but the general termination of these cases is death from external hemorrhage. It may be quite impossible to distinguish between a gluteal and a sciatic aneurism; when it is small, the height at which it is placed in the buttock and an interpelvic examination enable the surgeon to arrive at a right conclusion. The usual constitutional *treatment* should be given a fair trial. An aneurism of the buttock is well adapted for the employment of direct coagulants, *i. e.*, galvano-puncture, steel wire, or even perchloride of iron. There is no danger of wounding any important structure in operating, and if portions of clot are washed into the branches beyond the tumor, the embolism is without special danger; at the same time these aneurisms are particularly badly situated for any other surgical means of arresting their growth. The "old" operation has been performed, but its difficulties, and the danger of secondary hemorrhage, are very great; distal ligature cannot be practiced, and it is only in very rare cases indeed that there is

space to apply a ligature to the artery between the pelvis and the tumor. Ligature of the internal iliac artery has been successful. Direct pressure upon the tumor may be tried, but with great care, owing to the danger of causing a slough or suppuration.

Femoral aneurism is more common in Scarpa's triangle than in Hunter's canal. The tumor grows in the direction of least resistance, and may attain a large size; in Scarpa's triangle it is usually globular in shape, and projects through the saphenous opening; in Hunter's canal it is more flattened in form.

Aneurism of the profunda femoris has been met with. It is distinguished from femoral aneurism by the fact that the pulse in the popliteal and tibial arteries is the same on the two sides, and that the unaltered femoral artery can be traced beating over the side of the tumor in the upper part of the thigh. Femoral aneurism may undergo spontaneous cure, but its natural tendency is to burst.

The surgical means of *treatment* are, first of all, compression of the common femoral artery, and if this fails, either ligature of that trunk or of the external iliac artery. Ligature of the common femoral artery is discarded by many surgeons on account of the proximity to the ligature of one or other collateral branch, which exposes the patient to great risk of secondary hemorrhage. Further than that, the anastomotic circulation is less free than when either the superficial femoral or the external iliac artery is tied.

Traumatic femoral aneurism, when circumscribed, is to be treated by compression or ligature of the artery above. When there is no distinct sac to the tumor, it should be laid open and the wounded vessel tied above and below the opening in it.

Varicose aneurism has been met with in the groin. Ligature of the external iliac artery has proved unsuccessful, and it would be better in any such case to tie the artery where wounded. The obstruction of both the common femoral artery and vein exposes the patient to great risk of gangrene.

Aneurismal varix in the groin should be treated by elastic support.

Popliteal aneurism is more frequent than any other aneurism except that of the aorta. This frequency is due to several causes: (1) *The contact of the ar-*

tery with the bone. (2) The alteration of the length and caliber of the vessel caused by the frequent rapid *movements of the knee-joint.* (3) *The want of support of the artery:* all the other main arteries in the lower limb are well supported by muscles or fasciæ; the popliteal alone is surrounded by loose cellular tissue and fat. (4) *The termination of the artery* in small arteries which lie deep among muscles, and in the mouth of which an embolus may be caught. Double popliteal aneurism has frequently occurred, the two tumors being noticed simultaneously, or the second appearing after the cure of the first.

The aneurism may be either fusiform or sacculated, and the latter may spring from either the front or the back of the artery. When springing from the back the aneurism often attains a considerable size, compresses the popliteal vein and nerve, and tends to rupture. Sacculated aneurism of the front of the artery is usually of small size; it is liable to erode the femur or tibia, and cause effusion into the knee-joint, or to rupture into the articulation. Popliteal aneurism may spread upward, and rupture into Hunter's canal, or downward into the leg and rupture under the calf muscles; or it may burst subcutaneously. Sometimes the patient can state exactly when the tumor developed, but more often its origin and early progress are insidious. The first symptom is often pain about the knee or down the leg to the foot, and stiffness in the knee-joint, and the condition is frequently mistaken for rheumatism; if there is effusion into the joint still further support is lent to this error. Pressure upon the internal popliteal nerve causes pain shooting down the limb to the toes, cramps, muscular weakness, and paralysis. Pressure upon the popliteal vein causes cyanosis and œdema. Erosion of the bones or the ligament of Winslow is attended with constant aching or burning pain in the joint itself, with great stiffness of the joint, and pain on attempting to move it.

When a popliteal aneurism opens into the knee-joint, the synovial cavity becomes suddenly filled out, the part is hot to the hand, and if the femoral artery is compressed, the swelling of the knee yields a little to gentle pressure; the introduction of a fine trocar or a grooved needle in any case of doubt will establish the nature of the fluid in the joint.

Popliteal aneurism must be diagnosed from abscess, bursal cyst, pulsating sarcoma, and a solid tumor over the artery. The signs by which the diagnosis can be made have been already mentioned.

Treatment.—Spontaneous cure may occur, and in some cases it is sufficient to place the patient at rest in bed, with proper diet and the affected limb raised. Should this simple treatment fail, *flexion* should be tried if the tumor be small and firm, or Esmarch's bandage may be employed.

Digital or instrumental compression of the femoral artery has been successful in a large number of cases; if operation is necessary, the femoral artery should be tied at the apex of Scarpa's triangle, great care being taken not to wound or injure the femoral vein. Should secondary hemorrhage occur, the wound should be carefully plugged, or the artery religated where bleeding; and if this be unsuccessful, amputation will be necessary, as ligature of the artery at a higher level either fails to stop the bleeding or causes gangrene of the limb below. Should "moist" gangrene follow the ligature, the limb should be amputated above the knee without waiting for any "line of demarcation"; if the gangrene is "dry," the separation may be left to nature, the mummified part being meanwhile wrapped in iodoform wool. When pulsation recurs and persists after the ligature, digital compression of the artery in the groin, combined with direct compression of the tumor, is generally successful. If not, the surgeon has to choose between amputation and ligature of the external iliac artery. If the patient is old, with diseased heart or degenerate arteries, and the tumor is large, amputation is to be preferred, as the alternative course would be followed by gangrene. When, however, the patient is a young or middle-aged man, with healthy heart and arteries, the surgeon will be justified in tying the iliac artery.

When the aneurism is threatening to become diffused, it is safer at once to ligate the artery above; but if it is already diffused, amputation through the lower end of the femur is the only resource. Simple rupture of the sac into the knee-joint should be treated by the Hunterian ligature, in the hope that the aneurism may be consolidated and the blood absorbed from the joint; but if the

aneurism has caused caries of the femur or tibia and disorganization of the joint, amputation should be at once practiced. When the pressure of the tumor has caused gangrene of the leg and foot, the only course open to the surgeon is to amputate the limb. If the sac be inflamed, ligature of the artery above, together with appropriate local treatment, may prevent suppuration; if fluctuation be detected an incision should be made, and if profuse hemorrhage follow, amputation will be the only safe procedure.

Aneurismal varix of the popliteal artery and vein has been several times observed.

Aneurism in the leg and foot is rare, and is often traumatic in origin; it is met with in connection with the posterior and anterior tibial arteries, the dorsal artery of the foot, or the plantar or digital arteries.

Aneurisms in the leg should be treated by Esmarch's bandage, flexion of the knee, or digital pressure in the groin; when these means fail the Hunterian ligature should be practiced.

Digital aneurisms should be treated by incision and double ligature. Aneurisms of the foot are difficult to treat on account of the very free anastomoses between the different arteries; compression of the artery above, or Esmarch's bandage, should first be tried; if that fail to cure, the artery may be ligatured above and below the sac, or galvano-puncture or coagulating injections should be tried.

A. PEARCE GOULD.

Symptomatic Indications.—The most important remedies in the treatment of aneurism are *aconite* and *veratrum viride*, which are used to relieve the pain and control the arterial excitement. *Aconite* is indicated by great anxiety and fear of death; the nervous tension not being so great with *veratrum viride*. Aneurisms of traumatic origin indicate *arnica*. When there is much pain, coming and going suddenly, with congestive condition, relief may be obtained from *belladonna*. An irregular and intermittent pulse points to *digitalis*. As an intercurrent remedy to promote coagulation of the blood *secale cornutum* may be used.

ANGINA, a word used by the old writers to signify an affection of the throat, and applied indiscriminately to a

difficulty in swallowing and a difficulty in breathing. It is synonymous with *cynanche*, and, like it, is now seldom employed in its original sense.

ANGINA PECTORIS.—An affection of which paroxysms of agonizing pain in the cardiac region and a sense of impending death are the distinguishing features. Lesions of the heart and aorta are generally present. Angina pectoris is uncommon before the age of forty, and is of more frequent occurrence in the male than in the female sex.

Symptoms and course.—The pain commences in the first instance with great suddenness, as the result of some slight exertion, a full meal, exposure to a cold wind, emotional excitement, etc. Subsequent attacks are very liable to arise on still slighter provocation, and may develop during sleep, or without any obvious cause. Vague premonitory sensations in the precordial region occasionally precede an anginal seizure. Patients describe the pain as stabbing, gnawing, tearing in character, or compare it to the sensations of the chest being grasped in a vise. The pain is usually referred to the lower end of the sternum, or somewhat to the left of this point, more rarely to the right mammary region. As a rule the pain is not confined to the sternal region, but spreads over the front of the chest, and shoots back to the left shoulder and inner aspect of the arm, sometimes passing down to the tips of the fingers. It may also radiate to both arms, to the diaphragm, neck, and occiput, and occasionally, in cases of extreme severity, it travels down to the testes and lower extremities, and may extend to all parts of the body. In exceptional instances the pain shoots to the right arm alone, and still more rarely it commences in the left hand or arm, and spreads upward to the *præcordia*. A sensation of numbness or tingling is sometimes associated with the pain when it radiates to distant parts.

Cutaneous hyperæsthesia and numbness in the region of the heart have been noted in different cases. When patients are seized with angina pectoris, they generally remain rooted in the position in which the attack surprised them, for fear of increasing the pain. In other instances they assume various postures that seem to them to give relief—*e. g.*, on all fours, leaning over the back of a chair, standing

upright, etc. The sensation of dying is very characteristic of the classical type of the affection, and is probably connected with the severity of the pain. The heart's action is usually somewhat increased in frequency. The pulse may be weak, irregular, and intermittent, and occasionally becomes very infrequent. In some instances the tension of the radial pulse has been found to be distinctly increased. But, on the other hand, cases have been observed where the heart's action and the pulse have been quite unaffected. The respiration, as a rule, shows no important alteration, and there is no true dyspnoea, though a sense of oppression or suffocation is sometimes experienced. Most patients are afraid to breathe deeply, and the respiration becomes shallow and slightly hurried in consequence. In exceptional instances a full inspiration has been found to give relief.

During the paroxysm the patient may feel faint and giddy, and convulsions are stated to occur occasionally, but with rare exceptions consciousness is preserved. The skin is pale, cold, and bedewed with a clammy sweat, and the face betrays the greatest anxiety. Eructations, flatulence, vomiting, difficulty in swallowing and phonation, and a constant desire to micturate are occasional accompaniments of angina pectoris, and the termination of the attack may be marked by the passage of a large quantity of limpid urine. The paroxysm usually ends as suddenly as it begins, but at times it passes off more gradually. Anginal seizures may last a few seconds or minutes, or they may be prolonged for half an hour or even longer, and in such cases they probably consist of a succession of paroxysms.

The severity of the pain varies greatly in different attacks. At times a brief spasm of pain may alone be felt, whereas on another occasion the agony may be so intense that it leaves behind it a state of profound exhaustion. The patient may die in the first attack, or he may recover and remain free for years, and, it is said, for the rest of his life. Far more often the paroxysms show a tendency to recurrence, the pain becoming more severe, and the attacks more frequent. During the intervals the patient is free from anginal symptoms, and, except in those cases where organic disease is present, there may be no derangement of the general health.

Angina pectoris is very liable to end

fatally. In a relatively large proportion of cases death occurs suddenly during an attack, but gradual failure of the circulation is the more usual mode of termination.

The account that has just been given deals with the classical type of angina pectoris, in which a fatal termination within a few years is the rule and not the exception. Some writers, especially in Germany and France, use the term in a wider sense, and include a somewhat different class of cases, which, however, in point of symptoms resemble the classical form very closely. The pain is less severe, the tendency to radiation is less pronounced, and there is not, as a rule, the same overwhelming sense of approaching death.

This variety ("pseudo-angina") occurs in young persons, and especially in anæmic or neurotic females. Moreover, in these cases there is no organic cardiovascular disease, and there is little or no tendency to a fatal issue.

The "angina pectoris vasomotoria" of Landois and Nothnagel requires a brief notice. In this affection the attack is usually attributed to cold, and begins with pain, numbness, and coldness of the extremities, followed by a sense of oppression and palpitation, dull pain in the cardiac region, which may spread over the left side of the thorax to the arm, pallor of the face, cyanosis of the fingers and toes, and cold clammy perspiration. The action of the heart is at times excited, and the pulse is small and tense. A sense of anxiety or apprehension may be experienced, but this symptom is usually a subordinate one, and no danger to life is to be feared. The paroxysms are relieved by friction, and by the application of warmth to the extremities. It is doubtful whether this disorder really deserves the name of angina pectoris. At the same time it shows that a peripheral vaso-motor spasm may give rise to a certain amount of cardiac pain, if not to the characteristic agony of a true anginal seizure.

Pathology.—Morbidity anatomy throws a somewhat uncertain light on the pathology of angina pectoris. The heart is generally in a flaccid, uncontracted, or dilated state, and may present various structural changes in its walls or valves. The most frequent lesion is atheroma of the coronary arteries, or of the root of the

aorta, involving the orifices of the coronary arteries. Fatty and other degenerative changes, atrophy and dilatation of the heart, aneurism or dilatation of the arch of the aorta, and disease of the aortic valves have all been found in different cases, but no single lesion has been constantly present. A marked degree of hypertrophy is rarely met with. Walshe says that he has never known angina to occur in association with mitral disease. In a few instances anatomical changes have been detected in the nerves forming the cardiac plexus. It is said that in some fatal cases the heart and arteries have been free from disease.

The paroxysmal and capricious nature of the affection, the suddenness with which the pain begins and ceases, the development of the attack in response to such slight reflex impulses as the act of swallowing a draught of cold water, and the characteristic radiation of the pain are facts highly suggestive of a nervous origin. Trousseau, indeed, regarded angina pectoris as an epileptiform neuralgia. But, although no explanation is possible without invoking the influence of the nervous system, it appears that angina pectoris, in its severe form at least, is not a pure neurosis, but is rather a neurosis grafted upon an organic basis.

From the proximity of the cardiac plexus to the arch of the aorta, and from the distribution of the coronary plexus in the course of the corresponding arteries, the cardiac nerves are liable to become implicated in morbid processes affecting the walls of these vessels, and this circumstance has been thought to have some bearing on the pathology of angina.

On the whole, it seems probable that the essential element of a paroxysm consists in some abnormal condition of the cardiac plexus: in other words, that angina pectoris is a neurosis or cardiac neuralgia, but that vaso-motor spasm is very frequently connected with the development of an attack.

This view would admit the existence of a close relationship between the severe organic form and the functional or false angina. The fact that the danger to life differs widely in the two varieties is not incompatible with their essential unity, for degenerative changes in the heart's walls and insufficient coronary circulation may well account for the greater danger of a paroxysm in the organic form, the

shock caused by the intensity of the pain being more likely to cause fatal inhibitory arrest of the heart's action when the organ is structurally unsound.

The *ætiology* of angina pectoris is extremely obscure. The greater proclivity of the upper classes to angina has probably been overstated by some writers. Some cases of the functional variety occurring in young men have been traceable to the abuse of tobacco.

Diagnosis.—The diagnosis of the severe classical type of angina presents little difficulty. The character and localization of the pain, its sudden onset and disappearance, its tendency to radiate to the left shoulder and arm, and the sense of impending death, constitute a group of symptoms that can hardly be mistaken. If, at the same time, the patient be above the age of forty, and present evidence of organic disease of the heart or aorta, a positive diagnosis may be given. The absence of signs of cardio-vascular disease must not prevent us from diagnosing angina pectoris in a person past middle life, for the detection of coronary or myocardial disease is often quite impossible.

Attention should be particularly directed to the age, and in a less degree to the sex of the patient. It must, however, be remembered that the severe type of angina may occasionally occur in young persons.

The recognition of pseudo-angina is not always easy, though the age and sex of the patient and the character of the paroxysm will often enable us to make a correct diagnosis. It is of great importance to distinguish the organic from the functional form of angina; but in some cases this is impossible, and fallacies are especially likely to arise in the case of attacks occurring in women about the period of the climacteric.

Prognosis.—The prognosis of the organic variety is decidedly unfavorable, though in such cases life may occasionally be prolonged for years. Where there is reason to believe that the symptoms are due to pseudo-angina the prognosis is favorable as regards the duration of life; but in no case should a too sanguine opinion be expressed, in view of the difficulty of distinguishing the organic from the functional form under certain circumstances.

Treatment.—For the actual paroxysm, nitrite of amyl gives the most prompt

results in most cases. Glass capsules, containing a few drops of the drug, should be broken in a handkerchief, and the vapor should be inhaled until relief is obtained. Nitro-glycerine is another valuable remedy, and may be given internally in doses of 1 minim of a 100 per cent. alcoholic solution three or four times a day, or oftener, the quantity being gradually and cautiously increased if necessary. Nitro-glycerine may also be conveniently exhibited in the form of tablets. The combination of nitro-glycerine with ether and ammonia gives good results where the heart's action is weak; in other cases the drug may be advantageously prescribed with peppermint if flatulence be a troublesome symptom. Nitrite of sodium is believed to act in the same way as nitro-glycerine. The inhalation of amyl nitrite generally gives the speediest relief, but a regular course of nitro-glycerine not infrequently renders other measures unnecessary. The administration of this remedy in small doses, frequently repeated, is generally to be preferred to the use of large doses at longer intervals. In severe cases the patient should always carry about with him some capsules of amyl nitrite. The good effects of the nitrites are not confined to the severe organic form of angina, but are manifested in some cases of the functional variety also.

Where these remedies fail, Balfour recommends the inhalation of chloroform followed by a hypodermic injection of morphia. Numerous other medicines have been advocated, but arsenic and iodides are, perhaps, the only ones that appear to have much effect, and these drugs are greatly inferior in their action to the nitrites or morphia. The application of the constant current to the sternum has proved successful in a few instances, but electrical treatment would only be justifiable in the comparatively rare cases in which we can exclude organic disease. The general treatment of angina pectoris consists in the avoidance of everything that may predispose to an attack, such as exertion, emotional excitement, digestive disturbances, cold, etc. Regulation of the bowels is of great moment, as paroxysms of angina are not infrequently excited by straining at stool. Iron, strychnine, arsenic, and remedies directed to the improvement of the digestion will be useful in suitable cases. The meals

should not be large, and should consist of light, digestible food. Rest, both of mind and body, is an essential element in the treatment. The abuse of tobacco must be avoided. Anæmia and disorders of the nervous system must be dealt with on general principles. PERCY KIDD.

ANKLE-JOINT, SPRAIN OF. —

The treatment by strapping with adhesive plaster enables the patient to walk soon after the accident, attend to business, and the use of the joint prevents the impaired mobility which is so frequent after the injured member has been encased in plaster of Paris for weeks.

The strapping acts by supporting the parts, enabling the patient to walk with little pain; reduces the swelling by equally applied pressure, and promotes resolution. It is applied as follows:

The strips of rubber adhesive plaster are twelve inches long and one and one-half inch wide. The first strip commences at base of the little toe, passes along the outer side of the foot, around the heel, and terminates at the middle of the inner side of the foot, just under the plantar arch. The second strip commences at the junction of the middle and lower thirds of the leg, passes along the side of the tendo Achillis, beneath the heel, and ends just above the inner malleolus. The third strip is placed like the first and the fourth like the second, each successive strip overlapping about one-half of the preceding, until the outer side of the foot to the middle third of the leg is covered in.

When the sprain involves the tarsal or mid-tarsal joints, the first strip starts on the inner side of the heel, passes back of the heel, below the external malleolus, over dorsum of foot, and terminates just under the ball of the great toe. The second is started beneath the external malleolus, passes over the back of the heel, across the front of the foot, ending near the little toe, just under the outer side of the foot. A cheese-cloth bandage should then be closely and evenly applied to the leg and foot to retain the adhesive plaster and cause it to become firmly adherent. In persons having a sensitive skin the adhesive plaster will sometimes give rise to an erythematous inflammation requiring its removal.

ANIDROSIS.—A condition characterized by a deficiency of perspiration, and occurring as a result either of a con-

stitutional disease or of an altered state of the skin.

ANKLE, DISLOCATION OF. See DISLOCATIONS.

ANKLE-JOINT, DISEASES OF. See JOINTS, DISEASES OF.

ANKYLOSIS.—Three kinds: 1. Extra-articular; 2. Intra-articular or ordinary fibrous or false ankylosis; and 3. Bony or true ankylosis. In the first case there are not, in the second there are, fibrous bands within the joint. First case results from inflammatory thickening of surrounding parts, contracted ligaments and tendons, etc. Often there is a combination of all three.

Diagnosis.—In osseous ankylosis there is no motion whatever; in intra-articular fibrous there is some motion, which is checked more abruptly than in extra-articular. Anæsthetics may be required. Sayre tries to move the joint vigorously for two minutes under chloroform. If, within twenty-four hours, any swelling result, the ankylosis is, of course, not bony.

Causes.—Joint-disease, etc. Osseous ankylosis usually caused by traumatic disease.

Treatment.—1. Preventive. Proper passive motion applied in time. If ankylosis is inevitable, select the best position. 2. Curative. A. Fibrous ankylosis. —Passive motion, friction, douches, steam baths, screw splints, weights. Anæsthetics: subcutaneous rupture. Take a short hold (near the joint) and try to rupture by flexion. Tenotomy. Division of tight fascia. B. Osseous ankylosis. —Do not interfere if possible. Fresh disease may be excited, or the operation may be fatal. "Subcutaneous resection." Sawing, drilling, fracturing, cutting out wedge-shaped pieces of bone, fracturing shaft of bone just below joint. Little more than a good position aimed at. See HOT AIR BATHS, p. 1558. C. B. KEETLEY.

ANODYNES are remedies, acting through the medium of the nervous system, which relieve or allay pain. The chief of these is opium, including the various preparations made from it or its alkaloid, morphina. Among the others are cannabis indica, belladonna, hyoscyamus, stramonium, conium, veratrum, lupulus, gelsemium, bromide of potas-

sium, hydrate of chloral, chloroform, ether, and camphor.

ANOREXIA signifies loss or impairment of appetite, and is met with in many forms of gastric disorder, as well as in most febrile affections and in chronic disease.

ANOREXIA NERVOSA (*Apepsia Nervosa vel Hysterica*), a condition characterized chiefly by extreme emaciation, owing to abstinence from food, and occurring chiefly in neurotic females between the ages of sixteen and twenty-three, but occasionally met with in males at about the same period of life. It was first clearly described in 1873. Sir William Gull about the same time also drew attention to the disease, and ascribed it to a "failure of power of the gastric branches of the vagus." Anorexia nervosa has close relations with hysteria and neurasthenia.

Symptoms.—The patient becomes fearfully emaciated, the eyes sunken, the skin cold and of a sallow tint; there is no desire for food, and but little is taken except upon compulsion. The mind is not weakened; there is no craving for sympathy, rather an inclination to reserve and seclusion; the mental state is one of "inexhaustible optimism" (Laségue), with restlessness and a marked desire for walking exercise and capacity for undertaking it without apparent fatigue.

The pulse and respiration are slow; there is generally obstinate constipation, and in women amenorrhœa and an arrest of fecundity. Gastralgia, vomiting, and hematemesis may be present.

The *prognosis* is generally favorable, but some cases have terminated fatally from extreme inanition.

No changes have been found in the stomach or elsewhere which throw any light upon the pathology of the condition.

The *diagnosis* from gastric ulcer, cancer, or abdominal tuberculosis is in many cases most difficult.

Treatment.—The patient should be removed from the care of sympathizing friends, and a trial given to the Weir Mitchell treatment (seclusion, massage, and excessive feeding). Most cases recover as soon as they begin to take food. No drugs have been found of much use.

ANOSMIA is the loss of the sense of smell—either unilateral or bilateral. It

may be due to local disease affecting the mucous membrane of the nose, to injury or disease of the fifth or olfactory nerves, to disease involving the inner and lower parts of one or both anterior lobes of the brain, the olfactory bulbs, the under surfaces of the temporo-sphenoidal lobes (Ferrier), or part of a hemi-anæsthesia of either organic or hysterical origin. When anosmia is complete, taste, except for bitter, sweet, sour, and salt substances, is also lost.

ANTACIDS are given to correct excessive acidity of the stomach, whether due to the secretion of too abundant or too acid a juice, as in acute dyspepsia, or to the decomposition of food from impaired digestion. They are usually given after meals. The alkalies and their carbonates are the chief antacids, soda salts being preferable to potash, but when there is diarrhea the lime salts should be used.

ANTHELMINTICS are of two kinds, those which simply expel the worms (vermifuge)—to which class almost all the purgatives belong, scammony and jalap being the most popular—and those which kill the worm (vermicide). Male fern, pomegranate root, kamela, kousso, turpentine, and tannate of pelletierene are all used against tapeworms. Santonin acts especially on round worms, while threadworms are best destroyed by small injections into the rectum of salt and water or infusion of quassia; the latter, in combination with iron, may also be given by the mouth.

ANTIMONY, POISONING BY.—The chloride of antimony, or butter of antimony, is a violent irritant poison, but one very rarely taken. The potassio-antimonio-tartrate, or tartar emetic, is the better known. It produces a metallic taste, followed by a whitish appearance of the mouth, nausea, vomiting, and purging, with pain in the abdomen, heat and constriction of the throat, cramps in the limbs, cold sweats, great faintness, and weakness; the pulse becomes very feeble, the eyes sunken, and the voice reduced to a whisper; death may ensue from exhaustion with or without convulsions. There are no remissions, and the general depression is greater than in arsenical poisoning, to which otherwise the symp-

toms have much resemblance. If small and repeated doses of the poison have been given there will be vomiting and distension of the abdomen, purging, and perhaps blood in the motions; a pustular eruption occasionally appears.

Post-mortem appearances.—The contents of the stomach and intestines present a white or yellowish pasty appearance, and the mucous membrane may be more or less inflamed. The large intestine may be affected even when the small is found healthy; the liver may be fatty; the blood is generally fluid.

Treatment.—The stomach should be thoroughly washed out with the stomach pump and vomiting encouraged in every way; milk and water should be freely administered; astringent infusions—*e. g.*, tannic acid (gr. 30) in solution—may be given as antidotes; strong coffee and ammonia are useful if there be collapse.

ANTIPERIODICS check or cut short the attacks of those diseases which tend to recur in paroxysms. The various forms of intermittent fever due to malaria constitute the chief class, but certain kinds of headache and neuralgia must also be included. Cinchona bark and its alkaloids, especially quinine, are by far the most important of the antiperiodics. Salicin, salicylic acid, and arsenic are also used.

ANTISPASMODICS are used to relieve or prevent spasm. The diseases which call for this class of remedies are most varied. Convulsions, laryngismus, asthma, angina pectoris, hiccup, dyspepsia, colic, hysteria, are instances. Antispasmodics may produce their effects either by direct local action or through the medullary centers. Bromide of potassium is the most important. The other bromides, opium, belladonna, stramonium, Indian hemp, ether, alcohol, nitrite of amyl, musk, valerian, asafetida, camphor, and the volatile oils are also useful in various disorders, on reference to which the appropriate remedies and their doses will be found.

ANTISEPTIC AND WOUND TREATMENT.—**A. General antiseptic principles.**—The whole question of the treatment of wounds turns upon the differences which obtain between a compound and a simple fracture, an injury with skin broken and one in which it

remains intact. All surgeons endeavor to bring wounds into a condition comparable with that in which the skin is unbroken. Speaking generally, inflammation does not attend subcutaneous injuries. Wherever the skin is destroyed, however, external noxious agents are brought into contact with the injured tissues, and inflammation and fever ensue. This is entirely due to the growth and development in the wound-secretions of micro-organisms, which, abounding more or less in the atmosphere, are deposited everywhere. These germs vary in number, quality, and vitality; many of them, more especially those associated with putrefactive changes, thrive in dead or dying tissue, aided by moisture and heat, conditions which they find in wounds. It is against such organisms coming directly from without that the surgeon battles.

We must either destroy the germs when they have gained entrance, and thereafter exclude them; or we must render the wound an unfitting nidus for their growth, or entirely prevent their entrance.

Antiseptic methods and materials.—The antiseptic methods and materials used by different surgeons vary considerably. The *principles* are the same. The surgeon's hands and those of his assistants, the instruments, sponges, and everything which is brought in contact with the wound must be carefully purified and rendered antiseptic, as is also the skin of the part operated on. The surgeon either operates under a cloud of carbolic spray 1-30; or irrigates the wound with some antiseptic lotion; or does not act on it in any way beyond drying and draining it. In the last instance, he trusts to the dryness of his wound and the vitality of the tissues, which have not been irritated by applications, as being sufficiently inimical to any stray organisms which may have entered. Bleeding vessels are twisted or tied with purified catgut or silk; drainage-tubes are inserted, and the wound is closed.

Some surgeons contrive to leave their wounds untouched for fourteen or twenty days after operation, and then remove the dressing to find all healed. This end they attain by the most scrupulous attention to antiseptic detail, and by the use of trustworthy catgut and decalcified

bone tubes. Others, again, dress always at the end of twenty-four hours, and then remove the drainage-tubes. They again dress about the seventh day, to remove the sutures. Naturally, the number of dressings will vary greatly with the case and the surgeon. Much depends on applying a plenteous supply of an absorbent, elastic, porous, soft dressing, which admits of sufficient pressure by bandages to obliterate every cavity, and bring the divided surfaces into apposition.

In many cases, no drain is required. In the case of the abdomen, the peritoneum carries off secretion. Where wounds are aseptic, the cut surface not too extensive, and where careful dressing has obliterated every cavity, no artificial drain is required. It sometimes happens, however, that a little discharge does take place, and this by evaporation may cake on the dressing, dam up some further residue, and thus create tension. Hence, a drainage-tube should be used in all doubtful cases, for at least twenty-four hours.

Isolation.—As antiseptic treatment is mainly preventive in character, isolation or separation of septic and specific cases is to be observed. In regard to erysipelas this isolation is imperative. Hence, walls, roofs, and floors should have smooth polished surfaces, which can readily be washed down. Cornices, inaccessible picture-frames, shelves, and ledges, are all condemned as harborers of dust. The staff and dressers brought into immediate relation with the patient should have fresh clean clothing. They alone are allowed to assist, and they are ever on the alert to see that nothing employed comes in contact with other than antiseptic surfaces; this care is specially directed to the instruments, ligatures, and sponges. The operating room should be well stocked with suitable lotions, thoroughly dissolved, and recently (but not hurriedly) prepared.

Cautions!—The more potent the antiseptic, the more likely is it to react injuriously on the tissues; and hence poisonous effects often follow when carbolic acid, mercurial salts, or iodoform become absorbed.

Some patients are peculiarly liable to disastrous effects, and where such idiosyncrasies are displayed, the offending drug must be at once removed, its effects antagonized, and a milder and less

irritating antiseptic substituted for it. Care should be taken that pure preparations of all the various drugs are alone used.

Various antiseptics: (a) **Carbolic acid.**—The most useful antiseptic, and certainly that of most general application, is carbolic acid. It is volatile, searching, and does not damage instruments like the preparations of mercury. It is used in the form of lotion by dissolving pure phenol in water. The strong solution (1-20) is used for purifying the skin, sponges, towels, and instruments. The weaker solution (1-40) is employed in connection with parts and instruments already purified, and for irrigation. A solution in the proportion of 1-15 is used for the spray, which is diluted with a cloud of steam the strength of 1-30. Carbolic acid is used as a dressing in the form of gauze. Carbolic acid in oil or glycerine is frequently used for catheters and dressings.

Caution!—*Carbolic acid poisoning* exists in varying degrees. The passage of urine which is olive-green, and which darkens gradually on standing, is the first indication of carbolic acid absorption, and is in itself of little moment. Headache, giddiness, and sickness, are of greater import, more especially when these are associated with the absence of sulphates from the urine. In extreme cases, low temperature, extreme depression, and collapse ensue. Treatment consists in a change of dressing, together with the administration of sulphates, which, it is hoped, will combine with the free carbolic acid in the system, and be excreted as harmless phenol-compounds by the kidneys. In addition stimulation may be required.

(b) **Corrosive sublimate**; one of the most universally employed antiseptics, being cheap, effective, non-volatile. It, however, corrodes all metals, and can only be used in glass, porcelain, or vulcanite. In solution, 1-500, it has been used for the hands and skin, but in this strength is rather irritating. 1-1000 is the stronger form of solution used for general purification, while 1 to 1000-5000 is that employed for irrigation. When used to purify septic wounds, it should be employed in large quantity, as the mercury is speedily used up by forming compounds with albumen, and the lotion is thus apt to become inert. The addition

of common salt to the solution prevents this action.

Absorbent wool, gauze, jute, and wood-wool, are all to be had charged with corrosive sublimate, and make excellent dressing-materials.

Caution!—*Corrosive sublimate* solutions must be used with the greatest care. It is probable that more deaths have occurred from the use of mercurial salts as antiseptics than from that of carbolic acid. Irrigation of absorbing surfaces—as, for example, the tunica vaginalis and pleura—is fraught with danger. Diarrhea, vomiting, collapse, and death may rapidly ensue. Large moist dressings of corrosive sublimate must always be avoided. If evaporation be prevented, then the skin becomes irritated, and absorption rapidly follows.

(c) **Iodoform** has obtained a great reputation from its marked deodorizing properties, and from its supposed special action in tubercular inflammation. It should be lightly dusted over the wound. The fine sublimed crystals, mitigated with boracic acid or bismuth, are most suitable for this. It is insoluble in watery solutions, but dissolves in chloroform, ether, and oils. It has almost entirely replaced chloride of zinc in operations about the face and perineum. Nussbaum recommends a solution of iodoform (iodoform, 10; sulphuric ether, 70; distilled water, 200) for washing out foul cavities.

Caution!—*Iodoform* should always be used with great discretion. There is no occasion to apply it in large quantity to wounds and absorbing surfaces. Children, as well as old and weak people, are especially liable to be affected injuriously by it. Fatal results have followed from its accumulation in the deep recesses of wounds after insufflation. The symptoms vary from sudden collapse, associated with brain-symptoms and vomiting, to milder forms of loss of appetite, mental depression, and excitement. When the patient complains of feeling its taste and smell in everything, its use must be discontinued, and the patient stimulated and treated to plenty of fresh air.

(d) **Boric, or boracic acid**, is one of the mildest and most unirritating germicides. It may be used in saturated watery solution (1-30), or dusted on copiously when finely powdered. It is specially applicable in open wounds after their preliminary purification with stronger agents,

and highly suitable for irrigating the bladder. It is practically non-poisonous.

(e) **Chloride of zinc**, in the strength of 40 grains to the ounce of water, is a potent and lasting disinfectant. It is a valuable medium with which to soak strips of lint for use as plugs after operations in the vicinity of the oro-nasal cavities. It will maintain its action for forty-eight hours. It is, however, somewhat painful, and latterly iodoform, or iodoform mitigated with boracic acid or bismuth, has supplanted it to a great extent.

(f) **Other antiseptics**.—Among the many other powerful antiseptics, all of which have had their advocates, are *salicylic acid, benzoic acid, thymol, acetate of alumina, naphthalin, subnitrate of bismuth, iodol, and eucalyptus oil*. The latter is largely used in place of carbolic oil for disinfecting catheters, as being less irritating.

Mode of using antiseptics during operations.—Previous to operation, the skin should be washed with soap, shaved, and thoroughly scrubbed with carbolic lotion (1-20). The skin-purification should be thorough. For this many employ a preliminary washing with turpentine or some alkali. It is always good, when circumstances permit, to have a towel, soaked in carbolic, bound over the spot for at least thirty minutes before operating. The patient should be warmly covered with blankets. By spreading one or two sheets of mackintosh or gutta-percha, covered with carbolized towels, over the blankets, etc., in vicinity of the field of operation, an antiseptic area is provided, whereon instruments, etc., may be laid with safety. A mackintosh beneath the patient serves to protect the blanket. Everything being in readiness, and the patient "under," the surgeon proceeds to operate.

Par exemple, a chronic abscess. After opening it, the surgeon inserts his purified finger, and explores it thoroughly with the view of removing any necrosis or other source of irritation, and scraping away the so-called "pyogenic membrane." If he thinks it better to get rid at once of the organisms (micrococci and tubercle bacilli) which exist in the abscess-wall, he irrigates and then performs as far as he dare previous to draining; otherwise, he contents himself with draining, trusting that now the tissues will recover their

vitality, and that efficient drainage will act as an antiseptic by removing material in which organisms may grow. Where the spray is not used, it is customary to irrigate; and under any circumstances the blood-clot and débris may be with advantage washed away. In incised wounds ligatures should only include the bleeding vessel, and should be cut short, so that as little devitalized tissue as possible may be left in the wound. In the case of compound fractures and joint-wounds, where the recesses have been manifestly exposed to septic influences, most thorough and prolonged irrigation must be used. The skin should also be shaved and purified. Where dirt and sand have been ground into cartilage and bone, the bone-pliers and knife may be used to remove the engrained tissues. Do not otherwise remove bone, even although loose. If sepsis be conquered, the weak part will live. Free incisions may be made to avoid tension, and drainage-tubes inserted. Where a sharp edge of bone projects, which has been exposed and cannot readily be replaced, it is well to remove it with the forceps or saw.

Antiseptic ligatures and dressings.—Catgut ligatures are to be used. A difficulty arises in getting good catgut, and it is better that the surgeon should prepare his own. The longer it is stored, the better. That supplied by the instrument-makers is often unreliable, and is a fertile source of wound-infection. Under these circumstances some have preferred to use purified silk, fine Chinese twist, or Turner's plaited surgeon's silk. As shown by Lister, this, when aseptic, becomes also gradually absorbed in the tissues. The process is, however, much slower than with catgut, and the fragments of silk, remaining unabsorbed, have a tendency to irritate and act as foreign bodies, giving rise to small abscesses. The finer the silk, and the smaller the amount left in the wound, the less risk there will be of this. Should sepsis take place, the silk ligatures invariably slough out. Antiseptic silk is simply prepared. Strips of fresh ox aorta, kangaroo tendon, and allied animal textures have been prepared like catgut. The closure of the wound is affected by sutures of catgut, which become absorbed, or by silk, horse-hair, or wire, which require removal. In stitching, where there is much tension, a few deep sutures may be used in order to

secure the lips of the wound free for the closely applied stitches of apposition. These deep sutures may be on the plain of Lister's "Button" suture. The margins of the wound should be closely and accurately applied, each epithelial edge meeting its fellow, and no fat protruding. In wounds which unite by the first intention, and which are aseptic, the "Continuous" suture may be used. It is finished off by slipping the doubled end of the suture under the last stitch, and tying over that. The continuous suture is well adapted for closing intestinal wounds in emergency cases, on account of the rapidity with which it may be applied. A double row of sutures is often valuable in closing wounds of the intestinal canal. The principle to be carried out in stitching up the bowel is, that serous surface must be brought to meet serous surface by stitches which do not transfix the mucous aspect. Such is the well known "Lembert's" suture. All sutures which bear much tension will ultimately cut their way out; therefore, such as, for example, button sutures, should be removed at an early date. On the other hand, the stitches of apposition, which should be free from tension, may be left in longer. In any case, an area of redness round any stitch calls for its removal.

Drainage is carried out by means of ordinary rubber tubing, glass tubes, or by media which become absorbed, as decalcified bone tubes or prepared catgut. Where the drains are not absorbed, there is a great advantage in making separate apertures for them at the most dependent part, encouraging union by the first intention along the line of incision. A dependent aperture is made by thrusting a closed forceps through the tissues, till the skin is tense over it, and then incising. In this way all fear of injuring important structures is reduced to a minimum.

To finish the dressing.—Over the stitches a layer of "Protective" may be placed, which keeps the edge of the wound moist, and allows discharge to escape without caking into the dressing beyond. The original object of the protective, as its name implies, was to defend the edges of the wound from the antiseptic in the dressing. With dry dressings, however, an efficient covering for the lips of the wound is found in three or four folds of soft unprepared gauze, which has been

steeped for twenty-four hours in some antiseptic lotion, and which is squeezed dry prior to application. This does not adhere, and remains soft and pliant. Over all, the pads of dressing are placed with intelligence, arranged so as to receive the discharge and to press together the sides of cavities. Finally, a firm bandage, splints, and other supports, as need be.

Treatment of discharge.—Should discharge appear at one spot, the surface there may be touched with an antiseptic lotion and a fresh pad put over all. If the discharge be in quantity, a new dressing is required.

General remarks.—With absorbent drains and stitches, all may be left untouched for an indefinite length of time should a favorable course be pursued. When ordinary tubes and sutures have to be removed, the tubes may be taken out in twenty-four hours, the deep stitches on the third, and superficial on the seventh day. A slight rise of temperature generally takes place on the second or third evening in any case, but there is no occasion to dress unless something has gone wrong with the wound, as is evidenced by the rise being over 100° F., quickening of the pulse, local pain or disturbance, without other known cause.

Moist dressings may be used in septic cases, and where there is a copious discharge. They consist of ordinary dressings applied moist and covered with guttapercha or mackintosh.

Attempts to carry out a thoroughly aseptic surgery, that is, the ideal treatment, where one would operate in an aseptic room with aseptic surroundings and dressings, have not as yet taken a practical form. Sterile water prepared by repeated boiling should, however, always be available, since it is the best agent with which to wash out the peritoneal cavity. In its place, warmed boric lotion may be used.

Lacerated wounds, which are difficult to purify, should be treated by immersion in a warm bath of boracic lotion, or corrosive sublimate (1-4000). In this they may be left for three or four days, the lotion being changed from time to time. Where this method is inapplicable, a constant irrigation may be maintained with similar lotions (*see* WOUNDS).

Wounds which are septic are generally accompanied by pain, fever inflammation, and unpleasant odor.

Strapping.—Strapping is sometimes employed in lieu of stitching, or is put on when the wound shows a tendency to gape after the removal of sutures. Much neater and more serviceable, however, is the use of collodion with unprepared gauze. A strip of gauze should be laid over the wound, and one end of it secured to the skin by painting on the collodion with a brush. When this dries, traction may be exercised, and the skin pulled toward its opposing flap, which is pushed forward with the fingers and the other extremity secured in like manner to the skin. The whole extent of the incision may also be fortified by painting with collodion. Kocher combines bismuth with it, and this forms an efficient species of non-irritating plaster. A doubled fold of gauze may thus be affixed to each side of the wound, and when secured, the two may be brought together by lacing.

Strapping under an antiseptic dressing, after having been cut to the requisite size, should be washed in carbolic lotion (1-20). To this is then added an equal quantity of boiling water, and the plaster is now ready for application.

B. Special wound treatment.—(1) **Gun-shot wounds.**—Gunshot wounds in civil practice are generally caused by accidents with fowling-pieces charged with small shot, or they result from homicidal or suicidal wounds from pistol or revolver.

It need, perhaps, hardly be insisted on, that asepticity of such wounds, as of others, is one of the most important elements in their treatment. When none of the body-cavities have been penetrated, the first indication will be arrest of hemorrhage, temporarily with a tourniquet, then permanently. Under antiseptic precautions, portions of clothing, wads of paper or other foreign soft matter that may have been carried into the wound should be at once removed, likewise splinters of wood and greatly comminuted fragments of bone; the finger, properly cleansed, should be used as an exploring probe. If small shot in great numbers, or a bullet, have lodged, they should be searched for and removed, and the wound should be washed out with antiseptics. Isolated pellets may be safely left alone.

The surrounding parts should be thoroughly cleansed and purified, an antiseptic dressing applied, and the whole fixed in a splint.

Penetrating wounds of the abdomen

are dealt with elsewhere. When these wounds occur *in the thorax*, little can be done except to stop superficial bleeding, remove superficial foreign bodies, apply antiseptic dressing, and keep the patient perfectly quiet, resting chiefly on the injured side. *In the skull*.—Besides the general principles already laid down, the indications for treatment are mainly those of depressed fractures of the skull.

Some general rules, framed for the examination of gunshot wounds in military practice, may be mentioned here.

(1) Ascertain, if possible, the exact position of the patient at the moment of injury, and the direction from which the injury came. This will greatly help diagnosis of the probable injury and the track of the shot.

(2) Examine the clothes, to see if any parts are wanting, and hence possibly carried into the wound.

(3) Search for bullets by passing the hand lightly over possible seats.

Should symptoms of septic inflammation appear in the track of the bullet, free incisions must be made to permit of drainage and irrigation.

(2) **Lacerated wounds** owe their dangers to the injury as well as division of the parts affected, and to the frequency with which septic matter is rubbed into them. Even with the greatest care and trouble, it is generally impossible to purify them in the ordinary way. Consequently, the immediate dangers and subsequent troubles of sepsis are specially great.

When a lacerated wound is first seen, the surrounding skin should be cleansed and purified, and the wound itself freed from all apparent dirt, and afterward scrubbed with either 1-20 carbolic, or 1-1000 corrosive sublimate, lotion. It may then, after bleeding points have been secured, and torn nerves and tendons brought together with catgut stitches, be protected by an antiseptic dressing. In the hand and arm, however, all doubtful cases should be immersed in a bath of warm antiseptic lotion. Corrosive sublimate lotion 1-4000 answers well, and cases kept in it for several days have in the writer's experience shown no sign of poisoning. Carbolic acid about 1-80 or 100, salicylic acid 1-300, or boracic acid, saturated, may also be used. The fluid should be renewed daily, and every three or four hours part of it may be replaced by hot lotion, as the bath cools. The

patient's head and shoulders must be propped up in bed. The bath may either rest upon the bed, or be supported alongside the bed, on a slightly lower level than the mattress.

On the third or fourth day, or even sooner, the limb may be safely withdrawn from the bath, and treated with ordinary antiseptic dressings.

Many limbs and lives may be saved by this treatment which, without it, would be lost.

The difficulties involved in immersing the foot or leg in a bath are greater than those met with in immersing the upper limb. A very large metal leg-boot has also been made for this purpose, and might prove of service. Only the parts below the knee, however, could thus be immersed. The leg would require to be flexed at the thigh, with the knee raised.

In Vienna, bad cases of burn to the trunk have been treated by continuous immersion of the whole body. Irrigation with antiseptic lotions may be employed where the bath is not available. Instead of syphon tube two or three threads of worsted are generally enough.

(3) **Punctured wounds** (*i. e.*, those in which the depth of the wound is out of proportion to its other dimensions) owe their danger to risk of hemorrhage, in the first place, and to sepsis and confinement of discharge, in the second. Should there be reason, from the appearance and condition of the patient, from the state of the parts, and from the probable direction of the wound, to fear hemorrhage, the surgeon should try temporarily to control the circulation in the part, and after enlarging the wound to find and secure the injured vessel. In an inaccessible region such as the chest, rest, quiet, cold, and internal styptics, are alone available. When rise of temperature, pain, and other signs of inflammation render the advent of sepsis probable, free incisions are indicated.

In ordinary cases, punctured wounds may be treated like compound fractures—*i. e.*, with the view of rendering and keeping them aseptic.

(4) **Nerve injuries**.—When a nerve is completely divided, the muscles supplied beyond the point of section remain powerless until union takes place. The expected sensory disturbance may be complete, or it may be only partial, or even non-existent, because of abnormal distri-

bution or anastomosis. As the result of loss of the nerve stimulus, the muscles supplied by the divided nerve begin to degenerate rapidly and shrink. In recent wounds, the severed nerve-ends should therefore be carefully sought for and sutured together with fine catgut. Subsequent restoration of function ensues. In old standing cases, there seems to be no limit in time which forbids successful suture—the first sign of repair is return of motor power.

Pressure paralysis, as, for instance, the wrist-drop due to interference with the musculo-spiral nerve in the axilla from the use of a crutch, yields to massage, electricity, and superficial stimulation.

(5) **Treatment of ulcers.**—The general indications for the treatment of ulcers are: (1) to purify the surface of the sore, and free it from irritation; (2) to stimulate the circulation of the part, if it be sluggish; (3) remove obstacles to venous return, and treat any constitutional condition that may exist.

(1) Locally, foul ulcers in the skin should be dusted with iodoform, and dressed with lint, exactly fitting the sore, soaked in antiseptic lotion, and kept moist with oiled silk, which overlaps the lint all round with a $\frac{1}{2}$ -inch margin.

Should granulations become œdematous, and the healing be sluggish, stimulate the surface by touching it with blue stone (sulphate of copper), or by dressing with an astringent, such as 4 grs. to the ounce of sulphate of zinc.

Bright red, "healthy" granulations should, after being washed with a stream of boracic or weak lotion, be covered with protective, over which is laid absorbent antiseptic wool, or boracic lint applied wet and allowed to dry *in situ*.

The region of the ulcer should be kept as far as possible at rest. Thus, rest in bed is generally indicated in leg-ulcers, especially if extensive. In the case of ulcers elsewhere, fixation of the part should be carried out by a splint.

Before removing the dressing from an ulcer, the whole should be softened by soaking with lotion, to prevent any part from sticking in.

(2) *Tertiary ulcers* of gummatous origin are generally benefited by free blistering round the sore, in addition to other treatment.

In *callous ulcers* the thickened brawny condition of the surrounding parts may

be got rid of by various means, all of which, however, seem to act in common by stimulating the circulation; thus, free blistering of the surface of the sore and of the surrounding skin, firmly strapping the part, or compressing it with an elastic bandage, or rubbing and kneading it once or twice daily and fomenting it with hot water, have each and all been found useful.

To strap an ulcer, strips of plaster should be cut, $\frac{1}{2}$ -inch wide and 3 inches longer than the circumference of the limb. The limb should first be bandaged nearly up to the ulcerated spot, then successive pieces of plaster should be applied, beginning just below the ulcer. Apply the middle of each strip at the part of the limb opposite to the ulcer, then bring either end forward over the ulcer to overlap in front of it. The bandage should afterward be continued up the limb, well above the ulcer. Should the application seem too tight, relief may be given by carefully dividing with scissors the plaster opposite the ulcer. When removing the plaster in two or three days, it must be divided at this place, and carefully pulled forward at each side in one piece.

(3) The need for aiding venous return is almost exclusively found in ulcers of the leg, where varicose veins very frequently complicate, if they do not cause the ulcerated condition. Rest in bed in itself aids venous return, and in many cases is alone necessary for a cure. Where such confinement is impossible, support to the limb with a firm domet, or an elastic bandage, will sometimes suffice. Bandaging acts probably in several ways—*i. e.*, by supporting the venous walls when they tend to dilate, by aiding lymphatic absorption, and by stimulating the tissues by the mechanical pressure.

The constitutional conditions most frequently complicating ulcers are the strumous and the tertiary syphilitic.

The strumous taint is best treated by good food, fresh air, and exercise, with codliver oil and iron (iodide or syrup of the phosphates), and malt extract taken internally.

In tertiary syphilis, iodide of potassium (5 to 15 grs. thrice daily), is generally indicated, but in cachectic cases, a treatment more like that for "strumous" patients will be found best.

Any other general derangement, com-

plicating an ulcer, must, of course, be treated; thus the liver and bowels may require regulation, or dyspepsia call for special diet. A weak heart must be strengthened, and the system generally braced up.

(6) **Skin-grafting.**—To further the cicatrization of large granulating surfaces, skin-grafting may be used. In order to obtain good results, it is absolutely necessary that the granulating area be healthy and aseptic. The skin from which the grafts are taken should be first purified—that of the thigh or arm is usually selected. The surgeon pinches up the skin lightly, and shaves off a superficial portion, which should include the Malpighian layer. In doing so, he just draws blood. Having in this way removed a fragment about a quarter of an inch square, he lays it on the back of his purified thumb-nail, and divides it into a dozen pieces, which are now to be laid on, raw surface downward, at intervals over the granulating surface. The grafts and epithelial edges are next to be covered with overlapping protective, and a moist boric lint-dressing laid over all, and secured with a bandage. The coarse superficial epidermis of the grafts speedily disappears; but in a few days a new epithelial formation sprouts from each center.

This method has been modified by Thiersch, who, in a somewhat similar manner, grafts directly on to a raw surface. The area to be covered is first rawed, or it may be left bare as the result of operation or accident, and a sponge is bound on it till all bleeding has ceased. Then, with a razor, a large ribbon-like graft, equal in length and breadth to the razor-blade, is shaved from the anterior aspect of the patient's thigh, or other serviceable locality. This is transferred to the sore, and the process is continued till the area is covered. The extremely thin layer of skin removed leaves a surface which is bedewed with a slight ooze of blood; healing takes place with extreme rapidity, and the patient suffers no inconvenience. This operation requires the administration of an anæsthetic. The conditions should be aseptic rather than antiseptic, since the least amount of irritation gives the best result. Weak boric lotion or distilled water are the best agents.

Direct transplantation of skin gives better results than the so-called "skin-

grafting." A pattern of the surface which requires covering should be drawn on the skin. The part removed should include *all* the layers, and the fat adherent to its deeper parts must be carefully removed with curved scissors. The prepared skin is now bound down under a dressing to the bare area rawed for its reception. The wound left by the removal of the skin must be purified, and drawn together with button and secondary sutures (*vide* p. 135).

(7) **Sinuses**, or discharging channels, which refuse to finally close up, owe their existence to some local or constitutional cause. They may thus be due to a piece of necrosed tissue, bone, tendon, or gland lying deeply, to want of rest, or to a tubercular or syphilitic condition of the lining granulations. The treatment will, therefore, be to remove the dead tissue, scrape away the diseased lining, purify with antiseptics, keep the part at rest, and improve the patient's constitutional condition.

(8) **Erysipelas** and **erythema** are, fortunately, much rarer since the introduction of antiseptics than they were a few years ago. They are still liable to appear in surgical wards, however, as patients with wounds septic, though not erysipelatous on admission, may develop erysipelas after they have been in the ward for a few days, while other patients, who have had previous attacks of the disease, are liable to have it again in their wounds, although apparently there has been no fresh infection.

It is most important to remember the extreme contagiousness of erysipelas, and to take the most rigid precautions to prevent it from spreading. No case of erysipelas should be admitted within the precincts of an ordinary surgical ward, and every patient that shows signs of the disease should at once be removed to an isolation-ward, kept specially for the purpose. The bedding should then be purified, and the bed (as well as wall and floor near it) sponged well with carbolic before it is returned to the ward.

When circumstances demand that a surgeon should dress erysipelas and other cases on the same day, the latter should be taken first, and in dealing with the former—besides attention to scrupulous cleansing and purification—the surgeon should wear a clean linen over-all, by which he protects his clothes, and so

reduces to a minimum the chance of his carrying organisms away with him.

Erysipelas connected with wounds requires that the wounds be treated on general principles, especially providing for free drainage and washing out with antiseptics. The reddened surface of skin before being wrapped in cotton wool should be painted with tincture of iodine, which generally relieves the burning pain complained of. Watch must be kept for subcutaneous suppuration, and incisions made as soon as it appears. Generally milk diet is indicated. In bad cases, careful nursing and feeding at short intervals are of the utmost importance. Unduly high temperature may be reduced with the ice cap, or antifebrin. Sometimes sulpho-carbolate of soda is of service, *i. e.*, 1 grain to every two years of the patient's age, given every two or three hours (*Brakenridge*). Quinine may be tried, but it often sickens. Free stimulation will be required in asthenic cases.

(9) **Whitlow** is the name given to a cellulitis which often attacks the fingers, and frequently spreads up the sheaths of the tendons to the forearm. When seen in the early stage, the pain and throbbing may be treated by very hot fomentation and by firm compression with cotton-wool. When, in spite of this, inflammation proceeds, it should be treated by warm antiseptic applications, with early and free incisions as soon as suppuration seriously threatens. If the pus have burrowed into the forearm before the surgeon has been consulted, his duty will be to insure free escape of pus and to put the forearm in a splint. In bad cases, irrigation or continuous immersion is indicated.

(10) **Blisters** may be considered as the result of so rapid an effusion of fluid into the superficial parts of the skin, that the epidermis is raised up by it. Frequently they are caused by mechanical irritation, such as the friction of the feet in walking, or of the hands in rowing; but they may also be formed by superficial burns, or from the application of blistering fluids, or as the result of severe bruises, or in fractures. They are frequent in erysipelas and are seldom absent in inflammatory gangrene.

Their treatment will vary with their cause. *Blistered feet* may be prevented by avoiding the too sudden beginning of

long walks; by hardening the skin by bathing it in solutions of alum; by using well-fitting thick-soled boots; wearing woolen socks, and by smearing their surface with thin layers of soap, shaved off with a penknife, and laid on the inside of the stocking before starting for a long walk.

When blisters have formed, they should be pricked with a needle and the part protected from further irritation, if not by rest, by covering the part with protective soap plaster, or, if nothing else be available, a thin layer of soap.

Blistered toes may be wrapped with lint; but care must be taken to prevent such wrappings from working loose, and so causing more irritation than before.

Blistered hands must be treated in a similar way. Should any blister have suppurated or be much inflamed, the epidermis over it must be clipped away, and a moist antiseptic dressing applied.

Small blisters from burns or from blistering fluids should be snipped, and covered with boracic or zinc ointment.

The blisters of bruises or of erysipelas should be snipped, if large; dusted with powdered boracic acid, and covered with absorbent cotton-wool.

In gangrene, the blisters are forgotten in the seriousness of their cause.

F. M. CAIRD.

Antiseptic ligatures.—Catgut is made from the intestine of the sheep by scraping away the mucous membrane, and the peritoneal and muscular coats, thus leaving only the delicate *sub-mucous connective tissue*. This is twisted and dried, as a whole, or in strips, according to the thickness required.

(a) **Lister's chromic acid catgut.**—Pure carbolic acid (absolute phenol), 1 part dissolved in 20 parts of a solution of chromic acid in water (1-4000).

As soon as the solution has been made, introduce into it catgut equal in weight to the phenol used. Steep for forty-eight hours; take out the catgut and dry it *on the stretch*. When dry, steep it in 1-5 carbolic oil, and it is ready for use.

(b) **Macewen's chromic catgut.**—Make a watery solution of chromic acid, 1-5. Add 1 of this to 20 of glycerine. Hanks of catgut are steeped in this for seven or eight months—*i. e.*, until they become dark and semi-translucent. They are then ready for use, and are stored in carbolic (1-10) glycerine; this resists

action of tissues for fourteen days, and is absorbed in twenty days.

(c) *Later Method*.—Make, A, solution of chromic acid in water (1-5); B, solution of A in glycerine (1-5); C, solution of carbolic acid in glycerine (1-5). Soak gut in B for four days; dry, then store it in C. This lasts for about a week in the tissues. If gut were steeped in B for two days it would last four or five days, and be useful for sutures.

Macewen's chicken-bone drainage-tubes.—The tibia and femora of a chicken (after having been cooked) are scraped and steeped in hydrochloric acid and water (1-5) until soft. The articular ends having then been snipped off, the endosteum is raised at one end, and pushed through to the other along with its contents. They are next re-introduced into a fresh hydrochloric acid solution (1-5), till they become somewhat softer and more pliable than finally required. Lastly, they are steeped in carbolic acid and glycerine (1-10) for a fortnight, when they are ready for use. Holes may be punched or clipped. Duration in the tissues, about eight days.

If steeped in a chromicized instead of a carbolic solution, they will last from fourteen to twenty-one days.

Watson Cheyne's Antiseptic bougies.—Iodoform, 5 grs.; oil of eucalyptus, 10 mins.; oil of theobroma, 35 grs., in each bougie, which should be 4 inches long and diameter of No. 10 catheter.

Thomas' pitch pine sawdust as a surgical dressing.—The following is the author's description of the mode of preparation and application: "The formula of drugs with which I medicated the sawdust during many years was the following:—Ol. eucalyptol, $\frac{3}{4}$ iv; crude carbolic acid, $\frac{3}{4}$ iv; aquæ, 4 gals. This mixture was used to gradually and carefully impregnate a quarter of a sackful of clean deal sawdust, the sawdust having been previously coarsely sieved, so as to remove any wood chippings. Having employed this mixture for many years, I have great confidence in it; but as it is a remedy that has been used very liberally, I have been anxious to cheapen it without decreasing its efficacy as a wound dressing. The formula I now employ is as follows: Crude pyroligneous acid, 1 gal.; bichloride of mercury, 30 grs.; aquæ, 2 gals. This solution I employ to charge a quarter of a sackful of sawdust. This

formula I have used now for several months, and so far it appears to me to be of equal efficiency to my former preparation. The pyroligneous acid can be got in a crude state from the tar distillers. Now as to the various modes of application. When I desire its action as a moist application, I cover the locality, or bury a portion of the limb in the prepared sawdust, immediately covering the sawdust with either guttapercha tissue or sheets of tinfoil. If I am using it for compound injury to the hand or wrist, a bare sheet-iron splint is applied and strapped to the part for the purpose of fixation, and the whole is then covered with an ample quantity of the dust, sustained by a cloth and bandages. When using it for a compound fracture of the forearm, two hollow sheet-iron splints of suitable length are selected; their concavities are well filled up with sawdust, and applied so as to protect the wound, as well as to fix the fracture. Should two splints not sufficiently cover them, a third of a similar pattern is added. The same plan is followed with compound fractures of the humerus. The reader will note that in using the sawdust to injuries of the hand, the support is applied primarily, the dust after. I follow the same rule with compound injuries of the ankle and foot; the means of fixation, if practicable, is first applied, then the dust. Occasionally, of course, this is not possible, and the order has to be reversed. In compound fractures of the leg I select an iron trough boot, which I half fill with sawdust and place the limb on the bed of dust, then reduce the deformity; fill up the trough as high as possible with dust, then apply my bare sheet-iron splints, lining them with the dust contained in the trough. For compound injuries of the knee-joint, and fractures of the thigh, I apply my ring splint, with its special mode of fixed extension, then bury the limb in the dust, which is sustained by a bedroom towel and a few bandages."

ANTRUM, DISEASES OF.—Diseases of the Antrum may be classified into Cystic Disease of, Suppuration in, and Tumors of Antrum.

Antrum, cystic disease of.—Firstly, there is the form known as dropsy of the antrum, not owing to obstruction of the antro-nasal orifice, but to cystic disease of the mucous membrane; simple or

multiple cysts; bulging into nose, mouth, orbit, and cheek; thinning of bone, even to crackling. Contents: thin, brownish, serous, with cholesterine. *Treatment*.—Catheterize through nose, or tap through its socket. Restore shape of cheek by pressure with a pad. A second variety, called "Dentigerous Cysts," connected with misplaced teeth. Small ones common. Large ones cause absorption of neighboring parts. *Treatment*.—Open and remove the contained teeth; stuff cavity with lint till it begins to granulate. If cyst be large, remove part of the wall.

Antrum, suppuration of.—*Causes*.—Carious teeth, blows.

Signs.—Swelling, pain, puffiness of neighboring soft parts; perhaps escape of pus into nose. *Treatment*.—Remove the offending tooth and perforate through its socket, or extract second molar, or perforate canine fossa with a carpenter's gimlet. Wash out with Condy or carbolic lotion. Keep a free exit for the pus. Restore symmetry by pressure.

Antrum, tumors of, include, strictly, above mentioned cysts; also fibrous, sarcomatous, osseous, cartilaginous, fatty, erectile, and carcinomatous (epithelial and encephaloid); fourth, fifth, and sixth kinds very rare. Diagnosis practically has only to be made between (1) simple and (2) malignant disease; or between (1) malignant and within the antrum, and (2) malignant and extending beyond the antrum. If an operation is proposed, it should also be determined, if possible, where the tumor began, *e.g.*, behind the antrum or not. In doubtful diagnosis from cysts, determine by perforation. Malignant tumors (1) grow rapidly, (2) early affect submaxillary glands, (3) protrude early into neighboring cavities, forming a fungus.

Point of origin.—Tumors of malar bone spread over the upper jaw; intra-antral tumors expand it on all sides; post-antral tumors push it bodily forward without distorting it.

Treatment.—Operative or palliative. Question of operation.—If the soft structures of the cheek are not freely movable over the tumor, and if the glands are affected, do not operate; nor if disease be malignant, advanced, and post-antral in origin. In simple disease remove no more of the maxilla than the side diseased. For the operation, *vide* EXCISION OF THE UPPER JAW. C. B. KEETLEY.

ANUS, ARTIFICIAL (FALSE ANUS).—The term "artificial anus" is ill adapted for those varieties of abnormal openings of the bowel which are not the designed result of surgical operation, and to designate which the term "false anus" is more appropriate and correct.

The characteristics of a false anus are: (1) The escape of the greater part or whole of the fecal matter; (2) the absence of voluntary influence on the part of the individual to retard the escape; (3) the increased prolapse, during the discharge of fecal matters, of the already protruding and swollen mucous membrane of the intestines; (4) the ends of the bowel are adherent to the surrounding parts by false membrane.

Situation.—As a result of external violence, a false anus may occur in the loins, hypochondria, umbilical, iliac, hypogastric, or sacral regions; but when the consequence of disease it most commonly affects the inguinal and scrotal regions.

Any point in the intestine may be the seat of the internal opening, but it is most frequent in a part which, being free to reach the hernial apertures, can thus be strangulated by them, consequently the ilium is most frequently affected.

Causes.—(1) *Hernia*, which has been operated on too late or not at all, gives rise to false anus by ulceration, which may be combined with abscess; (2) *wounds*, especially in war; (3) *foreign bodies*, which, being arrested, lead to perforations, followed by fecal abscess or false anus; (4) *abscess* commencing in the parietes, or in ulceration of the intestinal mucous membrane; (5) *congenital defects* sometimes cause a false anus situated at the umbilicus or lower down the linea alba; (6) *error in diagnosis*; a fecal impaction has been incised in mistake for abscess.

Pathological anatomy.—The external orifice varies much in size and appearance. It is usually single, but may be double or even cribriform.

The distance between the lower edge of the intestinal aperture and the outer opening, which is usually from one-third of an inch to one inch, but may be even three inches, varies with the cause of the affection and the thickness of the abdominal wall. The two ends of the bowel are sealed by plastic lymph to the parietal peritoneum around the outer orifice, and thus the serous cavity is shut off. The

adhesions are from one-twelfth to one quarter of an inch wide. When false anus results from disease, adhesions precede the sloughing; but when of traumatic origin the adventitious barrier has to be thrown up round the site of injury. The adhesions never extend far along the extremities of the bowel, which have between them a *cul-de-sac*, into which the pressure of the viscera occasionally forces a hernia. The contiguous ends of the bowel, which are thus attached to the deep margin of the external opening, may be very obliquely placed with regard to one another, or they may be quite parallel. They may terminate in bending more and more, to become lost in the convolutions of the intestinal canal. Each end of the gut opens by a distinct orifice separated by a spur, or septum, termed the "éperon," or "promontory."

Symptoms.—Fecal matter, mucous substances, and intestinal secretions are discharged through the abnormal opening. Colicky pains are frequent, and in old long-standing cases callosities occur from the inflammation caused by the constantly escaping matters. The nearer the stomach the intestinal opening is, the less feculent and more chyle-like will be the discharge. Loss of strength, rapid emaciation, and death from inanition occur in many cases.

Terminations.—Patients may live with a false anus for several years. Death may occur from inanition, or from rupture of the bowel and fecal extravasation into the peritoneum, or from strangulation of the ends of the intestine.

Complications.—Prolapse of one or both orifices may occur; that of the upper orifice is the most frequent and extensive, sometimes attaining a length of eight or ten inches.

Treatment.—Palliative and curative.

Palliative.—Pressure of the truss so applied as to allow of the periodical evacuation of the bowel. The adaptation of a receptacle, of which numerous patterns in several materials have been tried. Columb's plan of making the upper end communicate with the lower by means of a curved gum-elastic tube, two or three inches long.

Curative.—1. *To remedy any existing complication* by: (a) Careful dieting; (b) an occasional evacuation by enema; (c) relief of prolapse by position and pressure; (d) prevention of premature

closure of external openings which would lead to intestinal obstruction.

2. *To diminish or remove the obstruction* caused by the *éperon* by: (a) Compression of the *éperon* by Desault's plan, viz., dilatation of the lower part of the bowel by introduction of long tents. (b) Perforation of the *éperon* by a seton in cases where perfect adhesion has taken place between the two serous layers of its coats. (c) Destruction of the *éperon* by Dupuytren's enterotome.

3. *To obliterate and close the external opening* by: (a) Pressure of a large elastic truss. (b) The use of caustic, or the thermo-cautery. (c) Suture after vivifying the edges. (d) Autoplasty, covering in the opening by a piece of skin detached from the neighborhood, and united by threads to the external aperture.

4. Another method of cure consists in *resection and circular suture of the intestine* in suitable cases.

ANUS, CANCER OF, usually spreads from rectum. If primary, commonly epithelioma. May be excised at first. See RECTUM, DISEASES OF.

ANO, FISTULA IN.—*Causes.*—It is the sinus left by an ischio-rectal abscess, *quod vide*. *Varieties and signs.*—Complete and incomplete, former opens both inside and outside anus; blind internal and blind external. Sometimes there are several openings; outer opening usually within one inch of the anus; granulation often projecting from it; course of fistula feels hardened and thickened; purulent discharge; tenderness; history of former abscess; constitution often phthisical.

Prognosis.—Permanent cure difficult if the openings be numerous and phthisis coexist. Ordinary cases easily remedied.

Treatment.—Introduce first a probe, then a director. Make blind fistula complete. Then slit up, on the director, the bridge of skin and sphincter covering the fistula. Precede operation with a purge and an enema. Dress with oiled lint, pad, and T bandage. Check severe hemorrhage with styptics and pads. Galvanic cautery. Ligature. Elastic ligature. Coexistence of phthisis does not usually contra-indicate operation.

ANUS, FISSURE OF, usually accompanied by anal ulcer. See RECTUM, DISEASES OF.

Causes.—Female sex; debility, cachexia, dirty habits, eczema.

Signs.—Burning pains after defecation, sometimes lasting for hours; seat of pain, chiefly sacro-iliac articulation; genito-urinary irritation; purulent, bloody and mucous exudation; patient feels and looks worn and despondent; on examining anus carefully (a speculum may be required), one or more small ulcers or fissures seen, generally very tender; sphincter very irritable and spasmodic; ulcer usually near coccyx and just within anus.

Treatment.—Cleanliness; soap and water; zinc ointment; glycerine of tannin; nitrate of silver; anodyne and astringent suppositories; division of ulcer or fissure and superficial fibers of sphincter to the depth of one-eighth of an inch. Rest in bed for some time after the operation.

ANUS, IMPERFORATE (including congenital malformed rectum). Six kinds.

Case 1. Congenital narrowness of anus.

Treatment.—Notch and introduce sponge-tents.

Case 2. Complete closure of anus; rectum normal. *Treatment.*—Crucial incision; no plug required.

Case 3. Closure of rectum by a membranous septum; anus normal. *Treatment.*—Pass an ear speculum up to the septum; pass a tenotomy-knife through speculum, and cutting in the median line, with an inclination toward the sacrum, divide the septum.

Case 4. Complete absence of anus.

Case 5. Absence of a considerable part of the rectum; often a fibrous cord instead. *Treatment.*—In cases 4 and 5 an attempt may be made to dissect up to the rectum as follows:

Operation.—Keep in mind small size of pelvis and relations of bladder and internal iliac vessels; empty bladder; incise exactly in the position of the anal depression; crucial incision; cut beyond the posterior margin of the depression; cut deeply with first incision; introduce finger with the point upward and backward. Generally the *cul-de-sac* of the bowel can be felt when the child cries, or when the abdomen is pressed upon by the assistant. Puncture upward and backward; enlarge with probe-pointed bistoury; bring mucous membrane of gut down to external wound if possible;

keep open at first with a suppository. If the operation fails never plunge a sharp instrument into the pelvis; but perform Little's operation. See COLOTOMY.

Case 6. Rectum may communicate or open into vagina. *Treatment.*—Plastic operation; operation for artificial anus, or nil. Colotomy sometimes causes a mere communication to close up, and all the fæces to pass per anum.

ANI, PROLAPSUS, is really a prolapse of rectum, usually of its mucous coat only.

Causes.—Constitutional weakness. Rectal, genital, and urinary irritation causing straining. Piles. Polypi, urinary calculi, worms, phimosis, constipation. Age of childhood.

Signs.—Protrusion of a ring of mucous membrane, becoming dark and turgid if allowed to remain prolapsed. Strangulation, suppuration, and even mortification may occur.

Treatment.—Reduce prolapse at once. Regulate bowels; mild aperients, Friedrichshall water, "effervescing citrate of magnesia." Recumbent position after, or even during defecation. Astringent injections, alum, tannin, iron. Tonics, iron, strychnia. Always seek for and remove cause. In bad cases ligature parts of the prolapsus, or paint it with strong nitric acid, bathing afterward in cold water. Incise freely a strangulated prolapsus. Children should have one buttock pulled to one side obliquely during defecation. This causes a tight fold of skin to support anus.

C. B. KEETLEY.

Symptomatic Indications.—The most generally useful remedy is *silicea*. The guiding symptoms are severe pain commencing shortly after stool and continuing several hours. Occasional swelling in the perineum, discharging blood and pus. Constipation. Fissure or fistula of the anus. *Rhatania* is a valuable remedy; there is present burning in the anus, with and preceding stool, with protrusion of varices; burning in the urethra during urination. *Aloes* is indicated in fissure of the anus in complication with piles. *Colocynth* is also useful in fissured anus when there are burning, sticking, and excoriated pains in the anus, with discharge of moisture from the rectum; frequent pressure at the anal sphincter, which ceases on the escape of some mucus.

Ignatia controls return of spasm and is particularly useful when moderate effort at stool causes prolapsus recti; after stool there are stitching pains upward into rectum.

Nitric acid is indicated in fissure of the anus which is very painful, especially after loose stool. *Peonia officinalis* is indicated in severe cases with burning and biting several hours after stool, preventing sleep; the patient must walk the floor; exudation of offensive moisture. *Hydrastis*, internally and externally, may be used for fissured anus and fistula. Guiding symptoms are constipation, piles, and ulceration.

AORTA, DISEASES OF THE.—

The aorta is specially liable to diseases of an inflammatory and degenerative kind, namely, acute and chronic endarteritis, fatty degeneration, and calcification (see ARTERIES, DISEASES OF). In addition stenosis of the aorta, simple dilatation, and aneurism.

Stenosis.—Stenosis, or narrowing of the aorta, also called coarctation, may be either a congenital malformation or an acquired condition. In the former case the narrowing is found close to the point where the vessel is joined by the ductus arteriosus. The amount of narrowing may be trifling, but if considerable the aorta and its branches on the proximal side are greatly enlarged. Beyond the narrowing, the vessel may be either of normal size or formed by vessels smaller than natural. The circulation is carried on by collateral channels, which become greatly increased in size. The enlargement of the vessels about the root of the neck, together with a murmur over the aorta, may suggest a correct diagnosis; but the condition is generally discovered only on the post-mortem table. In cases where the stenosis is acquired it results from the thickening and projection into the lumen of the aorta of atheromatous or calcareous patches, which may be covered with thrombi.

Simple dilatation.—This condition occurs chiefly in the subjects of chronic interstitial nephritis. It is caused by the extra strain thrown upon the aorta by the resistance to the circulation in the peripheral vessels, and the increase in force of the impact of blood against the walls of the artery resulting from consequent hypertrophy of the left ventricle. It is

also found in cases of incompetence of the aortic valve, the force of the current of blood propelled by the hypertrophied left ventricle being alone sufficient to cause it in this case. The ascending portion of the vessel is the part principally affected. In some cases it is possible to make out by percussion that the aorta is dilated, and the second sound in the aortic area is usually accentuated and of a ringing character.

Aneurism.—See ANEURISM.

DAVID W. FINLAY.

APHASIA.—Under this heading will be considered the disorders of speech usually associated with hemiplegia, but which also occur as a temporary symptom after some right-sided convulsions. They may be classified as (1) aphasia, (2) amnesia, (3) mechanical difficulties of articulation.

1. **Aphasia**, called also motor aphasia and ataxic aphasia, denotes the deprivation of the faculty of articulate speech, and is usually associated with an inability to write (agraphia). The aphasic can usually make some incoherent sounds, thereby showing that the vocal apparatus is not affected, and sometimes can say one or two words, as "Yes," and "No," or he uses some expression, such as "Baba," in reply to every question. He usually understands questions spoken to him, and also written questions; he can point out objects named, although he cannot name them; he knows when they are called by the right name, but he cannot repeat the name of an object when told to do so. The word spoken calls up in the patient's mind the idea of the word, but he is unable to repeat it, as the part of the brain which registers the word and executes the repetition of it is damaged. This area of the brain is in the posterior part of the *left* third frontal convolution of the cortex and the neighboring part of the island of Reil, and consequently aphasia is nearly always associated with *right* hemiplegia. In the cases recorded where it was present with left hemiplegia, the patient was left-handed. The condition of the aphasic varies in different cases; some can neither speak nor write; some can write, but cannot speak—aphemia (Bastian); some can speak a little, but cannot write—agraphia; or perhaps can only perform the very automatic action of writing their

names; they can all understand spoken language, and, usually, written questions. Although aphasics cannot speak or can only use a few words they will sometimes, when annoyed or bothered, swear or say "Oh, dear!" or even answer "No" correctly to a question. That these are only automatic reflex utterances is proved by the fact that they are quite unable to repeat the expression voluntarily when told to do so directly afterward. Aphasics can laugh, and sometimes sing and play at games, such as draughts, etc.

2. **Amnesia**, or sensory aphasia, is a condition which may exist alone or in association with aphasia, as just described. Three forms of amnesia are met with; they may occur either separately or in combination with each other. In one form of amnesia the patient can articulate quite well, and can converse and answer questions, but every now and again he forgets a word, and either comes to a standstill or puts in wrong words, or his language becomes a meaningless jargon; he knows what he wishes to say, but he cannot find the necessary word owing to a defect in the co-ordination of the speech centers. When asked the name of an object, he will say, "I know," but he has forgotten what it is, or he will make an attempt and produce a word something like the one required; but when the word is spoken he can repeat it correctly. In some cases "nouns" have disappeared from the patient's vocabulary (Broadbent). Two other forms of amnesia are met with, called "word-blindness" and "word-deafness," in which the patient can speak and write fluently. In *word-blindness* all written communications reaching the speech center through the sense of sight are cut off. He cannot read or understand written language; he may recognize and pronounce the names of letters, but he cannot understand the meaning of the words they form. He can express his thoughts in writing and write from dictation, but he cannot read or understand what he has written; he can also copy drawings and writing, but he usually copies the exact type and does not change printed into written characters. With all this he is able to speak and converse fluently, unless the word-blindness is complicated by motor aphasia. In cases which have been examined after death the lesion has been found to be in the angular gyrus of the left side—the

convolution which has been found by Ferrier to be a fundamental portion of the visual center. The angular gyrus is in communication by connecting fibers with the adjacent third frontal convolution, and in word-blindness either these fibers are injured or a part of the angular gyrus is damaged. In the other form of amnesia, *word-deafness*, the patient has lost the power of executing commands reaching him through the sense of hearing. He is not deaf to ordinary sounds or to music, but he cannot understand spoken words. He can usually read, write, and speak well, but in some cases his speech is a mere senseless jargon, owing to the fact that he is unable to call up the auditory impression or to hear the sound of the word he wishes to utter. This is also the case sometimes in reading aloud: he sees the word correctly, but cannot recall the sound of it so as to pronounce it properly; he speaks fluently, but does not know that he is talking nonsense. Though these patients can usually understand simple written commands, they cannot always comprehend long sentences. This may be due to the fact that, in reading, complicated words require not only to be received by the visual center, but the sound of them has also to be recognized by the auditory word-center before they can be understood, and, if the auditory word-center be damaged, the mere visual recognition is not sufficient. These patients can copy sentences correctly, but they cannot write from dictation. The lesion found in cases of word-deafness is situated in the superior temporo-sphenoidal convolution, especially that of the left side, the part assigned by Ferrier to the auditory center, and either this center is damaged or the connecting fibers between this gyrus and the third frontal convolution are destroyed.

3. **Mechanical difficulties in articulation.**—This form must be carefully distinguished from aphasia and amnesia. Here there is no difficulty in understanding written or oral communications. The patient is usually able to speak, but the words are "thick" and the pronunciation is imperfect. In some cases, however, the patient is unable to utter a sound, and this is associated with defective movement of the tongue and difficulty in swallowing. In such cases the lesion is situated in the pons Varolii or medulla.

Complete loss of all articulation is also produced by a double hemiplegia, which destroys the fibers in the internal capsules coming from the articulatory centers (third frontal convolution) of both sides. If the fibers in the internal capsule coming from the articulatory center of one side only, especially the right, be involved, the patient is able to speak, as each center acts bilaterally, but his speech is often indistinct. The quality of the speech differs according as the soft palate, the tongue, or the lips are affected.

The *prognosis* in aphasia and amnesia varies very much in different cases. Some patients, especially those advanced in age, never improve, and for the rest of their life can utter only one or two meaningless words, while other cases steadily improve, learning fresh words until they almost completely recover.

The *treatment* of aphasia is the same as that of the hemiplegia which so often accompanies it, but, in addition, very much may be done in teaching the patient fresh words and the sounds of letters. Many patients have to learn speech from the beginning, just like a child. In other cases it is useful to get the patient to learn to spell words by using detached letters. In short, every channel by which he can be made to relearn the functions of speech which have been lost must be made use of. The theory of the recovery from aphasia is that the opposite hemisphere—in most cases the right third frontal convolution—takes on the work of the damaged left side, and in time, by education, is able to perform the functions of its fellow.

C. E. BEEVOR.

Symptomatic Indications.—Unable to express himself properly while talking, *conium*. This remedy is especially suited to old people [men]. Makes mistakes about time and objects although they are quite clear and visible, indicates *crocus*. When the patient wants to write down something she loses the idea. *Crocus* is especially suited to women. Violent congestions to the head with loss of memory for words and of the power to articulate indicates *glonoin*. He loses his way in known streets. Confusion of thoughts, forgetful, mixing up words and syllables in writing, or leaves out part, points to *lycopodium*. The patient can express himself on abstract subjects very well, but when talking about common things gets confused.

Absent minded, says what she does not intend, and makes mistakes in writing indicates *natrum muriaticum*. Slow remembrance, slow talking, hunting for words when speaking points to *thuya*.

APHONIA.—For the production of voice it is necessary that the vocal cords should first be fixed in the proper position, and that they should then be thrown into vibration by air forced through the glottis by an expiratory effort. Aphonia, or loss of voice, may be due, therefore, to (a) interference with the approximation of the vocal cords, (b) alterations in the cords themselves impeding their vibration, and (c) a deficiency in strength of the expiratory current.

(a) The non-approximation of the cords may be due either to nervous, muscular, or mechanical causes. To the former class belong conditions producing paralysis of the abductor muscles of the cords, the so-called hysterical aphonia is a member of this group. In certain inflammatory affections, the muscles of the larynx become infiltrated, and are consequently unable to adduct the cords properly, or to render them sufficiently tense. Swelling about the arytenoid cartilages, new growths, etc., may set up changes in the crico-arytenoid joint, and thus lead to mechanical interference with the approximation of the cords. (b) The vocal cords may be destroyed by ulceration, be adherent to the sides of the larynx, or be so altered by the presence of a new growth as to be unable to vibrate properly. (c) Feebleness in the expiratory current may be due to advanced disease of the lungs, the loss of power in the respiratory muscles, or to conditions such as obstruction of the trachea by tumors, tracheotomy, and perforating wounds of the trachea, which prevent the air current from impinging upon the cords with sufficient force.

F. DE HAVILLAND HALL.

Symptomatic Indications.—Aphonia from cold, with hoarseness, expectoration of yellowish-green mucus, worse toward evening, points to *pulsatilla*, which is the most frequently required remedy. Next in importance is *causticum*, which is indicated in aphonia in sopranos from over-use of the voice; sudden loss of the voice after taking cold, often with catarrhal symptoms. Sudden loss of the voice with congestive condition indicates *bella-*

donna. Aphonia after singing or speaking; frequent changes in the tone of the voice; *arum triph*. Aphonia from over-exerting the voice, *arnica*. Aphonia after diphtheria, or at menstrual period, *gelsemium*. In tenor voices, from over-use, *kali bichrom*. Aphonia in bass voices; paralytic aphonia; vocal cords broad and relaxed; *phosphorus*. Complete or partial loss of voice; dryness of mucous membrane, *phytolacca*. Aphonia with bronchial and asthmatic symptoms; great muscular debility; exhaustion and tremors, *ammonium causticum*. Aphonia from cold, with bronchial rales, *antimonium tartaricum*.

APHTHÆ.—Much confusion has arisen from the use of this term as a synonym for *thrush*; the latter should be restricted to that form of stomatitis dependent on the presence of a vegetable parasite, the *oidium albicans*.

Symptoms.—Aphthæ, or aphthous stomatitis, commences as whitish, opaque, elevated spots on the tongue, buccal mucous membrane, or pharynx. At their commencement they are vesicular, but the vesicles soon rupture and leave small oval or circular ulcers, covered with a yellowish-gray or whitish slough, and surrounded by an inflamed margin. The patient is usually feverish; the mouth is sore and tender, and there is difficulty in sucking or taking food. Salivation is invariably present; the breath is generally foul, and there is frequently intestinal irritation. The disease has a tendency to come in crops, the patient getting nearly well, and then having a relapse.

Diagnosis.—It is distinguished from thrush by the larger size of the patches, and their irregularity, by their inflamed margin, and by the absence of the characteristic parasite found in the latter disease. It may be confounded with herpes of the pharynx, but in this comparatively rare affection the vesicles are larger and more distinct. In itself, aphthous stomatitis is not a severe or dangerous affection, more especially in childhood, but coming on in old age or in patients exhausted by disease, it is of an unfavorable augury.

Pathology.—The only point of difference of opinion is as to the condition which precedes the stage of ulceration. Some authorities maintain that this is of a vesicular nature; while others maintain that there is a fibrinous exudation.

Ætiology.—The disease is chiefly observed in children between the ages of six months and three years. It is generally associated with some febrile affection, such as measles, or occurs as a concomitant of dentition or intestinal derangement.

Treatment.—At the commencement, unless diarrhea exist, it is well to give a mild aperient, such as a teaspoonful of castor oil or of fluid magnesia: if diarrhea be present, 2 or 3 grains of carbonate of bismuth, with an equal quantity of the bicarbonate of sodium in cinnamon water, given every four or six hours, will quiet the bowels; a mixture containing 2 minims of liquor potassæ, 2 of ipecacuanha wine, 10 of syrup of tolu in 2 teaspoonfuls of dill-water given every four hours, will generally relieve the gastro-intestinal irritation accompanying aphthæ. The specific, however, for the disease is undoubtedly chlorate of potassium, which may be given in 2 to 5 grain doses, either alone in some sweetened water, or in combination with either of the mixtures just mentioned. Locally, the greatest cleanliness is requisite. If the child be old enough, it may be taught to wash out the mouth every two or three hours with a gargle containing 20 grains of borax and 20 minims of glycerine in the ounce of water. In the case of infants it will be necessary to swab out the mouth with the same solution by means of a piece of soft rag securely attached to a holder. Great attention should be paid to the diet, which should be plain and unstimulating; and, in the case of children using the bottle, the greatest care should be given to insure that both it and the tube are perfectly sweet. F. DE HAVILLAND HALL.

Symptomatic Indications.—The most frequently indicated remedy for this condition is *borax*, which has specific power over the disease. The aphthæ appear as red blisters on the tongue, which looks as if the skin were pulled off; shriveling up of the mucous membrane. Next in frequency of indication is *mercurius*, where the tongue is inflamed, swollen, and ulcerated on the edge. The gums bleed, and are ulcerated about the teeth. The breath is very fetid, and there is a profuse secretion of saliva. Dysenteric diarrhea, with griping and tenesmus, often accompanies the disease. Fetid breath also indicates *nitric acid*, particularly when the mouth is full of fetid ulcers, with putrid smelling

breath, and ptyalism of a corrosive nature, causing fresh ulcers to break out on the lips, chin, or cheeks. This remedy is particularly indicated when there is a syphilitic dyscrasia. Dark-colored eruption, with exhausting diarrhea, points to *arsenicum*, which has no rival in the severe forms. The mouth is reddish-blue and inflamed. There is also great restlessness, green watery diarrhea, with great weakness. Aphthæ in children calls for *chamomile*, when the child starts and jumps much during sleep, and is very uneasy when awake, wanting to be carried all the time. It cries for different things but rejects them when offered. *Aconite*, when the skin is hot and dry, with much heat about the head. There is constant restlessness, the child cries much, bites its fist and has a green watery diarrhea; excessive sensibility to the least touch. *Acid sulphuricum*, when the mouth is very painful and the child weak. There are vesicles on the inner side of the cheek and ulcers on the gums, with profuse flow of tasteless saliva. In adults, this remedy is indicated for ulcerous aphthæ. *Antimonium tartaricum*, with vomiting of milk after nursing. Aphthæ in pregnant and nursing females may be relieved by *caulophyllum*.

APNŒA has been used by some writers as synonymous with asphyxia, but it is now only employed in the sense in which it is used by physiologists, viz. : to denote the condition in which the blood is too highly arterialized, *i. e.*, contains too large a proportion of oxygen, and consequently fails to stimulate the respiratory center in the medulla, the result being that respiration is arrested.

APOPLEXY, CEREBRAL.—A sudden loss of consciousness, due to changes in the brain, usually the result of (1) hemorrhage, (2) thrombosis, or (3) embolism. Cases in which no lesion can be discovered after death are described as (4) simple apoplexy.

Symptoms.—There is sudden loss of consciousness, and the patient falls to the ground, but there is no failure of the heart's action as in syncope. Before the attack there may have been tingling and numbness in the limbs, with headache and drowsiness. In the attack the patient lies with all the limbs relaxed, the pupils are dilated and react very slightly

or not at all to light, the respiration is stertorous, the face is either flushed or pale, and there is retention of urine or it is passed involuntarily. In some cases the patient is able to swallow, but in others the power of swallowing is lost. The superficial reflexes are often abolished. Death may occur in a few minutes, or consciousness may remain in abeyance for hours or days. Later on there are often signs of paralysis on one side, that opposite to the seat of lesion in the brain, the paralyzed limbs being flaccid; the pupils are often unequal, and there may be conjugate deviation of the eyes and rotation of the head *away* from the paralyzed side, and *toward* the non-paralyzed side—*i. e.*, the patient looks toward the side of the lesion in the brain. The mouth is drawn over to the non-paralyzed side. These phenomena are due to the unopposed action of the non-paralyzed muscles. Should recovery take place, consciousness gradually returns, when the patient is usually found to be hemiplegic—*i. e.*, he has lost power in one-half of the body (*see* HEMIPLEGIA). There is often slight elevation of temperature on the paralyzed side. The state of the body temperature has been shown by Bourneville to be very important. In cases in which death occurs in a few hours, the temperature falls to 96° or lower, and goes on sinking; when it occurs in ten to twenty-four hours, the initial fall is followed by a rapid rise till death ensues; if death is to happen in a few days, there is a stationary period after the fall, and from the second to the fourth day a rapid rise occurs. Recovery is probable when there is an initial fall, followed by a slight rise for three or four days, and a return to the normal. In Bourneville's observations, the temperature was taken in the rectum.

The degree of unconsciousness, and the severity of the attack, depend upon the position and the extent of the lesion. The loss of consciousness is due to shock produced by the effused blood plowing up and lacerating the brain substance, or to anæmia, owing to the blocking of the vessels supplying a part of the brain. It is greater when it is caused, as in the former case, by hemorrhage, than in the latter, when it is due to thrombosis or extensive embolism.

1. **Hemorrhage** may occur either into the meninges or the substance of the

brain, pons, or medulla; in the latter case it is often due to rupture of an aneurism, about the size of a small pea, of the middle cerebral artery, especially the left; or of the basilar or other artery of the brain; or to rupture of miliary aneurisms of the size of $\frac{1}{25}$ th of an inch or less, which are sometimes found in large numbers on the arteries about the optic thalamus and in other places. Syphilis, alcoholism, and Bright's disease are the most frequent predisposing causes; in the latter disease the arteries are degenerated, and the increased blood pressure brings about rupture. Softened patches in atheromatous vessels may give way, and so cause hemorrhage.

2. **Thrombosis** results from narrowing of the arteries; the change may be either local or general. Nodules are produced between the inner coat and the elastic laminae; these project into, and narrow the lumen of, the vessel, or produce a rough surface on its interior, conditions which favor the formation of thrombi. A special form of disease of the cerebral vessels is caused by syphilis. Atheroma, either localized or diffuse, is frequently present in the subjects of chronic Bright's disease. Wasting diseases also, such as phthisis and carcinoma, by slowing the blood current, predispose to thrombosis. The arteries most affected are the middle cerebral, basilar, and carotid.

Thrombosis of the superior longitudinal sinus sometimes occurs in anæmic girls, and clotting in the lateral sinus is frequently found in association with caries of the petrous bone. Meningitis and erysipelas of the face and scalp may also present this complication.

3. **Embolism**.—Although embolism of the cerebral vessels frequently occurs without causing loss of consciousness, still if the emboli be numerous or the vessel occluded a large one, the ensuing anæmia of the part supplied will be severe enough to cause unconsciousness. Anæmia and, subsequently, softening of the part supplied by the blocked vessel ensue, owing to the absence of any collateral circulation above the circle of Willis. The left middle cerebral and internal carotid are the arteries most often affected, owing to the fact that the orifice of the left common carotid lies more directly in the course of the blood-current than does that of the innominate.

4. **Simple apoplexy** is the term applied

to cases of death from coma, when no lesion is found in the brain. It is probable that many of these are cases of epileptic coma.

Ingravescent apoplexy is a name given to loss of consciousness with slow onset. In such cases there is usually a gradual leakage of blood from the ruptured vessel.

The *diagnosis* of apoplexy from other forms of unconsciousness is considered under DISORDERS OF CONSCIOUSNESS. Of the different forms of apoplexy, it may be said that in hemorrhage the unconscious state is always longer and more profound than in that due to thrombosis or extensive embolism. Hemorrhage and thrombosis usually occur in old people, and embolism in younger persons. Prodromata such as headache, tingling, numbness, and drowsiness are present in the two former and not in the last.

The *prognosis* of apoplexy depends on the cause, being much more serious in hemorrhage. Death may ensue while the patient is unconscious. Profound coma with complete relaxation of the limbs, involuntary micturition and abolition of all the superficial reflexes, are very serious symptoms, and probably indicate the presence of extensive hemorrhage into the ventricles, the meninges, pons, or medulla. Any increase in the symptoms is usually due to a further hemorrhage, and is of bad omen, while a speedy return of consciousness indicates a favorable issue of the attack. The state of the temperature is a valuable guide in prognosis.

Treatment.—In apoplexy absolute rest is essential; the head should be raised a little, and the clothing round the neck loosened. Warmth may be applied to the extremities, and sinapisms to the calves of the legs are considered to have some effect in lessening the amount of blood in the brain. If there be signs of cyanosis and labored stertorous breathing, with a tense incompressible pulse, venesection is recommended by some writers, but is rarely of much service, and is a mode of treatment now seldom adopted. The bowels should be opened by a drop of croton oil placed upon the tongue. In hemorrhage stimulants are, as a rule, to be avoided, but if the pulse become very feeble they may be required, but should be administered with extreme caution. When the diagnosis of thrombosis or embolism can be made, ether

and ammonia or alcohol should be given if the pulse show any signs of failure, and when this is associated with cold extremities and tendency to collapse purgatives are contra-indicated. The catheter should be passed if there be retention of urine. If the patient be unable to swallow, and the state of unconsciousness be much prolonged, nutrient enemata may be required.

C. E. BEEVOR.

Symptomatic Indications.—Apoplexy from cerebral congestion indicates *aconite*. The pulse is full and strong; the eyes red, sparkling, and prominent, with dilated pupils; the skin hot and dry; the tongue paralyzed, with trembling, stammering speech; great difficulty in swallowing. Dark red or bluish color of the face indicates *belladonna*. The veins of the neck and head are swollen, and the arteries of the neck visibly throb; there is drowsiness, with loss of consciousness and speech; the limbs are paralyzed, particularly upon the right side; loss of sight, smell, and speech; involuntary emission of urine. Apoplexy in persons of sedentary habits yields to *nux vomica*. The guiding symptoms are, swelling and redness of the face; stupefaction, with stertorous breathing; paralysis of the lower jaw, and often of the lower extremities, which are cold and without sensation. Sopor and unconsciousness, with half-open eyes and dilated pupils, indicates *opium*. There is redness, bloatedness, and heat of the face; the respiration is labored, snoring and rattling; convulsive motions of the extremities, or tetanic stiffness of the whole body; slow pulse. Apoplectic seizures in old people, with symptoms of shock, call for *arnica*. The head is hot, and the rest of the body cool; there is paralysis of the limbs, especially of the left side; loss of consciousness, with stupefaction and stertorous breathing; sighing, muttering, and involuntary discharge of fæces and urine. Apoplexy of aged persons and those of intemperate habits indicates *baryta carb.* There is paralysis of the limbs, mostly on the right side, and disturbances of consciousness, with childish gesticulations and inability to keep the body erect. Features spasmodically distorted, the eyes fixed and turned upward; pupils immovable; breathing stertorous, and pulse almost imperceptible; paralysis of the esophagus, so that fluids pass down into the stomach with a gurgling sound, *hydro-*

cyanic acid. Sudden attacks of apoplexy where the patient falls down without any precursory symptoms; eyes staring, or lightly closed; pupils dilated, or contracted, and immovable, slow, feeble, or rattling breathing, *laurocerasus*.

ARCUS SENILIS is the grayish white opaque ring so often seen near the margin of the cornea. As a rule, it commences at the upper part of the cornea and then attacks the lower, two crescent-shaped bands resulting, which gradually coalesce to form a complete ring. There is always a narrow rim of healthy cornea left outside it. The color at first is grayish white, and gradually becomes more opaque as age advances. An arcus is not often seen before the age of forty, and is very rarely absent in old age. When met with in comparatively young people it is by some regarded as an indication of a tendency to fatty degeneration of other parts of the body, especially of the heart and arteries. But the connection between arcus senilis and fatty heart is extremely dubious. The appearance is due to a fatty degeneration of the cornea, and is almost invariably symmetrical, though occasionally more marked in an eye which is the subject of long-standing disease. It is not a condition calling for treatment.

ARSENIC, POISONING BY.—Metallic arsenic is not poisonous, but arsenious acid or white arsenic is highly so. It is a white crystalline or powdery substance, very insoluble in water, and is therefore usually administered in the solid form in cocoa, arrowroot, gruel, etc.; the addition of an alkali or an alkaline carbonate increases its solubility.

Acute poisoning.—The *symptoms* generally appear after an interval, which may be half an hour or an hour, and consist of a burning pain in the mouth extending to the stomach, nausea, vomiting, great thirst, and hoarseness; the abdomen is tender and may be swollen; and vomited matters may be white or black, if the powder had been mixed with soot; or blue, yellow, or green, if mixed with indigo. Diarrhea and tenesmus are usually present, with burning pain in the intestines and excoriation of the anus. Difficulty of breathing and frequent painful micturition are sometimes complained

of. Death may occur within twenty-four hours, or the symptoms may be less severe and there may be remissions. In this variety nervous symptoms, such as cramps, tremors, or even general convulsions, are sometimes met with. In other cases, the irritant symptoms are almost wholly in abeyance, faintness being the chief or only symptom. In cases that do not prove fatal, local paralysis in one or more of the limbs may persist after recovery from the gastric and abdominal affection. The above constitute the symptoms when the poison has been given in one large dose, but it is frequently administered in small and repeated doses. The chief symptoms then will be severe, and continued ill-health for which no cause can be assigned, a liability to vomiting, especially after each meal, or after a particular meal each day, and marked emaciation. Numbness, tingling in the limbs, conjunctivitis, intolerance of light, eczema, and falling off of the hair, are among the minor symptoms in such cases; the patients are irritable and depressed, and sometimes suffer from a general paralysis, closely resembling that due to alcohol; when a complete change of the surroundings is effected, the symptoms disappear.

Post-mortem appearances.—The mucous membrane of the stomach is almost always deeply congested and ecchymosed, rarely ulcerated; it may be smeared with a thick white or yellow paste, the color being due to the formation of a sulphide of arsenic. The duodenum, and sometimes the whole alimentary track, is usually inflamed; the rectum seldom escapes. The mucous membrane of the mouth and esophagus will be found inflamed and whitened. Should the patient have survived some days, fatty changes will be found in the liver and kidneys, and the spleen will be enlarged and soft. The blood is fluid. Arsenic prevents decomposition, and, in bodies that have been buried for some time, it will often be quite possible to make out most of the above signs in cases of arsenical poisoning.

Treatment.—The stomach-pump can only be used when the patient is seen within a very short time of swallowing the poison; vomiting should be encouraged, and milk and albuminous drinks, such as white of egg, barley water, linseed tea, may be administered

by the mouth. When the poison has been given in solution, and the patient is seen early, some freshly prepared ferric hydrate may be given as an antidote. This is made by precipitating tincture of perchloride of iron by carbonate of sodium and filtering. It should be given in hot water and in large quantities, or dialysed iron in doses of one ounce may be given repeatedly. By these means an insoluble ferric arseniate is formed. Diluents should be given freely, and if there be much prostration stimulants will be required.

Chronic poisoning.—There are other preparations of arsenic which may be dangerous; of these, the most important is the aceto-arsenite of copper or emerald green, which at one time was largely used in the manufacture of wall-papers and artificial flowers. An arsenical wall-paper is usually, but not necessarily, green. The danger from such a paper is diminished by varnishing and glazing. Those who suffer most are the paper-makers, the paperhangers, and the people who inhabit the rooms so papered. The symptoms are those of general indisposition, coming on very gradually, but steadily progressing; headache, nausea, and languor being succeeded by coryza, cramps, pain and tenderness in the abdomen, and a marked degree of cachexia. Paperhangers are liable to eczema about the root of the nostrils, the backs of the ears, bends of the elbows, insides of the thighs and scrotum. Removal of the exciting cause is sufficient to effect a speedy cure.

ARTERIES, DISEASES OF.—

Arteritis.—Several varieties of *arteritis*, or inflammation of arteries, may be distinguished.

1. **Plastic arteritis.**—By this is meant the sum of the processes leading to the healing of a wound in an artery. It is characterized by exudation of plastic lymph, and its subsequent organization. According to circumstances, this lymph either seals a wound in an artery, closes the end of a divided vessel, or infiltrates a thrombus, and occludes some extent of the lumen of the tube. In the majority of cases it is associated with similar processes in the sheath of the vessel. The causes of this form of arteritis are non-infective emboli; wounds and contusions of, and the application of a ligature to,

arteries. In the majority of cases it is strictly a conservative process, giving rise to no symptoms, and requiring no treatment.

2. **Suppurative arteritis** is a more intense form of inflammation, excited by a powerful irritant. The disease may start from the interior, being occasioned by the presence of an infective embolus or thrombus, or from the exterior, as the result of the extension of acute suppurative inflammation from surrounding tissues. In extreme cases the vessel is destroyed. When only softening of the vessel is occasioned, it is liable to be followed by a bulging of the wall and aneurism. If the coats of the artery ulcerate, hemorrhage occurs, unless a clot in the vessel extends beyond the area of ulceration.

3. **Chronic endarteritis; arteritis deformans; atheroma.**—These names denote a chronic subinflammatory disease of the arteries which is so common in old persons as to have been regarded as a constant effect of old age.

Causes.—*Mechanical strain* upon the larger arteries is the best established cause of atheroma, hence it is more common in men than in women, and in those whose occupation is laborious, and exposes them to sudden and severe or prolonged effort. *Alcoholic excess* is another well-established cause, which probably acts through the strain put upon the large arteries when the heart's action is excited. *Plethora* acts in a similar manner. The *obstruction* to the flow of blood through the arterioles, caused in chronic Bright's disease by arterio-capillary fibrosis or spasm, increases the tension in the larger arteries, and predisposes to atheroma. *Gout*, by causing renal disease, is frequently associated with chronic endarteritis. *Syphilis* has been asserted to cause atheroma, but the proof of this is not complete. Atheroma is essentially a disease of later life, coming on with the decline of general nutritive vigor. The effect of strain is well shown by the frequency of the disease where arteries are in contact with bone, as along the back of the descending aorta, at the brim of the pelvis, and in the ham, and also around the mouths of the lateral branches of arteries.

Pathological changes.—These commence and are most marked in the tunica intima, which becomes thickened by an overgrowth of its deeper layers, consist-

ing of cells and intercellular laminæ. The middle coat is often not at all affected, but it may be thinned or invaded to some extent by the new tissue of the intima. Changes in the adventitia are more common, consisting of a fibro-cellular thickening which becomes more and more fibroid. The thickening of the intima occurs first in small isolated streaks and patches, and around the orifices of lateral branches of the artery. The affected areas grow at the edge, and usually coalesce with others in their neighborhood, so that ultimately large areas of a vessel may be involved in the disease. The patches are raised above the surface, are of a glistening, semigelatinous appearance, and a firm consistence. Very soon they become yellowish in color, owing to the fatty degeneration, which is a constant change in atheroma. If this advances rapidly, the disintegrated tissue, consisting now of fatty granules, minute oil drops, and cholesterine crystals, forms a so-called "*atheromatous abscess*," shut off from the vessel by a thin pellicle of intima. This pellicle may be ruptured, and the contents of the "abscess" are then washed into the blood current, and probably block up some small arterioles and capillaries, but, not being injective, give rise to no acute changes in the tissues in which they lodge. An "*atheromatous ulcer*" is then left. In other cases the fatty degeneration of the inflammatory products is unattended with softening, and they persist in the form of raised firm yellow patches. In this tissue lime salts are frequently deposited in the form of plates, which may attain a considerable size.

The calcareous plates are at first covered with the innermost layers of the intima, which are liable to be disintegrated and washed away, and sometimes the edge of a plate is exposed in the vessel. In these cases more or less extensive clots of fibrin may form on them ("thrombosis"); or portions of them may be subsequently detached by the current of blood, and carried into some smaller vessel ("embolism").

Distribution.—Atheroma is most frequent in the aorta and the large arteries. It is less common in the small arteries, excepting those at the base of the brain; it is more common in the arteries of the lower limb than of the upper, and in the splenic artery than in any other artery of

the abdominal viscera. It attacks especially the curved parts of arteries and the spots in contact with bones, and frequently is very marked around the apertures of lateral branches.

Effects.—The most constant effect is a *loss of elasticity* in the vessel, which entails a loss of the propelling force of the heart, and renders the vessel liable to yield under the pressure of the blood, and to become elongated and dilated. The dilatation may pass on to the development of an *aneurism*. The occurrence of *thrombosis* and *embolism* has already been noticed; either of these may lead on to *gangrene*. Arteries thus diseased are more liable to *rupture* under the influence of injury than are healthy vessels, and when the affection is far advanced it interferes with the healing of wounds in arteries, and in the distension of arteries which occurs in the establishment of an anastomotic circulation.

Signs.—Well-marked atheroma can be recognized by the elongation and tortuosity of superficial arteries, such as the temporal and the brachial, and by the too marked “locomotion” of the vessel with each pulse wave; the arteries are also less compressible than normal.

4. Syphilitic arteritis.—The disease is best known as it affects the smaller arteries, especially of the brain and other viscera. The vessels become thickened, indurated, and irregular in outline. The adventitia shows a moderate amount of a delicate cellular infiltration. The tunica media is generally unaffected; occasionally it is involved by an extension of the disease in the intima. But it is in the intima that the changes are most marked and most characteristic. This coat is enormously thickened, even to the degree of complete occlusion of the vessel. Fine nuclei and cells appear beneath the endothelium, which multiply and enlarge, and at the same time become separated by fine fiber cells and fibers; as the disease progresses a tissue-like loose granulation tissue is formed, which tends to become more fibrous: new capillaries are developed in it which communicate with the vasa vasorum. The lumen of the artery is narrowed, generally distorted, often converted into a mere slit, and may be entirely obliterated either by the progress of the disease or by the formation of a thrombus. The process is throughout chronic and recurrent.

5. Obliterating arteritis.—By this name is known a chronic disease of the intima of arteries, which gradually leads to an obliteration of the vessel. It occurs independently of syphilis, or of other known dyscrasiæ, and probably spreads from the smaller to the larger arteries of a part. It is a very chronic disease, and at first causes severe aching pains, with coldness of the region affected. When the larger vessels are implicated, they are felt to be hardened, at first with a diminished pulse, and then pulseless; subsequently they undergo shrinking. The part is cold, livid on exposure, wasted, and gangrene may occur. The pain may be intense, and at the period of greatest severity pyrexia may be noticed. The disease is a very rare one; it has been noticed in both the upper and lower limb, chiefly in persons of middle life; its cause is unknown, and no special treatment has been recommended for it.

Calcification of arteries.—Calcification is a frequent termination of atheroma, large flat plates often being found in the aorta and other large vessels. This variety is known as *laminar calcification*. Calcareous degeneration is also met with as a primary change affecting the middle coat of arteries of the third and fourth magnitude. The lime salts are deposited in the muscular fiber-cells, and as these run circularly round the arteries, calcareous rings are formed, and hence this variety is named *annular calcification*; when, by the extension of the degeneration, adjacent rings are welded together, it is known as *tubular calcification*. This disease is often associated with atheroma in the larger arteries; it occurs symmetrically, and is a senile change. It can be recognized by the rigidity of the vessels under the finger, and by the irregularities which are felt when the finger is passed along the vessel. By lessening, and then destroying, the elasticity of the arteries it impedes the circulation through the capillaries, and when advanced the lumen of the vessel is narrowed by the thickening of the middle coat. The intima is liable to become detached, owing to the interference with its nutrition by a rigid barrier between it and the vasa vasorum in the adventitia; when this occurs thrombosis is likely to follow; and if from this or any other cause an artery is obstructed, the rigidity of the surrounding vessels greatly impedes the establishment of an

anastomotic circulation. The common effects of the degeneration are coldness of a part, and slow wasting; ill-defined pains are sometimes assigned to it. Its real importance is in connection with senile gangrene, arterial thrombosis, and the establishment of anastomotic circulation.

Occlusion of arteries in their continuity.—*Causes.*—An artery may be occluded as a result of injury or disease. It has already been stated that complete division of an artery or an extensive wound in it is followed by the permanent closure of the vessel. The partial or complete rupture of an artery, or the application of a ligature to it, has the same effect. Arteritis obliterans slowly accomplishes the same end. Disease of the vessel leading to the formation of a thrombus, or the impaction of an embolus brought from a distance, also leads to the closure of an artery, unless suppurative arteritis is excited. Arteries are also often occluded by the pressure of tumors or of contracting cicatrices.

Effects.—The simplest case in which to study the effects of arterial occlusion is that of the ligature of a vessel in its continuity. The first effect is a blanching of the part with a loss of all pulsation in the arteries arising below the ligature. The part quickly becomes cold and benumbed, and if from the extent or position of an arterial obstruction, or from disease of the vessels, an anastomotic circulation is not established, the part dies, undergoing the changes described as “dry” gangrene. More usually blood is carried into the empty vessels by the numerous arterial anastomoses that exist almost universally in the body. When this first occurs all the communicating vessels participate; but gradually certain special channels enlarge, often considerably, and serve as the main channels for the blood, while the others contract to their normal size. The temporary deprivation of blood causes the vessels beyond the ligature to yield to the pressure of the blood first brought to them through the anastomosing channels, and thus the pallor and coldness first noticed are followed by increased redness and heat in the part; which gradually subside as the tissues resume their full vitality. Finally, the part is generally left a little shrunken and cold, owing to the blood supply being below the normal. If vessels are very atheromatous, or are

calcified, they are unable to undergo the required enlargement; and when a considerable extent of a vessel is obstructed it may be impossible to carry blood into the parts below the obstruction; in these cases “dry” gangrene occurs. When venous obstruction is superadded, the force of the heart, which is largely dissipated in propelling the blood through the anastomosing arteries, may be unable to accomplish the return of blood from the part; in that case “moist” gangrene results.

Symptoms.—When due to embolism this occurrence is often marked by an acute pain, and the empty vessels beyond may be tender to the touch; the sudden occurrence of the occlusion, the absence of other causes, and the detection of some source of the embolus such as valvular disease of the heart, are the factors in the diagnosis. When due to a thrombus, the symptoms come on soon after a contusion of the artery or in connection with advanced disease of the vessel; when due to the pressure of tumors, the arterial occlusion is gradually brought about, and the loss of the pulse in the vessels follows upon its slow diminution in force and volume. When this is the case the effects of the arterial occlusion may be slight, or nil.

Treatment.—The limb or part should be placed in the position most favorable for the circulation of blood, should be carefully protected from all sources of irritation, and should be lightly swathed in cotton wool.

Symptomatic Indications.—*Aconite.*—Acute arteritis; febrile symptoms. *Arsenicum.*—Chronic aortitis; emaciation; debility. *Phosphorus.*—Atheroma; primary fatty degeneration. *Plumbum.*—Atheroma; general chronic endoarteritis. *Spigelia.*—Pain of chronic aortitis, resembling that of angina pectoris. *Secale cornutum.*—Senile gangrene.

See ANEURISM.

ARTERIES, LIGATURE OF.—

Arteries are tied either in the continuity or at a point wounded or severed.

1. *Ligature in the continuity.*—Operation generally done at a point selected, 1, because it is not too near a diseased part of the vessel (*e.g.*, an aneurism); 2, it is not so far off an aneurism that collateral circulation would at once nullify the operation; 3, it is not close to the origin of a large branch, the rush of

blood through which would prevent coagulation and secondary hemorrhage.

Operation.—Learn well the superficial and deep landmarks, and the anatomy of the part. Mark out the vessel's course. Incise the skin and superficial fascia equally and sufficiently. A director may be used for the deep fascia. Avoid superficial veins; avoid opening sheaths of muscles. "The surgeon should not at the commencement occupy himself with looking for the artery, but should seek the first marked point of guidance, then the second, then the third, and so on to the end" (Bryant). Handle of knife will push muscles, etc., aside. Retractors. Feel artery pulsate. Opening in sheath to be small, and made with knife-blade held on a plane just superficial to the artery, that is, "on the flat." Insinuate aneurism-needle round artery. Draw out ligature with forceps. In tying, press down knot with tips of fore-fingers; do not lift vessel from its bed. Cut one end of a silk ligature short, and both ends of a catgut one. Close wound and dress. Before actually tying ligature, make sure that you have surrounded the artery, the whole artery, and nothing but the artery. Needle should be passed between the artery and its vein.

Process of repair, etc.—The two inner coats are divided by the ligature and retract a little. A clot forms up to the nearest branch. Lymph is effused around the ligature. In the most favorable cases the lymph and the clot organize; and the cut arterial coats grow together, so that when the outermost coat is ulcerated through, a new barrier has been formed against hemorrhage. But these processes may wholly or partially fail. Then there is more or less danger of secondary hemorrhage.

Dangers.—Secondary hemorrhage from above cause, or from suppuration. Gangrene, from non-establishment of collateral circulation, from injury to, and consequent coagulation in, the vein, or from suppuration of an aneurismal sac. Erysipelas and other accidents to which all wounds are liable.

2. *Ligature of an artery open in a wound.*—Be careful not to include neighboring nerve. Reef-knot. Hemp, silk, and catgut ligatures. Carbolized catgut is absorbed or organized, and scarcely, if at all, acts like a foreign body in a wound.

One end of a hemp or silk ligature must be left hanging out of the wound.

Axillary.—Very rarely tied. Line of artery, from just internal to coracoid process, curving outward and downward to commencement of brachial artery. Divide skin and pectoralis major. Beware of vein and brachial plexus.

Ligature of special arteries.—*Abdominal aorta.*—First method: incise the abdominal wall as in ovariectomy; divide the peritoneum covering the aorta, and pass the ligature. Second method: make an incision like that for ligature of common iliac, and proceed as if for ligature of that vessel, but keep a little higher. Doubtful whether operation is ever justifiable. For details, *vide* larger works.

Brachial.—In middle of upper arm. Line of incision, inner edge of biceps. Avoid basilic vein and internal cutaneous nerve; open deep fascia; look out for median nerve; artery usually lies just beneath it, but may be superficial to it. Remember occasional high division of brachial.

Carotid, common.—Position: head back, face turned away at first. Place of selection—just above omo-hyoid (*i. e.*, level of cricoid cartilage). Line of artery, sterno-clavicular articulation to midway between mastoid process and angle of jaw; incise skin along anterior border of sterno-mastoid three inches; platysma; deep fascia. Raise head, relax and retract sterno-mastoid; look for omo-hyoid; carotid sheath with descendens noni. As a rule, jugular vein and vagus nerve not seen. In tying artery low down, divide partially sterno-mastoid, sterno-hyoid, and sterno-thyroids. *Fatality.*—40 per cent.; in ordinary cases one in three. When operation is for hemorrhage, 56 per cent. die. When for aneurism, on Brasdor's method, only one in four. For affections of the nervous system, only one in thirty-four. *Chief dangers.*—Brain symptoms and secondary hemorrhage.

Carotid, external and internal.—Ligature of common carotid preferred. For external carotid proceed as follows: line of incision same as for common carotid; incision from angle of jaw to thyroid cartilage; freely incise any glands which may be in the way; tie and divide cutaneous veins; look for hypoglossal nerve; tie the artery between origins of supra-thyroid and lingual arteries.

Femoral.—The common femoral rarely

tied; ligature of external iliac preferred. Incise in line of artery; crural branch of genito-crural nerve; open sheath; tie about one inch below Poupart's ligament; pass needle from within outward.

Superficial femoral tied in two places:
 1. At apex of Scarpa's triangle. Position: abduction and rotation outward; knee flexed; line of artery, from middle of Poupart's ligament to front of inner condyle; incise skin 3 to 4 inches at junction of upper and middle one-thirds of thigh; divide fat; avoid saphena vein; divide fascia lata well to inner side of sartorius, so as not to open sheath of that muscle; retract sartorius outward; feel for sheath of artery; branch of ant. crural over sheath; open sheath; clean artery with point of director; pass needle from inner side.
 2. In Hunter's canal. Done when operation in Scarpa's triangle fails. If done at lower end of Hunter's canal, draw sartorius to inner side; incision in the same line as when artery is tied in Scarpa's triangle, but longer, and of course lower down thigh. Other steps similar to first operation. *Fatality.* One in four. Syme was successful twenty-three times in succession.

Iliac, common.—Line of artery; from half-inch to left of umbilicus to middle of Poupart's ligament. Incision from end of last rib downward and forward to crista ilii, and then forward above and parallel to crest of ilium as far as antero-superior spine; divide muscles and transversalis fascia, using finger as a director; roll up peritoneum and intestines out of way, and tie artery. Second method; incise skin first from outside internal abdominal ring, parallel to Poupart's ligament, three or four inches toward ant. sup. spine of ilium; then continue incision with a curve inward toward umbilicus, and proceed with muscles and transversalis fascia much as in first method. Remember relation to veins, ureter, and spermatic vessels. *Fatality.*—Very great—twenty-five in thirty-two. Chief causes: exhaustion and hemorrhage.

Iliac, external.—Line of artery same as common iliac. Incise skin half an inch above Poupart's ligament from just external to internal abdominal ring outward in a curve three inches long, and parallel to the ligament; divide muscles and transversalis fascia carefully; push up peritoneum; separate artery from vein; pass needle from within outward; the

higher up the artery is to be tied, the farther must the outer end of the incision be extended upward and inward, the incision thus becoming like that for the common iliac. Beware of seven dangers: 1, wound of epigastric artery; 2, wound of spermatic cord; 3, laceration of peritoneum; 4, puncture of external iliac vein; 5, of circumflexa ilii vein; 6, ligature of genito-crural; 7, too free disturbance of subperitoneal cellular tissue. *Fatality.*—One in three. Chief causes: gangrene, hemorrhage, and peritonitis.

Iliac, internal.—Steps of operation as for common iliac. Trace internal iliac from bifurcation of common iliac; scratch artery clean with finger-nail and director; pass ligature three-quarters of an inch from origin. Beware of ureter, vein, and peritoneum. *Fatality.*—One in two.

Innominate.—Incision along anterior border and sternal end of sterno-mastoid, divide as much of sterno-mastoid as may be necessary to expose carotid, and trace carotid downward to innominate. *Fatality.*—Only one case has recovered. In it the carotid and vertebral were also ligatured (Smyth's case).

Lingual.—Line of artery just above greater cornu of hyoid bone; incision horizontal, with center opposite end of greater cornu of hyoid bone; look for hypoglossal nerve, artery crosses beneath it; divide hyo-glossus muscle from hyoid bone; artery is thus exposed. *Object.*—Usually to check hemorrhage from center of tongue.

Radial.—Line of artery; from inner side of biceps tendon at bend of elbow to half an inch internal to styloid process of radius. Ligature in upper third; incision in line of artery. Separate supinator longus from pronator teres, and tie. Lower third: divide skin and deep fascia to outer side of flexor carpi radialis.

Subclavian.—Tied only in third part of its course. Raise patient on a pillow, head back, face turned away, arm pulled down; incise along clavicle, pulling skin down over it; divide border of sterno-mastoid if necessary; deep fascia; retract external jugular; separate vessels and cellular tissue beneath deep fascia without using knife-blade; feel for scalene tubercle and scalenus anticus. Subclavian lies behind them; brachial plexus and subclavian vein; pass needle from below upward. *Fatality.*—Nearly

one in two. Chief causes : hemorrhage, gangrene, intrathoracic inflammation, "sloughing or suppuration of aneurism."

Tibial, anterior.—Line of artery ; from head of fibula to midway between two malleoli. Upper or middle third ; divide skin in line of vessel ; look for a white line in deep fascia, marking outer border of tibialis anticus ; divide the line and separate tibialis anticus from ext. long. dig. above, and from extensor prop. poll. below ; nerve superficial ; patient should put tibialis anticus into action before anæsthesia. Lower third : artery nearly superficial.

Tibial, posterior.—Upper half : two methods—First (Guthrie's), perpendicular incision, six inches long, through middle of gastrocnemius, soleus, and deep (sub-muscular) fascia ; artery lies on tibialis posticus ; nerve crossing superficially and obliquely from within outward. Second method : incision three-quarters of an inch behind and parallel to posterior border of tibia, down to tibial origin of soleus. Separate soleus from bone, divide submuscular fascia, and find artery immediately beneath it.

Near ankle.—Artery lies beneath thick deep fascia, rather nearer malleolus than heel. Incise over it.

Ulnar.—Line : from middle of bend of elbow, curving inward slightly, to outer side of pisiform bone. Upper half : incise obliquely over course of vessel and well to inner side of arm ; find outer border of flex. carpi ulnaris ; divide it from flex. sublimis, and find artery between superficial and deep flexors ; inner border of flexor sublimis may be found in thin people by putting that muscle in action.

Above wrist.—Divide skin and deep fascia just outside tendon of flex. carpi ulnaris. Nerve on the inner side,

C. B. KEETLEY.

ARTERIES, INJURIES OF.—The injuries of arteries may be considered under the heads of :

Contusion.—The severity of this injury varies greatly. In the slightest case there is no gross change produced in the vessel, and no immediate effect, but the vital properties of the intima are so altered that in a few hours or a day or two the blood gradually coagulates at the injured spot and blocks it up. The only evidence of such an injury is the occlusion of the

artery, coming on not at once, but at an interval after the injury. When the contusion is more severe the brittle inner and middle coats are torn across and curl up inside the adventitia. The blood then coming in contact with tissues uncovered with intima speedily coagulates upon the ends of the torn coats, and the clot extends until the blood channel is completely blocked. This condition is marked by arrest of pulsation at a particular spot in an arterial trunk, coming on immediately after an injury.

When the contusion is more severe still, not only are the two inner coats divided and curled up, and a clot formed upon them, but the adventitia may be severed, and so crushed that its elasticity is destroyed, and it falls over the end of the plugged vessel ; or without division of the vessel, its outer coat may be so bruised that its vitality is destroyed and the dead part is separated and its place occupied by new living tissue.

Treatment.—This resolves itself into the preservation of rest for the artery, its protection from injury, and attention to the parts deprived of their direct blood supply.

Laceration deserves a separate notice, because its effects upon the arteries are so special. When a vessel is overstretched to the point of laceration, the brittle inner and middle coats quickly snap and curl up within, while the outer coat is drawn out, stretched beyond the play of its elasticity, so that after it snaps across its ends fall over those of the vessel. It thus happens that even the largest arteries may be torn across without the occurrence of hemorrhage, and it is a well-known fact that lacerated wounds are particularly free from bleeding. No special *treatment* of the laceration is required.

Wounds.—When an artery is completely severed its cut ends contract and retract within the cellular sheath of the vessel in a way that will be further spoken of when describing the natural arrest of hemorrhage. When an artery is completely severed, and the wound is transverse to the axis of the artery, it gapes widely ; when the cut is longitudinal its edges do not gape, and blood escapes only or chiefly during the ventricular systole ; when the wound is oblique it is intermediate in character.

Hemorrhage is *the* symptom of a

wounded artery. A fine puncture may be inflicted upon an artery without causing any bleeding. The nature of the wound in the soft parts has a considerable influence upon the effects of a wound of an artery. Where it is a simple incision, the blood escaping from the artery is freely spurted from the wound, but when it is of the nature of a punctured wound or a valvular incision, the blood cannot thus freely escape, and it tends to infiltrate the cellular tissue of the part, along which it may spread for a great distance. If the external wound is closed while the bleeding from the artery continues, this tendency is greatly increased. In this case the injury is similar to the subcutaneous rupture of an artery. When the infiltrated blood is in small quantity and does not form a distinct tumor, it is known as an *extravasation* or *sugillation*; when it forms a distinct tumor but the communication with the artery is closed, it is a *hematoma*; and when the communication between the artery and the blood tumor persists it is a *traumatic aneurism*.

When an artery is divided completely across, the parts to which it is distributed are at once deprived of blood. But, owing to the free communications between the small arterioles, blood is quickly poured into the empty vessels from neighboring ones in which the circulation is uninterrupted. The complete division of an artery also stops the pulse in the vessel beyond and in its branches; when, however, an artery is only wounded, and not completely severed, a certain amount of pulsation may still be detected in it and in its branches beyond.

The complete division of an artery leads to its complete occlusion; but a small wound in a vessel, one extending not more than one-quarter of its circumference, may be healed up without occluding the vessel, plastic lymph first sealing up the wound and then firmly cicatrising it.

A. PEARCE GOULD.

ASCITES (Dropsy of the Peritoneum).—Ascites may be part of a general dropsy, the result of disease of the heart or kidneys, or it may be of local origin. In cardiac disease it depends upon the failure of the pumping action of the heart, by which the peritoneum—a large lymph space—is kept dry; in renal disease it results from more complex and obscure

causes, in which the following factors co-operate: (1) Accumulation of water in the blood from failure of the kidneys to secrete sufficient urine; (2) increased outflow of watery lymph from the capillaries, partly from the altered state of the blood, partly owing to increased permeability of the vessels, the consequence of an alteration in their walls. Experiments on the production of dropsy by artificial rendering of the blood more watery shows that dropsy of the peritoneum invariably followed.

Ascites of local origin results from (a) an obstruction to the portal circulation, or (b) some affection of the peritoneum itself—*e. g.*, chronic inflammation, tubercle, or malignant disease. Obstruction to the portal circulation is the most common cause, and is generally due to atrophic cirrhosis of the liver (*q. v.*). In some cases of cirrhosis, owing to the development of a collateral venous circulation, no dropsy ensues, but this is exceptional.

In rare instances ascites is caused by blocking of the portal vein from thrombosis or from the presence of an enlarged gland in the hilum of the liver.

Chronic inflammation, tubercle, and cancer cause effusion of fluid by blocking the lymph paths by which it is normally removed from the cavity, while at the same time there is an increased outflow from the capillaries.

In simple dropsy the fluid in the peritoneal cavity is clear yellow serum, which coagulates on standing. It usually contains more water and less albumen than the fluid in the pleura and pericardium, but less of the former and more of the latter than that in the subcutaneous tissues. In renal dropsy it often contains urea. In inflammation, tubercle, and malignant disease the fluid is turbid, highly albuminous, sometimes quite viscid, and contains shreds of lymph, fragments of new growth, and may be tinged with blood. In simple dropsy the peritoneum is opaque-looking from œdema of its endothelium. In chronic inflammation it is swollen, softened, and covered with lymph, and in tubercle and malignant disease it is studded with these growths. Chronic inflammation may originate from changes in some abdominal or pelvic organ, inflammation of the uterine appendages being a common cause. In cases of ascites of long

standing, the result of portal obstruction, the peritoneum, including its reflexion over the liver, is often found covered with a thin white membrane, which can be peeled off from its surface, and which, when held to the light, is seen to possess a finely fibrous texture. The portion removed from the surface of the liver—*e. g.*, in a case of atrophic cirrhosis—may be fenestrated, the apertures corresponding to the nodules. By some this condition is regarded as primarily a perihepatitis, but more probably it is the result of a slight chronic peritonitis caused by the presence of the fluid, as a precisely similar condition of the pleura is seen in long-standing hydrothorax. Tubercle may be primary, or secondary to tubercle elsewhere; it is especially frequent in connection with tubercular ulceration of the intestine. Malignant disease of the peritoneum is most often secondary to cancer of the stomach, intestine, liver, or ovary, or to sarcoma of the pleura. Cancer of the peritoneum when primary is usually of the colloid variety.

Signs.—If the quantity of fluid be considerable, the abdomen becomes uniformly swollen. When the patient lies on his back, the fluid gravitates to the flanks, so that there is a convex curve from the costal border to the iliac crest, and on percussion the note in the flanks is dull, while in the umbilical region it is clear. On turning the patient on his side, these phenomena are reversed, a clear note being elicited in the flank which is uppermost, while the area of dullness on the lower side rises into the umbilical region. When the walls of the abdomen are tense, a *percussion wave*, usually termed “*fluctuation*” (*q. v.*), may be felt by laying one hand lightly on one flank, the patient lying on his back, and tapping with the fingers of the hand on the opposite side.

Treatment.—This must depend upon the nature of the case, and forms part of the treatment of special diseases which are discussed elsewhere. Fluid in the peritoneum is best removed by *paracentesis* (*q. v.*), and the repeated performance of that operation may sometimes lead to a cure of the condition, even though the original cause, *e. g.*, cirrhosis of the liver, remain.

If the amount of effusion be insufficient to justify operation, its removal may sometimes be effected by the administra-

tion of purgatives and diuretics. The use of bitartrate of potash electuary is sometimes very successful—*R* Potassii bitartratis 3 ss, mellis 3 j; sig. a teaspoonful to be taken every two hours till the bowels are freely moved. Or it may be combined with jalap—*R* Potassii bitartratis 3 ss, pulveris jalapæ grs. x, mellis 3 j; sig. a teaspoonful to be taken every two hours till the bowels are freely moved. This treatment can be persevered with daily, but is apt in some cases to cause gastric derangement.

The use of hydragogue cathartics, such as elaterium (gr. $\frac{1}{8}$), gamboge (gr. j), colocynth (gr. j), is not free from danger.

Diuretics are of little use when the ascites is excessive. The venous pressure seems to be too great to allow them to act. In cases of moderate effusion, however, the resin of copaiba in doses of 10 to 15 grains is often of service.

Several cases of tubercular peritonitis with effusion have recently been successfully treated by laparotomy and washing out the peritoneal cavity. A trial of this method should therefore be made in suitable cases.

ROBERT SAUNDBY.

Symptomatic Indications.—As ascites is but a link in a chain of morbid changes the dropsical condition is to be regarded as but one of the symptoms which indicate the remedy, and a selection made only after a careful consideration of the whole morbid condition. When the remedy has been chosen it should be given a thorough and continued trial. In the majority of cases dependant upon lesions of the kidneys, *apis mel.* will prove curative. The urine is scanty and dark, with the appearance of coffee grounds. There is thirstlessness; great soreness of the abdominal walls, and stinging, burning pains in different parts of the body. *Apis* is also indicated in ascites in complication with uterine tumors and inflammatory processes of the bowels, or after scarlet fever or peritonitis or pleuritis. *Arsenicum*, a frequently indicated remedy, is very valuable in ascites from enlargement of the liver or spleen, or from cardiac weakness. Where *arsenicum* is indicated there will be found debility, emaciation, pale earthy or greenish color of the face, constant burning thirst, though the patient drinks only in small quantities; suffocative spells, particularly at night. *Apocynum cann.* is useful in

ascites from cardiac or portal derangements. The guiding symptoms are sinking feeling at the pit of the stomach; irritability of the stomach, cannot retain any food, or even water; muddy urine; bloatedness of the face when lying down, passing off after sitting up. *Aurum met.* in persons of a scrofulous diathesis, when there is functional disturbances of the abdominal organs, in combination with albuminuria. Ascites of hepatic origin. *Cinchona*: ascites after intermittent fever, or loss of blood or exhausting discharges. Organic disturbance of the liver and spleen. Where *digitalis* is indicated the pulse is small, feeble, and irregular; the face pale; the lips livid, and there is much dyspnœa. The abdominal swelling has a doughy feeling, yielding easily to the pressure of the fingers. *Helleborus*: in acute cases; after scarlet fever; drowsiness; slow answering questions; frequent, scanty micturition.

ARTIFICIAL RESPIRATION.— See DROWNING.

ASPHYXIA includes all conditions which interfere with the functions of respiration and prevent the due oxygenation of the blood, death, when it occurs, resulting from poisoning by carbonic acid. Asphyxia is the cause of death in most cases of drowning, in strangulation, suffocation, laryngeal obstruction (whether from foreign bodies, new growths, past ulceration, false membrane, œdema, or spasm), acute capillary bronchitis, paralysis of the chest walls or diaphragm (whether from acute or chronic myelitis, or as a sequel of diphtheria), and in mechanical compression of the chest, and also in certain cerebral states, *e. g.*, epilepsy. Death is sudden when the obstruction to respiration is at once complete; when incomplete, it is gradual in its onset. The chief feature in all cases of asphyxia is the lividity, which before death always becomes extreme, being most marked in the lips and tongue, which may become almost black. The eyeballs are prominent, the superficial veins stand out prominently, and the breathing becomes more and more embarrassed and shallow. Convulsive twitchings about the mouth and the limbs are often noticed. The pulse becomes feeble and frequent, but the heart keeps beating after all signs of respiration have stopped.

The *post-mortem appearances* are: intense venous congestion throughout the body, the right side of the heart and venous system being engorged with black fluid blood, the left side of the heart and arteries being frequently empty. The lining membrane of the air passages will be found intensely congested, and the dependent parts of the body will show post-mortem staining.

The *treatment* would consist of tracheotomy when the obstruction was in the larynx or above it, and artificial respiration.

ASPIRATION.—The aspirator is an exhausting syringe, used for drawing off fluids without admitting ingress of air, and in exploring for purposes of diagnosis. The needle should be pressed in with a screwing motion, and the taps should be managed carefully and without hurry.

ASTEATOSIS CUTIS is a condition of diminished sebaceous secretion as the result of which the skin becomes dry, scaly, and often fissured. It accompanies prurigo, lichen, ruber, and other diseases, in which the sweat secretion is usually proportionately diminished, and occasionally occurs as an independent disease, resulting from frequent washing in hard water, or from the use of certain chemicals (laundresses, photographers). The inunction of lanolin or vaselin gives relief.

ASTHENIA is a synonym for debility, a want of strength. It is a relic of an antiquated pathology, which classified all acute diseases into sthenic or those which required antiphlogistic remedies, and asthenic, or those which did not call for such active treatment.

ASTHMA.—Asthma may be considered as a disease, and as a symptom of many different diseased conditions. An asthmatic paroxysm consists of a more or less sudden difficulty of breathing, accompanied by a wheezing noise. The affection may be a pure neurosis, a symptom of bronchitis, or some cardiac or renal affection, or due to direct mechanical irritation of the vagus or its branches. The onset may be sudden. A severe attack has developed in thirty seconds, but more often there are some premonitory

symptoms, not constant for every case, but known by experience to the patient. These are, chiefly, unusual buoyancy of spirits and mental excitement, or depression and a feeling of chilliness, a sensation of irritation in the air passages, vague pains, an itching under the chin, headache, an irresistible sleepiness, flatulent distention of the stomach, and a tendency to pass large quantities of very light-colored urine of low specific gravity. If the attack take place during sleep, the latter becomes disturbed, and the patient wakes with a fit strong upon him. The afternoon, after an early dinner, is a favorite time for an attack. A slight sense of constriction of the chest, a short, dry cough, and a slight wheezing accompanying inspiration are the earliest symptoms; the chest girth is increased, necessitating the loosening of the clothes, and an alteration takes place in the carriage of the body, the shoulders being raised higher than usual.

When an attack is fully developed, the sense of suffocation is terrible. The patient sits up in bed with the elbows fixed and the shoulders raised; sometimes he leans forward, with the hands supporting the head, or with the head thrown back resting on the pile of pillows he is obliged to have at his back; or he stands, perhaps, near an open window with little clothing on but regardless of cold, the elbows resting on some high piece of furniture. Generally the paroxysms are too severe to permit of the slightest exertion; the perspiration pours off the face from the violence of the respiratory efforts, and at the same time the extremities are icy cold. The countenance is anxious and haggard, and generally pale; there is turgescence of the cervical veins, and sometimes pulsation in the jugulars. Speech is almost impossible. There is no rise of temperature during the attack. The pulse is generally small and quick, but is sometimes intermittent, the intermissions taking place at each effort to inspire. The diaphragm is lowered to its maximum, and there is epigastric pulsation. The chest assumes a barrel shape, and is fixed in the position of deep inspiration. The lungs are full of air, but the air cannot be renewed; the chest feels as if bound with iron, and that relief would follow if it could only be cut open. The efforts of the patient to introduce air exaggerate

the condition still more; all the auxiliary muscles which are strangers to ordinary respiration are called into action, but little movement of the chest results. The respirations do not exceed the normal, but expiration is slow and prolonged. During the height of an attack, the wheezing may be either expiratory or inspiratory. The sound is produced in the larynx, the glottic orifice being spasmodically constricted at an early stage of the seizure.

At some places the respiratory sounds are absent; at others a weak vesicular murmur is heard; but these characters change, sounds becoming audible where previously they were absent, and *vice versa*. This paucity of intrathoracic sounds is to be accounted for by the diminished amount of the tidal air. The wheezing sounds produced in the larynx and glottis are heard over every part of the chest, and vary with the amount of mucus in the larynx or tubes. The quantity of secretion is very small, and does not much affect the sounds. At the acme of the attack, the walls of the air vesicles are so tense that nearly all the blood is squeezed out of the vessels, but as the distention diminishes, more blood finds its way into the capillaries; secretion takes place, râles of a moist character are developed, and expectoration is sooner or later established. This consists of tough, semi-transparent pellets of mucus of a pale gray color, resembling boiled tapioca. This character of the expectoration is peculiar to asthma.

To percussion the chest is hyper-resonant throughout, owing to temporary emphysema, which is present in all cases. The supra-clavicular regions are drawn in, the skin appearing quite tense over the extraordinary muscles of respiration, which stand out like thick cords, and the intercostal spaces are also made more apparent. The diaphragm is in a state of tonic spasm, its lowered position in some cases causing enlargement of the abdomen; but retraction is the rule. As exhaustion comes on, the severity of the attack begins to abate, respiration becomes more free, and cyanosis decreases. The mucous pellets above described continue to be coughed up for a day or two after the attack, of which they are the result and not the cause.

The *duration of the attack* is often only from two to six hours, followed by sleep, the patient waking up in perfect

health, or suffering for a day or two from wheezing and dyspnœa on the slightest exertion. But sometimes the attacks have a cumulative character, and continue for four or five nights. The duration of the intervals varies, but there is perfect organic integrity of the respiratory and cardiac functions so long as the asthma remains uncomplicated—a proof of the nervous character of the disorder. The attacks are often most severe in the young, and become less marked as the patient grows older. Unless asthma be banished, habitual catarrh and emphysema are established, and the respiration is no longer free between the attacks. There is permanent emphysema in inveterate cases, and the ordinary complications and consequences follow—viz., chronic bronchitis, dilated right heart, tricuspid incompetency, and dropsy. As these organic changes take place, the peculiar characters of the asthmatic seizure may be gradually effaced. Spasmodic asthma sometimes subsides if the patient develop bronchitis, but, as a rule, the attacks accompany severe chronic bronchitis.

Of the *pathological anatomy* of asthma there is very little to be said, the disease being of a purely nervous character. In uncomplicated cases nothing abnormal is found after death. In some very rare cases the vagus or phrenic nerve has been found altered by the pressure of tumors. Autopsies of long-standing cases disclose the consequences of asthma: viz., emphysema, bronchial catarrh, bronchiectasis, and lesions of the heart and aorta. Death during a fit of pure asthma is almost unknown; the act of dying, so to speak, relieves the spasm, and the attack subsides. Asthma is rarely recovered from, but the progress is always slow, and without any marked influence upon the duration of life.

Pathology.—The theory that asthma results from a spasmodic contraction of the muscular coat of the smaller bronchial tubes has been supported by many writers, while others consider that a spasmodic contraction of the diaphragm is the chief cause. Another theory is that asthma is due to a reflex spasm of all the inspiratory muscles arrested in the act of deepest inspiration, with overdistention of the bronchial tubes and air cells.

Ætiology.—All writers agree that

asthma is a nervous disease, and that the nervous irritation may be central or peripheral. In those subject to asthma there exists an abnormal excitability of the pneumogastric nerves. When this is increased, a very slight cause is sufficient to bring on an attack; at other times it requires some definite and usually easily recognized cause to produce an attack. This sensitive condition of the pneumogastric nerves is above all things dependent upon locality and digestion. In many cases the disposition is hereditary, and often occurs in gouty families. The disease is commoner in the male than in the female. The effects of locality have been supposed to be due to moisture, the production of ozone, or to atmospheric electricity. Certain winds, especially an east wind, act as an exciting cause in some patients. There are many instances of attacks being brought on by electricity.

Indigestion is a fruitful exciting cause; some articles of diet in particular are more obnoxious than others, such as wine, beer, pastry, sweets, and honey. It is a very dangerous thing for asthmatics to go to sleep after a meal before digestion is accomplished; and cold feet, independently of anything else, are said to bring on attacks. Patients suffering from cardiac disease often have well-marked attacks of asthma.

Many vegetable emanations, as from hay, privet, and ipecacuanha, produce attacks in persons predisposed to them; also the smell of certain animals, as dogs, cats, rabbits, guinea-pigs, goats, a sweating horse, or a menagerie. Dust of all sorts may also become an exciting cause, and the dust from blankets is particularly objectionable. Immoderate fits of laughter have often been known to produce a paroxysm. Certain conditions of the mind have also a great effect both in producing attacks of asthma and in causing their sudden relief, such as anxiety, grief, or sudden joy. Often, if the mind can be influenced by some circumstance calculated to produce pleasure and entirely divert the attention, an attack of asthma will pass off. Severe mental strain, as well as absence of employment calculated to interest and excite the mind, are fruitful causes of the continuance and return of many nervous diseases, and among them spasmodic asthma.

Treatment.—The effects of remedies

in asthma are very capricious. During a paroxysm emetics are often very serviceable. Relief is experienced when the first sense of nausea and faintness is induced and before the stomach is emptied. Lobelia also relieves attacks directly its depressing effect is produced. Sedatives and antispasmodics are the most serviceable drugs, and many of them have been used with beneficial results; above all in value is the hypodermic injection of morphia. The objection to it is that, if often used, the dose must be increased; but it is better to increase the dose of morphia than to allow the patient to suffer the agonies of asthma. One-sixth of a grain is at first usually sufficient to subdue the symptoms. Tobacco often gives relief when an attack is threatening, but this drug, in common with others that are directed to be used by smoking, is only available when the attack is not very acute, for, when severe, patients have not breath enough to enable them to smoke. Datura stramonium and datura tatula are both efficacious drugs in some cases, but stramonium sometimes produces intolerable headache. Many proprietary powders, when burnt near the patient and the fumes inhaled, give great relief. The chief of these are Himrod's Powder, Popham's Specific for Asthma, Senier's Asthma Remedy, and Girdwood's Asthma Remedy. Nearly all of them contain some plant of the order Solanaceæ and nitrate of potash. A powder of the following composition is often of great service: Pulv. stramonii $\frac{3}{4}$ j, pulv. seminum anisi $\frac{3}{4}$ ss, potassii nitratis $\frac{3}{4}$ ss, tabaci contriti grs. xxx, a teaspoonful to be burnt and the smoke inhaled. Niter-paper alone is a most valuable remedy and useful in the great majority of cases. It is made by saturating blotting-paper in a solution of nitrate of potash (grs. xxx ad $\frac{3}{4}$ j). Chlorate of potash is added to some papers, but the addition is not an advantage, as the paper then burns too quickly and the fumes become suffocating. Some asthmatic patients dare not go to bed without first filling their chamber with niter fumes; they then sleep in safety. Nitrite of amyl gives temporary relief, but the effect often only lasts for about ten minutes; the dyspnœa then gradually returns. Iodide of ethyl is also reported to have been useful in some cases; in others it aggravated the attack. Chloroform never fails

to subdue a paroxysm, but its effects are as evanescent as the drug. Ether, in the form of Hoffman's Anodyne, often gives partial relief, and chlorodyne is often found useful. Hydrate of chloral has been tried, but with contradictory results. Stimulants are sometimes of value, but usually asthmatics do not bear alcohol well in any form. Coffee is a very old remedy, but, if not taken on an empty stomach, it may impede digestion, and do harm rather than good. Citrate of caffeine has recently been found efficacious in doses of from 1 to 5 grains. The condensed-air bath has been known to relieve an asthmatic attack in patients suffering also from chronic bronchitis and emphysema, but in cases of pure spasmodic asthma it has produced a most dreadful sense of suffocation. A rarefied air is sometimes beneficial, but old asthmatics should avoid high altitudes. Electricity is occasionally successful, but sometimes produces attacks in those predisposed to them if used when the patient is in health and breathing freely. It has not yet been decided what form of electricity gives the best results. Iodide of potassium is one of the most valuable drugs in the treatment of asthma; it should be given in considerable doses—grs. x, or more.

Between the paroxysms the general health should be improved, and the tendency to spasm may be diminished by the prolonged administration of small doses of liq. strychninæ, nux vomica, and arsenic. Belladonna, cannabis indica, bromide and iodide of potassium have also been tried, but with varying results. Of course, if the asthma be complicated by bronchitis, treatment must be directed to the relief of that condition. When warning phenomena are experienced, an attack may often be avoided by calming the excitability of the vagus by fumigation with niter-paper, or by smoking tobacco or stramonium. If the patient be robust and suffer from abdominal plethora, a brisk purgative will often suffice, followed by light diet and repose for two or three days. At the commencement of an attack, the patient should be raised, or placed in an armchair; if in bed he should be supported comfortably by pillows, the room warmed, the clothes loosened, and all his wants anticipated. Cutaneous irritation, such as rubbing, the application of a mustard and linseed-

meal poultice to the chest, or simply brushing the hair for a considerable time, is often soothing.

For the avoidance of attacks the most potent influences are locality and diet. As regards locality, each patient must seek out for himself a place that suits him, and the sites vary within very narrow limits; but, when once a suitable locality has been discovered, the effect is permanent so long as the patient remains there. There is nothing haphazard or irregular about this influence of locality; a patient knows that in a certain place he will be well, and that in another place he will have an attack; and if repeated twenty times it is always with the same result. This effect of locality is immediate, and peculiar for each individual sufferer. Careful dieting is necessary for all patients, and especially for those with a gouty diathesis. Dietetic treatment involves the avoidance of all indigestible food, of heavy meals, and late suppers, and particularly of those things which experience has proved to be provocative of attacks.

W. E. STEAVENSON.

Symptomatic Indications.—If given in the commencement, *aconite* will often avert an attack of spasmodic asthma, or a small cup of *coffee*, black, will mitigate a paroxysm. *Aconite* is also useful in the asthma from cold in children, which follows an attack of coryza and sneezing. For the asthma of old people the most useful remedies are *antimonium tart.* and *arsenicum*. The indications for *antimony*, are dyspnœa, coming in suffocative fits, the chest sounding on coughing as if it were full of mucus but none being raised. This remedy is also useful in bronchitic asthma of children. The *arsenicum* is adapted to asthma with debility; chronic asthma, with heart disease, or after catarrh or bronchitis. In spasmodic asthma, with nausea and vomiting, *ipêcacuanha* frequently proves curative, particularly when the attack is accompanied with troublesome cough, and rattling of mucus. The face is pale, the body often stiff, and the extremities cold. By some writers, *nux vomica* is regarded as the best anti-asthmatic remedy, particularly in spasmodic asthma with digestive derangement: asthenia, with imperfect and slow digestion. *Grindelia* frequently gives relief in the spasmodic form; mucous asthma, with

tenacious sputa. Asthma of cardiac origin is frequently relieved by *cactus grand.* The chest feels oppressed as from a weight, with stitches of pain about the region of the heart. When other remedies fail, *kali iod.*, perseveringly, is of great value. Resort may also be had to *cannabis sat.*, in humid asthma; dyspnœa, mucous râles; rattling cough, thick, yellow sputa. *Opium*: in pulmonary spasms, deep stertorous breathing, and suffocative fits.

ASTRINGENTS are substances which produce contraction of the tissues. Internally, they are used to control hemorrhage or to check diarrhea, and act in two ways. The so-called constringents coagulate the albuminous tissues in the mucosa, and thus interfere with the circulation and diminish the amount of exudation through the walls of the vessels; of this class are tannic and gallic acids, the persalts of iron, alum, catechu, kino, krameria, and cinnamon. The dilute mineral acids, acetate of lead and nitrate of silver, on the other hand, cause contraction of the vessels, and so arrest hemorrhage or diminish exudation. Locally, astringents are used to reduce the exuberant granulations of ulcers or are applied to chronically inflamed mucous membranes to diminish secretion. Nitrate of silver, sulphate of copper, and alum are the chief local astringents; they are used in the solid or liquid form, or as a spray.

ASYSTOLISM is a word used to express an inability on the part of the right ventricle of the heart to empty itself of its contents, a condition met with especially in the later stages of nitral incompetence. The term has not come into general use.

ATELECTASIS AND COLLAPSE OF THE LUNGS.—The former term implies the absence of expansion of the lungs at birth—*i. e.*, the retention of the fetal condition; while the latter implies that lung tissue previously expanded has become airless.

Atelectasis occurs in infants congenitally; the respiration of such infants is feeble, and even intermitting; they wail, but do not cry; they show difficulty in sucking; are cold and livid, with weak pulse. A portion of lung is

uninflated; oftenest it is the inferior and posterior portions of the right lung. The lung itself is dark red in color, without crepitation, exuding no bubbles, but sanguineous serum; it sinks in water. The cause is defective nerve energy from pressure. The treatment is tappings and frictions before the cord is cut, to insure thorough expansion of the lungs. Nevertheless, if the first difficulties be overcome, such a child often remains weak, unable to suck properly, with a whining feeble cry, perhaps jaundice, and with poor and very incomplete respiratory action. The general surface is cold. I think it best to wrap such infants in cotton-wool in order to maintain artificially the warmth so much needed. Besides this, stimulating embrocations.

Collapse may be brought about by mechanical hindrance to the entrance of air to the whole or any part of either lung, or by the absence of inspiratory traction. In children a complete collapse of a whole lobe is sometimes found, the lung tissue appearing perfectly airless. This condition is of purely mechanical origin, although formerly supposed to be the result of inflammation, and described as lobular pneumonia.

The commonest forms of mechanical hindrance to the entry of air are:

(a) Obstruction of the upper air passages by a solid body, or by mucus as in bronchitis; pressure from without, as by aneurism, enlarged glands, or any form of tumor; spasm of the circular muscular fibers within the walls of the finer tubes.

(b) Pressure exercised upon the lung by solid, fluid, or gaseous accumulations in the pleural cavity. The condition of the lung in cases of pleural effusion is a result of collapse combined with œdema, and is generally termed "carnification."

To the absence of inspiratory traction must be ascribed the collapse of the margins and of portions of the lower lobes of the lungs, which often occurs independently of bronchial obstruction. The effect of weakness of the chest walls, or of their muscular coverings, as a contributing cause in the production of atelectasis, is seen in the frequent occurrence of the condition in rickety children. The smaller tubes being most subject to obstruction from the inspiration of sticky mucus, it follows that collapse of small tracts occurs most frequently at the surface of the lung. Finally, the gases of

the residual air are absorbed by the capillaries of the part, and the vesicles collapse from the natural elasticity of their walls. The collapse of larger tracts, sometimes of a whole lung, is usually associated with the presence of air or fluid in the pleural cavity, being due in the one case to disturbance of the natural pneumatic relations upon which normal inspiration depends, and in the other to direct mechanical pressure.

The appearances presented by limited areas of collapse on the surface of the lungs are quite characteristic. Each area is sharply defined, with an angular outline corresponding to that of the lobules affected, sunken below the surface, of a dark purplish color, somewhat wedge-shaped on section, non-crepitant, and with a glistening surface. If there be also œdema, fluid will exude on pressure.

Symptoms.—Dyspnœa, more or less constant, and a varying degree of cyanosis, are the only symptoms which can be directly attributed to atelectasis. Recent collapse of any considerable tract of lung tissue of necessity adds gravity to the symptoms of whatever condition may have produced it, materially reducing, as it does, the extent of lung available for respiration. This is especially the case in broncho-pneumonia, of which affection atelectasis is an important feature.

Physical signs.—When, as is usually the case, the areas of collapse are small and scattered irregularly through the lungs, no definite physical signs may be produced. If extensive, the breath sound is absent, and there may be dullness on percussion. When any considerable tract of lung—the whole of a lobe—has undergone collapse, a distinct depression of the chest wall may be present. In cases of collapse due to intrapleural pressure, the place of the shrunken lung is taken by the fluid or air which has given rise to the condition, and hence no depression results. Within certain limits a collapsed area of lung is capable of re-expansion, especially in early life. When any plastic adhesive changes have been set up, this is no longer possible, and these changes are most prone to occur in lung tissue collapsed by actual pressure. Hence it frequently happens that the evacuation of fluid pent up for a long time within the pleura is not followed by recovery of the compressed lung, a result

in part also due to the thickening of the visceral layer of the pleura, a change almost invariably found when fluid, even though it be a simple serous effusion, has been long present within the cavity. In collapse from plugging or spasm the absorption or removal of the obstruction may be followed by complete restoration of the lung tissue. A low form of pneumonia leading to fibrosis and bronchiectasis frequently follows collapse.

Treatment must be directed toward relieving or removing the conditions which have produced the collapse. Re-expansion may sometimes be assisted, when urgent symptoms have passed away, by means of the inhalation of compressed air in a suitable apparatus.

See AIR, COMPRESSED, THERAPEUTICS OF. E. C. BEALE.

ATHEROMA.—See ARTERITIS.

ATHEROMATOUS TUMORS.—See TUMORS (*Cysts*).

ATHETOSIS.—The word means “with no fixed position,” and the condition is characterized by slow, involuntary, spasmodic, irregular, and continually changing movements of the paralyzed hand and foot, but especially of the former. The fingers and the thumb assume various peculiar positions due to spasm of the interossei and lumbricales, but extension of the middle phalangeal joints is most common. The foot is usually in the position of talipes equinovarus, with extension of the big toe. The movements occur during rest, but usually cease during sleep. They are increased by voluntary efforts, which they very much impede. Athetosis only occurs in cases in which some voluntary power has returned, and it accompanies the return of power. Two forms of the disease are observed: (1) In children, without anæsthesia of the affected parts. In such cases epileptic fits often occur in the athetosed limbs. The lesion is probably a thrombosis of the veins of the motor area of the cortex. (2) In adults, sometimes associated with hemi-anæsthesia, but not with epileptic attacks. In such cases the lesion is considered to be situated in the posterior third of the hinder limb of the internal capsule, and in the optic thalamus contiguous to it.

The disease is probably due to irritation of unstable gray matter.

The *prognosis* is unfavorable as regards the cessation of the movements.

Treatment consists of nervine tonics and sedatives, especially the bromides, which are particularly indicated if there be epileptic fits. The uninterrupted galvanic current, with the positive pole at the neck and the negative on the affected arm, is of service in some cases.

C. E. BEEVOR.

ATRESIA is an imperforate condition of some orifice or canal whose lumen should be patent. It may be the result of congenital malformation or of disease.

ATROPHY.—As atrophy of a part manifests itself by diminution in size, and microscopically by diminution and often disappearance of its constituent elements, it may be defined as a retrogressive change in parts originally well formed and well grown. The causes most potent in inducing atrophy are (1) disuse, (2) diminished blood supply, (3) injury to nerves, and (4) continuous pressure.

Atrophy from disuse.—Among familiar examples is the shriveling of the ductus arteriosus, hypogastric arteries, and umbilical vein immediately after birth. After successful lumbar colotomy, the large bowel on the distal side of the artificial anus will become thin and wasted. In the stumps of limbs after amputation, the bones, muscles, nerves, and vessels become reduced in size; the contractile elements of the muscles are replaced by fat, or represented by collections of fatty and fibrous tissue. In amputations so planned that the patient can utilize the stump in walking this atrophy may be in a large measure prevented. After injury to the vas deferens the testicle will atrophy, and in some cases totally disappear.

Atrophy from diminished blood supply.—It is a well-established fact that organs most frequently used have the best blood supply—indeed healthy function and efficient blood supply go hand in hand. Embolism of a branch of the renal artery will cause atrophy of a wedge-shaped portion of the kidney cortex corresponding to the distribution of the plugged vessel. Atrophy of the retina is caused by plugging its central artery, due either to embolism or extension of atheroma from the internal carotid to the ophthalmic artery. Badly adjusted trusses have been known to oblit-

erate the spermatic artery and induce atrophy of the testis. Attempts have been made, by ligature of the nutrient artery, to utilize these effects in practice : *e.g.*, to reduce limbs of inordinate size, as in elephantiasis and congenital giant-limbs ; also to check the growth of large tumors which were beyond the reach of legitimate surgery. In a few instances the results have been encouraging.

Atrophy from injury to nerves is seen in the wasting of muscles which follows division or injury of the dominant nerve or nerve center, a condition of great interest. Muscles are to be regarded as the peripheral end-organs of motor nerves, in the same sense that the retina is the end-organ of the optic nerve. The atrophy of the thumb muscles following division of the median nerve occurs too rapidly for us to attribute it merely to disuse. Many forms of muscular paralysis, and subsequent atrophy from injury to nerves, are of the utmost diagnostic value in clinical medicine. For example, pressure on the recurrent laryngeal nerve by a thoracic tumor induces atrophy of the principal laryngeal muscles. Wasting of one-half of the tongue following injury to the base of the skull is indicative of damage to the atlas or the occipital condyle, implicating the hypoglossal nerve. In paralysis of the fifth cranial nerve the muscles of mastication of the affected side waste more rapidly than when simply disused, as in cases of excision of the lower jaw.

There is an interesting form of this change to which the term "correlated atrophy" may be applied. In cases of successful amputation at the hip-joint or upper third of the thigh the corresponding os innominatum will become thin and light, the aorta narrower, and the heart distinctly smaller. Such changes are a combination of diminished use and limitation of blood supply. The change in the heart is what would be expected : it is a muscular organ developed according to the amount of work required of it, and as the lower limb represents about one-fourth of the total body weight, its removal ultimately diminishes the work which the heart is called upon to perform. When the operation is performed without much loss of blood, a remarkable tumultuous action of the heart may occur and last for several days. In medical practice this correlated atrophy may be well studied

in the nervous system ; destruction of the corpus striatum by hemorrhage is followed by atrophy of the motor tract of the crus cerebri (crusta) and of the lateral tracts of the cord. These facts have been utilized by experimentalists to trace the course of the various tracts in the spinal cord. There is also reason to believe that, in old standing cases of paralysis of the leg, diminution or atrophy of the convolutions occurs in the leg area of the motor region of the cerebral cortex. In the same group must be placed the atrophy of the anterior quadrigeminal bodies when the eyes have been extirpated in young animals.

Atrophy from continuous pressure.—Among the many examples of this common form of atrophy may be mentioned the thinning of the skull bones in cases of intracranial tumors, especially cysts. The pressure of hydatid cysts lodged in the brain of sheep will produce holes in the bone, and allow the cyst-wall to project beneath the skin. The erosion of bone from the continuous pressure of aneurisms is a well known example. Loose bodies in joints will often hollow out recesses in the heads of bones, and the continuous pressure exerted by the dislocated head of a femur or humerus will rapidly form a new, and often useful, joint-socket. It is by continuous pressure that cystic tumors of the abdomen often open into the intestine, rectum, or bladder ; or cysts in opposite ovaries will unite and form intercommunicating chambers, and hydatid cysts open into the peritoneum.

ATROPHIA CUTIS.—A term applied to various changes in the skin characterized by the diminution or disappearance of certain of its elements.

Senile atrophy is the general degenerative change of advanced life. The skin is thin, loose, wrinkled from the absorption of subcutaneous fat, and generally discolored. Troublesome itching (*pruritus senilis*) is often complained of. The hair falls off, and the sebaceous glands are destroyed or blocked and distended, but the sweat glands are unaltered. Small, warty, brownish elevations, which can be detached by the finger nail, are common on the trunk, neck, and arms (*verruca seniles*).

The cases described as general idiopathic atrophy of the skin closely cor-

respond to the hide-bound condition of diffuse scleroderma.

Lineæ albicantes are the result of extreme stretching of the skin, and the consequent forcible separation of bundles of connective tissue, which become parallel to one another, and remain so. Minute hemorrhages result from the rupture of blood vessels, so that the lesions are at first pink and sometimes even raised, but after absorption of the blood, linear, glazed, white, atrophic scars are left. They are commonest on the abdomen of females as the result of pregnancy, or on the mammæ from lactation, but may be found over any form of prominent, rapidly formed tumor, and are frequently a striking feature in cases of diffuse lipomata.

Neuralgia, injuries to nerve-trunks, progressive muscular atrophy, tabes dorsalis, and acute rheumatism are sometimes accompanied or followed by a tropho-neurotic condition known as glossy skin. It chiefly affects the fingers, the skin of which becomes painful, pinkish, tightly stretched, glazed, and sometimes ulcerates. The nails are often involved; they become curved, their matrix exposed and ulcerated from retraction of the skin. Persistent neuralgia, especially of the fifth nerve, is sometimes followed by atrophic scarring.

Striæ atrophicæ are lesions similar in all their objective characters to lineæ albicantes, but having no known ætiology. They are commonest about the buttocks and thighs, and are probably due to perverted innervation.

Maculæ atrophicæ are round or ovalish, white, depressed spots of thinned skin, varying in size from a pin's head to a threepenny-piece, most common in women about the neck and trunk. As they give rise to no subjective symptoms, their early stage is seldom observed; in it the spots are raised, hard, pinkish, or surrounded by a purplish, vascular halo, and, indeed, are identical with minute spots of scleroderma, with the localized or diffuse forms of which they are frequently associated. The disease is very chronic, lasting for years, but tends to ultimate spontaneous recovery, the little depressed spots filling up almost completely.

In none of these affections is treatment of any avail.

J. J. PRINGLE.

AUSCULTATION, or listening, is a means of diagnosis applicable to any of the internal organs of which function or movement produces sound. It is chiefly employed in the physical examination of the heart and lungs. Auscultation may be practiced directly, by applying the ear to the chest wall, or mediately, by means of a stethoscope. The forms of stethoscope in common use are the rigid tube of wood, vulcanite, or metal, with broad ear-piece and narrow chest-piece, and the flexible, single or binaural, instrument. The first has the advantages of enabling the auscultator to appreciate any abnormal impulse of the heart or of an aneurism, and also that it can be applied to the chest when covered with a layer of clothing, whereas the flexible instrument must be applied accurately to the skin itself. The binaural stethoscope, however, is more convenient for the examination of children and of patients in the recumbent position.

AUSCULTATION OF THE HEART.—Two factors are concerned in the production of the first sound of the heart (1) the contraction of the ventricles, and (2) the closure and sudden tension of the mitral and tricuspid valves. The sound resulting from muscular contraction is long and low pitched, while that produced by the sudden tension of membranous structures, like the cardiac valves, is short and high pitched; the normal first sound is the resultant of these two factors. In disease, if the former element predominate, as in hypertrophy, the sound is prolonged and of low pitch; if, on the other hand, the muscular force be feeble and the cavities dilated, the sound, owing to the predominance of the valvular element, becomes short and high pitched. In the production of the second sound there are also two factors—(1) the closure of the aortic and pulmonary valves, and (2) the sudden tension of the aorta and pulmonary artery. If the blood tension in either vessel be raised, the elastic recoil will be more forcible, and a louder or *accentuated* sound will result. When the factors concerned in the production of either sound of the heart do not come into operation synchronously on the two sides, either sound may be double instead of single, a condition to which the term *duplication*, or more commonly *reduplication*, is applied. It is a change fre-

quently observed, and is probably due to alterations of tension either within the heart or in the aorta or pulmonary artery. If one of the normal sounds be replaced, or obscured by a sound having a blowing character, a *murmur* or *bruit* is said to be present, the name given to it corresponding with the period of the cardiac cycle in which it occurs. If in the period of auricular systole, it is termed *presystolic* or *auricular systolic*; if in that of ventricular systole, *systolic*; if during the diastole of the ventricles, *diastolic*; and should it immediately follow the first or second sound *post-systolic* or *post-diastolic* (see HEART, DISEASES OF VALVES).

All murmurs should be timed by the carotid pulse, *not by their relation to the apex beat* (see PALPATION).

The following views as to the mode of production of murmurs are generally accepted:

1. All murmurs are due to sonorous vibrations occurring in the blood stream, the result of friction of the particles of the blood against each other.

2. This friction is induced by eddies or oscillations, which originate during the passage of the stream through a narrow into a wider part of the vessel.

3. Murmurs are primarily independent of the condition of tension of the structures forming the orifice, and are chiefly affected by the rapidity of the flow.

4. The primary vibrations in the stream may be varied by certain conditions of the orifice and valves.

5. These primary vibrations may produce secondary vibrations in the containing vessel and neighboring parts.

The most frequent cause of murmur is some change in one of the cardiac valves permitting of reflux into the cavity which it guards, or producing a narrowing of the orifice.

Cardiac murmurs may also be present without structural change in the valves or orifices, especially in anæmia and chlorosis, and when the action of the heart is excited. Such sounds are termed *anæmic* or *hæmic* and *functional* murmurs respectively.

Hæmic murmurs are described in the article on CHLOROSIS.

Sounds closely resembling those resulting from organic disease of the valves, but really produced outside the heart, are of frequent occurrence, and are termed *false* or *cardio-pulmonary* murmurs.

The various conditions which may give rise to these murmurs may be classified thus: 1. Displacement of, or pressure upon, the heart, the result of disease of the (a) lung, (b) pleura, (c) thorax, or (d) abdomen. 2. Effusion into the pleural cavity. 3. Changes in the pleura of the precordial area. 4. Changes in the lung overlying the heart. 5. Changes in the pericardium.

1. (a) *Displacement of the heart, the result of disease of the lung.*—As a result of the contraction of a cavity, say in the apex of the left lung, the heart is frequently found displaced upward. Under these circumstances a systolic murmur is often heard in the second or third left interspace, having its maximum intensity about two inches from the edge of the sternum. The presence of the cavity, and of the indurated lung surrounding it, intensifies the murmur, which may be so distinct as to be audible over the greater part of the left chest. This sound, though more commonly suggesting aortic disease or a hæmic murmur in the pulmonary artery, may be mistaken for the murmur of mitral regurgitation. When the presence of the cavity is detected and the displacement of the heart recognized, the differential diagnosis should not be difficult, especially when the somewhat rare association of phthisis and valvular disease is borne in mind.

- (b) *Pressure upon the heart, the result of disease of the left pleura.*—Perhaps of all the false murmurs none are more common, or present greater difficulties in diagnosis, than those caused by pressure upon the heart resulting from the contraction of the left side of the chest after an attack of pleurisy. The pleura is probably thickened, and the lower lobe of the left lung partially collapsed, and at each systole a sound is produced by the sudden impact of the heart displacing the air in the larger bronchi. This may be audible not only at the apex and in the axilla, but also at the angle of the left scapula, in the trachea, and in the mouth. This murmur may be present even during attacks of functional palpitation.

- (c) *Displacement of the heart from deformity of the chest.*—Murmurs originating from this cause are occasionally met with.

- (d) *The upward pressure of a large effusion into the peritoneal cavity* is

sometimes the cause of a false murmur, systolic in time, and audible at either the base or apex of the heart. When the fluid is withdrawn by paracentesis, the murmur disappears.

2. *Effusion into the pleural cavity.*—In some cases of pleural effusion, more frequently when the left side of the chest is affected, a loud and prolonged systolic murmur may be heard either near the apex or at the base of the displaced heart. Such a condition is likely to produce a murmur either in the pulmonary artery or in the aorta by pressure upon the vessel, or what is more probable when the murmur is localized at the apex, within the ventricle itself. The murmur completely disappears on the removal of the fluid from the chest.

3. *Changes in the pleura of the precordial area.*—The sounds simulating cardiac murmurs resulting from this cause will be found described under FRICTION SOUNDS.

4. *Changes in the lung overlying the heart.*—In the subjects of pulmonary phthisis it is very common to hear a systolic murmur about the apex of the heart which closely resembles the murmur of mitral regurgitation. The sound is caused by the impact of the heart upon lung tissue partially consolidated, producing an audible sound by displacement of the air in the bronchi in a similar way to that already described. It is almost always most distinct during expiration, is superficial, high pitched, and disappears when the breath is held after a deep inspiration, and often becomes inaudible when the patient lies down. This murmur may sometimes be heard in the axilla and at the angle of the left scapula. The most common site of a murmur thus produced is not, however, at the apex of the heart, but in the second left intercostal space, about two inches from the sternum. In doubtful cases of early phthisis of the left upper lobe, the presence of this morbid sound is strongly suggestive of lung consolidation. In many of these cases, however, it is possibly due to some displacement of the pulmonary artery, the result of the disease of the neighboring lung.

5. *Changes in the pericardium.*—The characters of the pericardial friction sound are described under FRICTION SOUNDS and in the article on DISEASES OF THE PERICARDIUM. False mur-

murs, when due to chronic changes in that membrane, are frequently heard at one particular spot—viz., the sixth left interspace and over the seventh rib close to the base of the ensiform cartilage. Here the right ventricle is in contact with the chest wall, and it is on its anterior surface that the “white patch” is most commonly found. The sound produced by the movement upon each other of the pericardial surfaces at this spot is systolic in time, usually short, sharp, localized, and superficial; it seldom acquires a blowing character. In fact, it often resembles more nearly a rough reduplication of the first sound than a murmur. It is perhaps doubtful whether the altered sound, which is so commonly heard at this spot, is in all cases due to the presence of a “white patch” on the pericardium. It is especially common in emphysema with downward displacement of the heart. The effect of change of position upon this murmur is variable. It may disappear entirely when the patient is in the recumbent position, as often happens with friction sounds audible elsewhere over the heart, while at times it is hardly at all affected by such a change. When the heart is not displaced, a murmur presenting similar characters may often be heard in the fifth left interspace close to the sternum. Thickening of the pericardium of the left auricular appendix occasionally produces a rough systolic murmur in the second left interspace.

The following precautions should be observed in the examination of all cases presenting murmurs. Assuming that the presence or absence of those consecutive changes in the heart which are almost invariably associated with disease of any given valve has been noted; if there be still room for doubt, the following points must be observed carefully:

1. The exact period in the cardiac cycle occupied by the murmur. False murmurs are often not exactly synchronous with the commencement of systole or diastole; they may precede or follow the one or the other.

2. The site of maximum intensity and the line of conduction of the murmur. These do not usually coincide with what is found with similar murmurs of organic origin.

3. The condition of the lungs. With doubtful apex murmurs evidence of pul-

monary engorgement is strongly in favor of organic valve disease, as that condition is almost invariably absent in the reflux of anæmia.

4. The effect of change of position upon the sound. *It is essential to examine every case of suspected valve disease both in standing and recumbent position.* It may be stated with confidence that an opinion given in a doubtful case without observing this precaution is of no value. Functional and false murmurs often disappear when the patient lies down, while an organic murmur, especially that of mitral stenosis, may be only audible in that position. A murmur which suddenly and completely disappears when the patient lies down, provided there be not at the same time any marked alteration in the pulse-rate, is certainly not due to organic disease of a valve.

5. It is important in all cases to auscultate the trachea. A murmur audible in the trachea may be due either (1) to the conduction of the murmur of aortic stenosis; or (2) to the impulse of an aneurism; or (3) to the impulse of the heart causing an air wave in the bronchi and trachea, this latter being by far the most common cause for tracheal murmurs. Mitral murmurs are not audible in the trachea.

6. False murmurs often disappear completely when the breath is held.

7. The state of the pulse may at once negative a suspicion of organic disease founded on the presence of a murmur.

J. K. FOWLER.

AUSCULTATION OF THE LUNGS (BREATH SOUNDS).—

Three varieties of respiratory sounds are to be recognized in every healthy chest: (1) the sound produced in the glottis, and audible over the lower end of the trachea, which is termed "tracheal" or "bronchial" breathing; (2) the sound produced in the alveoli and audible over the lungs, termed "vesicular" breathing; (3) the sound audible about the roots of the lungs which combines the characters of the two preceding, and is termed "broncho-vesicular" breathing. As the normal respiratory sounds vary considerably in intensity in different individuals, there is no common standard of reference, and one side of the chest must always be compared with the other. Any change in

the *quality* of the sounds, however, is to be regarded as abnormal.

The varieties of respiratory sounds, normal and abnormal, may now be more fully described:

Vesicular breathing.—This is a soft rustling sound audible during inspiration. It is generally followed, without any appreciable interval, by a fainter sound, of shorter duration and blowing quality, heard during expiration; but this may be absent. The two sounds constitute the normal respiratory murmur audible over the healthy lung.

Prolonged expiration.—The expiratory sound may be prolonged—a sign the significance of which varies with the pitch and quality of the sound. If high pitched and bronchial or tubular in quality, it indicates consolidation of the lung; if, on the other hand, the pitch be low and the quality faintly blowing, but not bronchial or tubular, emphysema is probably the cause, or it may be due to the presence of a cavity in the lung, either distant or of small size.

Exaggerated breathing.—This is a sound possessing the characters of vesicular breathing in an exaggerated degree. It is the normal breath sound of children, but when met with in adults indicates that an increase of function in one part is compensating for deficient action elsewhere.

Exaggerated breathing is perhaps best heard over the unaffected side in cases of pleural effusion.

Diminished breathing.—The characters of the normal breath sound are retained, but the intensity is much diminished. It is present under a variety of conditions, involving lessened functional activity of the lung, and very commonly at the apex in the early stage of phthisis.

Suppressed breathing.—The breath sound is absent, a condition met with in cases of pleurisy with effusion, also in certain cases of pneumonia, when the bronchi are filled with exudation (massive pneumonia), and in complete occlusion of a bronchus from any cause.

Interrupted breathing: wavy or cog-wheel breathing.—The inspiratory sound is divided into two or three parts, owing to an irregular expansion of the lung, the result of disease of either the bronchi or the lung interrupting the entrance of air, or of irregular contraction of the muscles of respiration. It may be

heard at the apex of the lung in phthisis, but is an untrustworthy sign owing to its close simulation by the breath sound present in certain nervous conditions. It is also occasionally simulated by a succession of "air-wave" murmurs (cardio-pulmonary) produced by the impact of the heart upon the lung.

Bronchial breathing is the glottic sound, as heard in the normal chest near the lower end of the trachea, over the seventh cervical spine. The sound there audible may be taken as the standard of comparison by which to gauge the quality of similar sounds heard elsewhere in the chest of the same patient; the term "bronchial breathing" being used to signify that the sound heard over an area of disease in the lung is of the same quality as that audible over the seventh cervical spine. It is of variable intensity, and differs from vesicular breathing in that the inspiratory sound is higher in pitch and tracheal in quality, while the expiratory sound is separated from the former by a distinct interval, is tracheal in quality, usually more intense, and of equal or longer duration.

When heard in phthisis or pneumonia it signifies the presence of consolidation in an area of lung; in large pleuritic effusions it may be audible over the site occupied by the lung, and indicates that it is compressed or collapsed. It is occasionally audible over the whole of the affected side in cases of pleural effusion, especially in children; when so audible in the case of adults it is considered to indicate the existence of positive intra-thoracic pressure; as, however, it is occasionally present in cases of moderate effusion in which there is no displacement of the heart, that statement cannot be absolutely accepted. It probably indicates that the large bronchi of the collapsed lung are still patent. When a thoracic aneurism or mediastinal growth is situated between a large bronchus or the trachea and the chest wall, bronchial breathing is often audible over the area occupied by the tumor.

Broncho-vesicular breathing, as the name implies, combines the characters of bronchial breathing with those of the normal respiratory sound, and indicates the presence of an amount of consolidation short of that necessary to produce bronchial breathing. It is heard normally over the sternal portion of the infra-

clavicular regions in front and the upper part of the interscapular region behind. In the inspiratory sound the vesicular quality is diminished, but not absent; the tracheal quality is more or less marked, according to the degree of consolidation; the pitch is raised in proportion as the tracheal quality predominates over the vesicular; the intensity is variable.

The pitch, tracheal quality, and length of the expiratory sound correspond with the characters of the inspiratory sound.

Tubular breathing is the glottic sound conducted through an area of lung completely consolidated.

Tubular breathing and bronchial breathing are often used as synonymous terms, but the former sound differs from the latter in possessing a "whiffing" character and in its higher pitch.

It is heard typically in lobar pneumonia, when the bronchi are patent; when present in phthisis, it usually indicates that a portion of lung situated near the surface is *completely* consolidated, the bronchi being patent.

Cavernous breathing is a modification of the glottic sound produced by the presence of a cavity within the lung or external to it, in communication with an open bronchus.

The inspiratory sound is low pitched, hollow, and blowing; the expiratory sound is still lower in pitch, has the hollow, blowing character more marked, and is usually more prolonged.

It requires a partially empty cavity, in communication with an open bronchus, and at least equal in size to an unshelled walnut to produce a breath sound of this character.

The breath sound audible over the supposed cavity should always be compared with that over the lower end of the trachea, as errors in the diagnosis of cavities are of frequent occurrence owing to the neglect of this precaution.

Amphoric breathing is a sound of variable intensity presenting the hollow blowing character of cavernous breathing, in an exaggerated degree, and with the addition of a distinctly "metallic" quality.

It indicates the presence of a large cavity either in the lung or external to it in the pleura, in communication with an open bronchus.

The differences between vesicular, bronchial, tubular, cavernous, and amphoric breathing may be expressed in tabular form thus:

Vesicular Breathing.

(I. = inspiration; E. = expiration.)

	Pitch	Quality	Interval	Duration	Intensity
I.	low	vesicular	none	E. shorter than I. or	variable
E.	lower	blowing		absent	faint or absent

Bronchial Breathing.

I.	high	tracheal (seventh cervical spine)	distinct	E. equal to or longer than I.	variable
E.	higher	do.			greater

Tubular Breathing.

I.	higher than in Br. br.	laryngeal or whiffing	distinct	E. equal to or longer than I.	variable
E.	higher	do.			greater

Cavernous Breathing.

I.	low	blowing and hollow	distinct	E. longer than I.	variable
E.	lower	both characters more marked			greater

Amphoric Breathing.

I.	low	hollow and metallic	distinct	E. longer than I.	variable
E.	lower	both characters more marked			greater

AUSCULTATION OF THE LUNGS (ADVENTITIOUS SOUNDS).—A great variety of sounds to which, as a whole, the above term is applied, become audible in diseased conditions of the lungs, bronchi, and pleuræ.

Friction sounds will be found described under that heading.

Rhonchi are dry musical sounds produced in the bronchial tubes. When

low pitched, loud, and snoring in character, they are termed *sonorous rhonchi*; when high pitched and whistling, they are called *sibilant rhonchi*; the pitch of the sound being chiefly dependent upon the caliber of the tube in which it is produced. Sonorous rhonchi usually indicate that mucus is present in the large tubes; sibilant rhonchi, that the lining membrane of the smaller bronchi is swollen. The former often disappear when the patient coughs; the latter are usually uninfluenced by cough.

Rhonchi may be audible during either inspiration or expiration, or may accompany both parts of the respiratory act; in bronchitis they are often especially marked during expiration.

Stridor is a harsh vibrating sound resulting from obstruction of the larynx, trachea, or a main bronchus. This sound may be caused by a variety of local conditions, but is most often due to compression of the trachea by an aneurism, an enlarged thyroid, or an intrathoracic tumor. Paralysis or spasm of the vocal cords, the result of pressure on the recurrent laryngeal or pneumogastric nerves and cicatricial changes within the larynx or trachea, may also produce stridor.

Râles are moist sounds produced by the bubbling of air through fluid in the alveoli or bronchi, and by the separation of the moist surfaces of the swollen mucous membrane. They vary much in character, being chiefly influenced by the condition of the lung, as regards sponginess, consolidation, softening, or excavation, in the neighborhood of which they are produced. The presence of consolidated lung gives a sharp, crackling, explosive quality to the sound, whereas, when the surrounding lung is of spongy texture, the sound is usually of a bubbling character. Sounds of the first variety are termed (1) small, (2) medium, and (3) large crackling râles.

(1) *Small crackling râles* are sharply defined crackling sounds of small size, chiefly audible during inspiration, but also during expiration.

They indicate the presence of fluid in the finer bronchi, the surrounding lung being usually consolidated. Sounds of this character are present when a tubercular deposit or pneumonic exudation is undergoing softening.

(2) *Medium crackling râles* are

sounds presenting the same general characters as the above, but of larger size. They are met with under the same conditions.

(3) *Large crackling râles* are sounds produced at the site of softening in the lung when the process has extended to such a degree that small cavities, the size, perhaps, of a pea or hazel-nut, have formed, the surrounding lung being still consolidated. They are usually fewer in number than either of the former varieties. Râles of this character are of frequent occurrence in phthisis, and are also heard when a pneumonic area is breaking down.

Moist sounds produced in the neighborhood of spongy lung are termed (1) small, (2) medium, and (3) large bubbling râles.

(1) *Small bubbling râles* are sounds differing from the corresponding râle of the former variety in that they are less sharply defined, and suggest the bursting of a soft bubble rather than the explosion of a minute shell. They are produced by the passage of air through mucus in the bronchioles, the surrounding lung being of spongy texture. Sounds of this character are heard in cases of capillary bronchitis, especially in children.

(2) *Medium bubbling râles*.—These sounds are similar in quality to those above described, but are produced in larger tubes, and are therefore of larger size.

(3) *Large bubbling râles*.—The character of these sounds is almost sufficiently indicated by the name. They are produced in the larger bronchi and trachea by the passage of air through frothy mucus, and are heard in cases of bronchitis and pulmonary engorgement when the vital powers are failing.

Gurgling.—Large liquid sounds of a character indicated by the name, produced in a cavity in the lung, and best elicited by making the patient cough.

Clicking sounds.—The character of these sounds is best illustrated by whispering the word "click." They differ from râles in being sticky rather than moist in quality; they are produced during inspiration only, and are most often heard at the apex of the lung in phthisis. The presence of "clicks," as they are generally termed, indicates the commencement of softening in a tubercular deposit.

These sounds are not distinguished by German writers from crackling râles, and it must be admitted that the difference is but slight and with difficulty appreciated by students of auscultation.

Crepitation is a sound almost exactly similar to that produced by rubbing the hair between the fingers close to the ear.

The use of the term should be strictly limited to sounds of this character—*i. e.*, to the sense in which it was employed by Laënnec.

Crepitation is caused by the passage of air into vesicles either containing a fibrinous exudation or in a condition of collapse.

It is heard typically during the latter part of inspiration in the early stage of pneumonia, and also at the bases of the lungs when in a state of œdema, lobular collapse, and hypostatic pneumonia.

Metallic tinkling.—When a moist sound is produced in a large, dense, walled cavity (pulmonary or pleural), or in a neighboring bronchus in communication with it, the sound acquires a peculiar quality, which is best described by the terms "metallic" and "tinkling."

Succession splash.—A peculiar splashing sound, described by Hippocrates, is produced by the sudden movement of air and fluid in a cavity. It is present in cases of hydro- or pyo-pneumothorax, and is elicited by shaking the patient or making him cough.

Bell sound.—When air is present in the pleural cavity (pneumothorax), if a coin placed flat upon the chest be struck with another coin, a sound like the tinkling of a bell will be audible through the stethoscope applied over the affected area.

J. K. FOWLER.

AUSCULTATION OF THE VOICE (Vocal Resonance).—The voice sounds, as heard over the healthy lung, are diffused, distant and low pitched. They vary in intensity in different individuals, being chiefly dependent upon the quality of the voice. They are *diminished* in intensity by the intervention of any badly conducting medium between the lung and the chest wall, a condition present in pleurisy with effusion, in thickening of the pleura, and in pneumothorax; by occlusion of the bronchi, owing to the presence of morbid growths in the lung or mediastinum; or of solid

fibrinous exudation filling the tubes, as occasionally occurs in croupous pneumonia (massive pneumonia); and by the extremely spongy condition of the lung present in emphysema. The voice sounds are *increased* in loudness, but without alteration in pitch, when a degree of consolidation of the lung is present insufficient to produce bronchophony, or when the voice is transmitted through a cavity not surrounded by consolidated lung (Flint). The vocal resonance is normally more intense in the neighborhood of the trachea and large bronchi than elsewhere, and in the right infraclavicular region than in the left. The conduction of the whispered voice is modified by the same conditions which affect the loud voice, and in a similar manner.

Bronchophony is a sound of variable intensity characterized by concentration of the transmitted voice, elevation of pitch, and a degree of nearness to the ear, falling short of the condition requisite for pectoriloquy—*i. e.*, the sound, though seeming to originate near to the end of the stethoscope, passes away from the observer, and does not appear to have been spoken from the end of the instrument straight into his ear. Bronchophony is usually found with bronchial breathing, and has the same significance. It is normally present over the lower cervical spines, in the upper part of the interscapular region, and over the sternal portion of the infraclavicular regions.

Pectoriloquy is by some writers considered to be merely an exaggerated degree of bronchophony. It differs from it, however, in the fact that, while in the latter the *noise* only is transmitted, in pectoriloquy *articulate speech*, in addition to sound, becomes audible. Pectoriloquy has been divided into "bronchophonic pectoriloquy" and "cavernous pectoriloquy," the one form indicating the presence of consolidation of the lung, the other, of a cavity. If pectoriloquy be accompanied by the characters of bronchophony (nearness to the ear and elevation of pitch) the transmission is by solidified lung; if, on the other hand, speech be transmitted and the characters of bronchophony be wanting, the [inference is that the pectoriloquy denotes a cavity (Flint). If words articulated in a whisper be conveyed to the ear of the auscultator, *whispering pectoriloquy* is said to be present. The sign has the

same significance as pectoriloquy of the loud voice.

Ægophony is a term applied to a modification of the vocal resonance in which the transmitted sound has a nasal or bleating character. It occurs in pleurisy when the amount of effusion is but moderate, and is most often heard about the angle of the scapula. It is believed by Dr. Stone to depend upon the interception by the exudation of the fundamental vowel tone and the passage of the harmonic overtones.

J. K. FOWLER.

BACK, SPRAINS OF.—Usually occur in neck or loins, often affect intra-vertebral ligaments; tumefaction, rarely ecchymosis, stiffness, tenderness; in severe cases, patient lies on his side, semi-flexed; hematuria, when the kidneys are hurt; occasionally symptoms of paralysis; if such persist, intravertebral hemorrhage, inflammation of the meninges, or injury to the cord is indicated.

Causes.—Falls on head or buttocks, railway collisions, Rugby football, etc.

Diagnosis.—From fracture or dislocation, line of spinous processes, straight; tenderness, more or less diffuse; patient can probably, though with pain, raise himself into the erect position, straightening the spine.

Prognosis.—Good, even when there is hematuria; even severe paralysis sometimes passes off in a day or two, but danger of inflammation spreading to meninges or cord. This danger is greatest in atlo-axial region. See SPINAL MENINGITIS, FRACTURE, HEMORRHAGE, etc.

Treatment.—Rest (*see* SPRAINS). Actual cautery and Corrigan's Button or Sayre's Jacket in obstinate cases.

C. B. KEETLEY.

Symptomatic Indications.—See SPRAINS.

BAKER'S ITCH.—See ECZEMA.

BALANITIS.—Inflammation of glans penis, or lining membrane of prepuce.

Causes.—Gonorrhea, phimosis, dirty habits, ill health.

Treatment.—Warm water, zinc ointment, astringent lotions, nitrate of silver. A chancre may coexist.

Symptomatic Indications.—*Mercurius corrosivum*: when from a hard

sore will rapidly subdue. *Aconite*: in early stage, with inflammatory symptoms. *Corrallium rubrum*: when accompanied by gleet. *Nitric acid*: internally and externally, in weak solution; when from soft sore. See GONORRHEA, PHIMOSIS, etc.

BANDAGING is employed under varying circumstances and for many purposes, but its chief use is to give rest and support. With it one may retain splints and dressings, prevent and cure swelling, or check bleeding. Impregnated with some stiffening agent, such as plaster of Paris, it gives us a rigid material most useful in the treatment of fractures and other lesions.

Simplest form of bandage.--This, the roller bandage, is usually made as follows: procure six yards of muslin, about one yard in width, and remove the selvages. Mark off with scissors short strips of the desired breadth; then grasp the alternate strips gathered in two separate bunches, and pull in opposite directions. From such a web may be obtained 16 rollers, $2\frac{1}{2}$ inches broad, suitable for the head and upper limbs; 12 rollers, 3 inches broad, suitable for the lower limbs; 8 rollers, 4 inches broad, suitable for the trunk. These are frequently known as eights, twelves, and sixteens. The strips must now be rolled. Start at one end as if making a cigarette with the finger and thumb. Lay the small roll on a flat surface, such as a table, or on the thigh; steady the loose strip with the left hand; press the right firmly against the roll and run it down over the strip, which will coil round; a firm uniformly wound bandage will be obtained; or, again, the small initial roll may be held between the forefinger and the thumb of each hand, and rolled with the fingers. To finish off the bandage, a few stray threads from the margin may be wound around the roll to keep it together, and the frayed edges trimmed.

To apply the bandage, select the size required, break the encircling threads, and liberate the free end or "tail." The compact roll is known as the "head," and we may further recognize an anterior and posterior surface, an upper and a lower margin.

We may now look at the surface which we are about to bandage. Note that it is always curvilinear. It may be re-

solved into a series of cones, with bases or apices opposite, with here and there perhaps a short cylinder. In the lower limb, for example, we may trace a cone as we pass from the toes to the heel, another from the heel to the ankle; at the ankle, we may meet with a short cylinder, which is continued upward as a cone gradually expanding at the calf of the leg; and so on.

Rules for bandaging.—General rules to guide in bandaging may be laid down as follows:

- (1) Fix the bandage.
- (2) Bandage from below upward, and from within outward, over the *front* of the limb.
- (3) Use equable pressure throughout.
- (4) Let each succeeding turn overlap two-thirds of its predecessor.
- (5) Keep all the margins parallel, and let the crossings and reverses be in one line, and rather toward the outer aspect of the limb.
- (6) End by fixing the bandage securely.

Typical cases: (a) **How to bandage the foot.**—Let us exemplify this by covering in the left leg. Stand in front of the patient, who extends his foot. Grasping the roller in the right hand, lay the tail against the ball of the great toe. The bandage must now be carried in a loop around the ankle, and back again to the point from which it started (Fig. 1, A). Therefore, let the head roll on the dorsum of the foot to the outer malleolus, behind the ankle to the inner malleolus, across the dorsum and the first turn to the ball of the little toe, and beneath the sole to the great toe, thus making a double loop, or figure-of-eight, and fixing the end. Now cover in the limb by taking a complete turn over the dorsum of the foot at the roots of the toes, ascending on the inside with a gentle spiral. We cannot, however, continue this simple spiral, otherwise the bandage would stray and portions of the foot would remain uncovered. The spiral is not suitable for cones, and in order to atone, as it were, for the increasing diameter, since our bandage is of uniform breadth, it is necessary to employ a reverse (Fig. 1, B). To make a reverse, hold the head lightly in the right hand—we may note that the *anterior* surface of the bandage is at present exposed—free about three inches of tail, steady the lower margin of the

bandage with the left forefinger against the dorsum of the foot rather to the outer side of the middle line; pronate, and circumduct the head by sweeping it to the inner aspect of the foot over the fore-

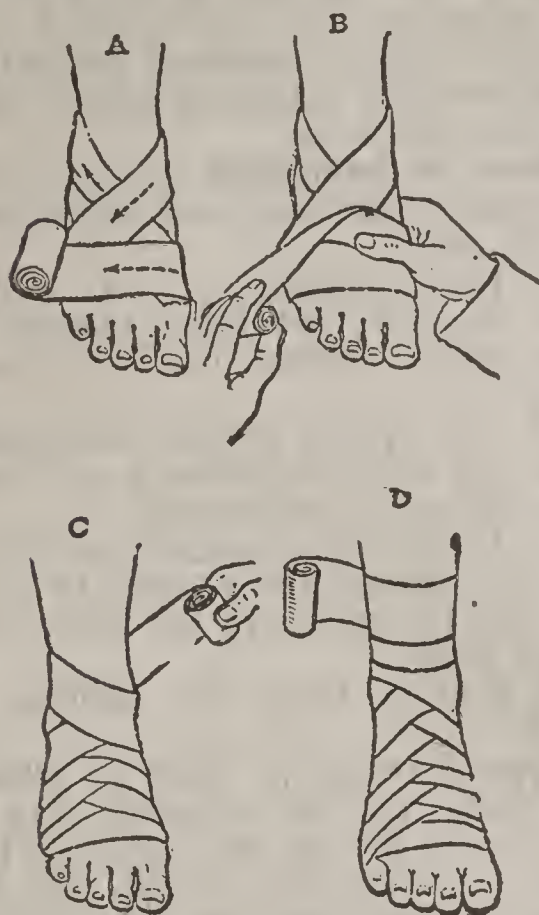


FIG. 1.—Bandaging the Foot.—(A) Fixing; (B) Reversing; (C) Figure-of-Eight; (D) Complete.

finger, and then outward, so that a fold forms. The *posterior* surface of the bandage is now exposed, the upper margin points to the toes, and the head no longer rolls on the foot, but requires to be unwound, as we carry the roller under the sole upward with a gentle spiral ascent. As the bandage passes from the outside to the inside of the limb, it is received by the left hand, and transferred again to the right hand. The bandage now reaches the point of the former reverse, but at a higher level, overlapping two-thirds of the last turn, and a second reverse is required. Again we repeat our former maneuver, fixing the margin in the same line as our previous fold. We may note that now we bring the *anterior* aspect of the roller into view, and the bandage again rolls. In this way we make two or three reverses, alternately rolling and unwinding the bandage, exposing alternately its anterior and posterior surfaces. As we mount the instep, however, it will be found that the bandage no longer lies

smoothly, that is because we approach the junction of two cones at the heel, and wherever that occurs the figure-of-eight is required (Fig. 1, C). In place of reversing, we pass round the outer malleolus, and so come down from behind the inner malleolus, over the dorsum, under the sole, ascend on the inner side, cross the dorsum, and so back to the internal malleolus. This is repeated until such time as we reach the ankle, when, as we now meet a simple cylinder, two or three spirals are available. The bandage once more shows by its tendency to stray that we are at the cone of the calf, and again reverses are employed. To finish the bandage, a figure-of-eight turn is made around the upper part of the calf, and the tail of the bandage is fixed at the last reverse by means of a pin inserted parallel to its margins (Fig. 1, D).

We may here observe that the simple *spiral* is used in the case of cylinders, the *reverse* when covering cones, and the *figure-of-eight* at the basal junction of cones.

Typical cases: (b) How to bandage the hand.—Just as we bandaged the lower extremity, so may we bandage the upper. The arm should be extended and supine, so that the palmar aspect of the hand occupies a position similar to the plantar of the foot. Small oblong pads of dry cotton-wool (preferably charged with some non-irritating antiseptic) are laid between the fingers so that the skin secretions may be absorbed. It is of cardinal importance that the skin-surfaces should always be kept apart, or else chafing will certainly ensue.



FIG. 2.—Bandaging the Hand.—(a) Fixing; (b) Reversing.

The hand now corresponds to the foot.
 The forefinger “ “ great toe.
 The little finger “ “ little toe.

The wrist now corresponds to the ankle. The thumb " " heel.

The initial figure-of-eight turn for fixation is made by laying the tail of the bandage under the second phalanx of the forefinger, looping round the wrist, descending to the terminal phalanx of the little finger, and so on in every respect just as we bandaged the foot. As the heel was left exposed, so also do we leave the thumb free.

In bandaging the left limbs, our manipulations are chiefly carried out with the right hand; but in the case of the right limb the left hand is employed, a task which, at first somewhat awkward to accomplish, becomes easy with practice.

Cautions!—It is of the utmost importance that there should never be any constriction of the limb. The bandage should exert uniform pressure with ease and comfort to the patient. It is necessary to increase the tension somewhat with the circumference of the limb. In any case, the condition of the exposed digits affords a sure guide to the state of



FIG. 3.—Bandaging the Closed Fist.—(a) Figure-of-eight Loops; (b) Finishing.

the circulation. In children, especially, the utmost care is requisite, for their soft tissues yield readily, and with a moderate amount of force constriction may be caused, the circulation impeded, and gangrene, as the result of tight and careless bandaging, ensue. The slightest œdema or discoloration is a warning, which we dare not neglect.

Special forms of bandage: The spica.—This is simply a figure-of-eight, and the term "spica" refers to the cross-like arrangement seen at the intersections of the figure-of-eight.

In order to cover in large prominences, such as the heel, the bent knee, and elbow, a modification of the figure-of-eight, known as the "Divergent Spica," is made use of.

(1) *Divergent spica of the heel.*—Lay the tail against the external malleolus, and carry the roller under the sole to the internal malleolus, and thence from within outward over the dorsum to the point from which you started, thus fixing the bandage. Now travel over the tip of the heel, so that its most projecting part is embraced by the tense middle portion of the turn, and the two margins are left loose. Pass over the dorsum and again

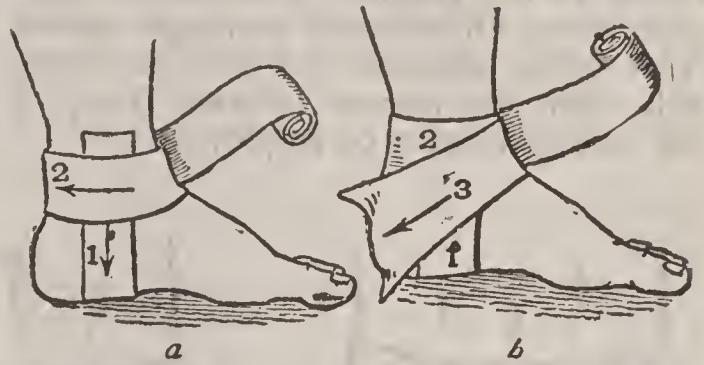


FIG. 4.—Divergent Spica of the Heel.

round the heel, diverging from the tip, so as to fix the lower loose margin; the next turn, passing round the heel at a higher level, includes the upper loose margin. In this way the middle third of the first turn over the heel is exposed, and the succeeding turns confine and overlap the loose margins of their predecessors. The bandage may be carried over the forepart of the foot and up the leg, if necessary. Such a bandage serves to retain dressings, etc., but is not frequently required.

(2) *Divergent spica of the knee-joint.*—The limb must be slightly flexed. Lay the tail against the inner condyle. Pass the roller over the front of the patella, and outer condyle back to the starting-point. The second turn travels in a

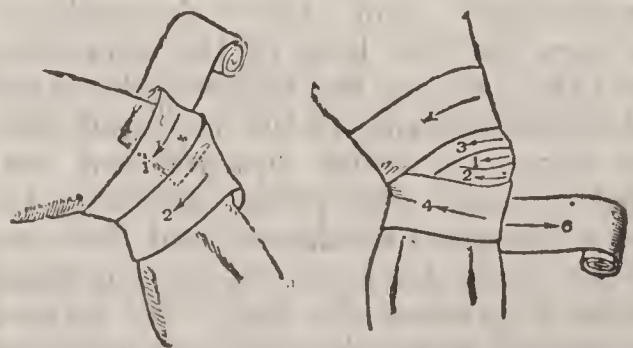


FIG. 5.—Divergent Spica of the Knee-Joint.

similar direction, but at a lower level, so that the lower loose margin of the first turn is fixed, and in a similar way the third turn secures the upper loose mar-

gin. A transverse elliptical series of margins, which imbricate, are thus seen in front of the knee-joint, and a limited range of movement is allowed, as the layers glide easily on each other, like scale-armor, as the limb swings to and fro. Such a bandage may be useful in giving support to a joint which has been inflamed. It specially protects the posterior and lateral aspects of the joint; the anterior does not require such covering, owing to the patella. In cases of varicose veins, an ordinary bandage carried from below upward, and over the knee, will allow the patient to walk freely, if the divergent spica be employed.

canal. Beneath each crossing a small flat compress of lint may be laid so as to afford sufficient pressure.

(5) *In femoral hernia.*—The *descending spica* is preferred in cases of femoral hernia (Fig. 7). Lay the tail over the saphenous opening, and carry the roller over the symphysis and round the pelvis at the same level as before. As the first loop is completed, the bandage is next passed downward into the perineum and outward round the thigh back to the starting-point; thus the second loop is finished, and the succeeding turns follow in the same manner, each lower than the preceding one. It will be observed that,

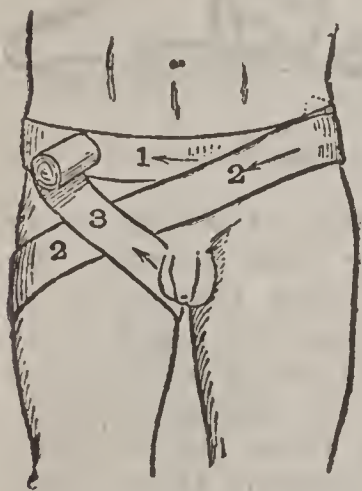


FIG. 6.—Spica of the Groin—Ascending Form.

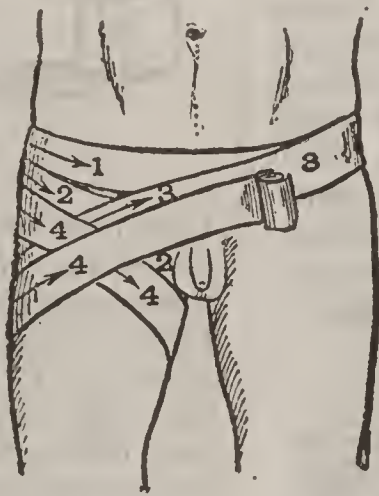


FIG. 7.—Spica of the Groin—Descending Form.

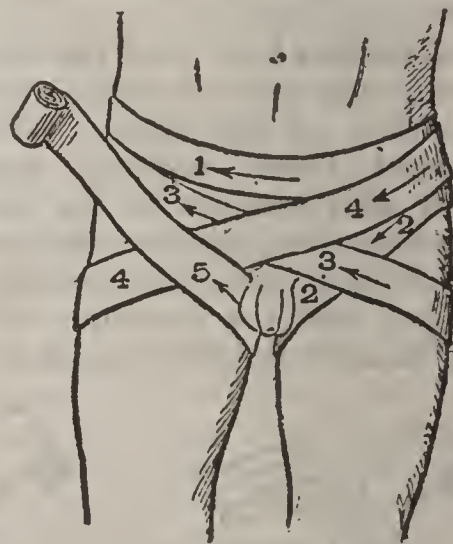


FIG. 8.—Double Spica of the Groin.

(3) *Divergent spica of the elbow* differs in no respect from that of the knee. It is employed in cases where we keep the arm at rest in the flexed position, as after fractures and injuries to the joint.

(4) *Spica of the groin—the ascending spica.*—This is simply a figure-of-eight used to confine dressings or to retain a rupture. There are two forms, the “ascending” and the “descending.” To form the first loop of the ascending spica (Fig. 6), lay the tail over the external abdominal ring of the ruptured side, and carry the roller upward and outward around the pelvis, midway between the great trochanter and the crest of the ilium back to the starting-point where it crosses the tail. To form a secondary, carry the bandage over the outer aspect of the thigh round into the perineum and back to the starting-point again. In this way a series of crossings are produced, each higher than the preceding one, with which we may exert pressure all along the line of the inguinal

as regards the successive crossings, the line of support in each case agrees with the direction of taxis used in reducing the hernia, viz., from below upward, in the first case—from above downward, in the second.

(6) *Spica of the shoulder* is practically the continuation upward of the bandage of the upper extremity. The larger loop of the figure-of-eight is formed by passing from the highest limit of the upper arm over the shoulder and behind the chest, under the opposite axilla, and back again over the shoulder. As the smaller loop is formed by carrying a turn round the arm, the crossing takes place in the line of the last reversal. In this manner, by continued overlapping turns, the whole shoulder may be covered in. We do not carry the bandage around the neck, since it is so freely movable; but we select the chest instead, much in the same way as we take the fixed pelvis when applying the spica of the groin, in preference to the mobile abdomen. Just as the rise

and fall of the abdominal parietes would vary the tension of the bandage, so also would the movements of the neck relax or tighten the figures-of-eight, and the bandage would not be secure.

(7) *Double spica of the groin* is of little practical importance, but is some-



FIG. 9.—Bandage for Left Mamma, begun.



FIG. 10.—Double Spica for Left Mamma.

times used to retain dressings. The diagram (Fig. 8) explains itself. There are three crossings produced, one at each groin, and one in the middle line. This bandage might be used in cases where there was an *inguinal hernia* on one side, a *femoral* on the other. For double

herniæ of the *same* kind, it is better to apply a separate single roller to each.

(8) *Single spica of the mamma* (Left).—Lay the tail against the left side, and take a complete circle round the anterior aspect of the waist, traveling toward the mammæ, so that the roller confines the tail. Support the left breast gently with one hand, while with the other carry the bandage from below upward; withdrawing the hand, the bandage takes its place, and the second loop is completed as the roller travels to the right shoulder, and obliquely over the back to the point from which the ascending loop started. A series of such figures-of-eight may be superimposed as required.

(9) *Double spica of the mamma* may be compared with the double spica of the groin. The one breast is supported from below upward, the other from above downward, just as in the two forms of hernia. Where both mammæ are inflamed, separate bandages for each are more useful (Fig. 10).

(10) *How to bandage the head.*—The divergent spica is the typical bandage for the head. Owing to the tendency of the figure-of-eight loops to slip on this part of the body, it is important that the initial and concluding turns should be secure, and that all should have a mutual dependence. Three main series of loops,

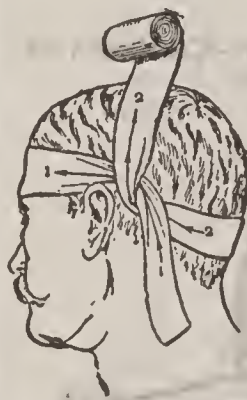


FIG. 11.—Knotted Bandage of the Head, beginning.

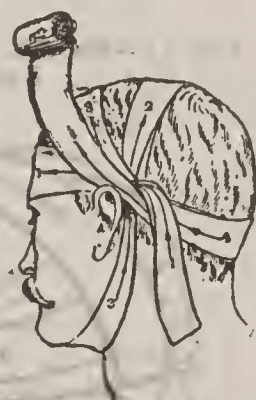


FIG. 12.—Formation of Divergent Spica over Anterior Part of Head.

at right angles to each other, are employed. (1) *One, horizontal* in direction, passing above the level of the ears, grips the cranium firmly (Fig. 11) between the frontal eminences and superciliary ridges anteriorly, and below the occipital protuberance posteriorly. (2) *A second series, coronal*, runs from the vertex below the chin, passing behind and sometimes in front of the ears. *A third final turn* courses over the vertex *from behind* for-

ward. At the various crossings, pins should be inserted, or all may be basted together with a needle and thread.

To cover in the fore part of the head, proceed as follows: grasp the loose tail in one hand, and carry the roller around the head to form the horizontal turn. Pass the roller beneath the loose end, carry it at right angles to the first turn, and so form the coronal circle. The scalp is thus divided into an anterior and a posterior segment; one may, therefore, cover each of the exposed portions with a separate divergent spica, making use of the loose tail as a fixed point, around which our successive turns play, as seen in the diagram (Fig. 11). Finally, by carrying the bandage from behind forward we complete all; for to this concluding turn the others are all pinned, and so secured.

The posterior segment of the scalp is

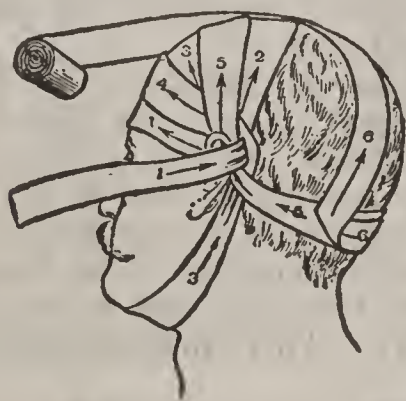


FIG. 13.—Postero-Anterior Turn—Conclusion of Knotted Bandage.

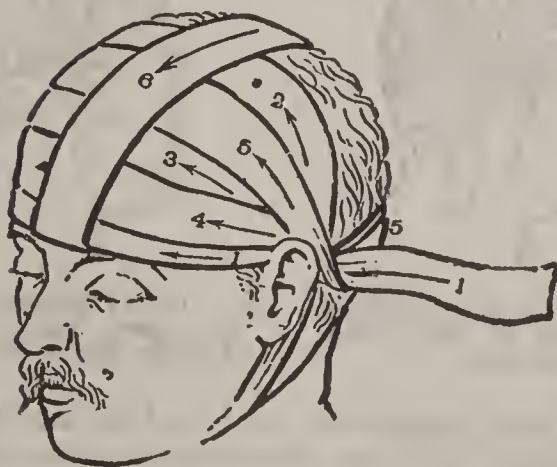


FIG. 14.—Completed Knotted Bandage.

more difficult to cover in. By giving an increased obliquity to some of the loops, by carrying the turns around the forehead, under the chin, and perhaps in front of the ears—according to the individual peculiarities of the head in question—a good result may be obtained. Should

the shape of the skull prevent the application of such a bandage, or if it be desirable to cover in the whole scalp, the *capeline bandage* or *double-headed roller* may be used as follows:

To cover in the whole scalp.—Fasten two rollers together as shown in Fig. 15.

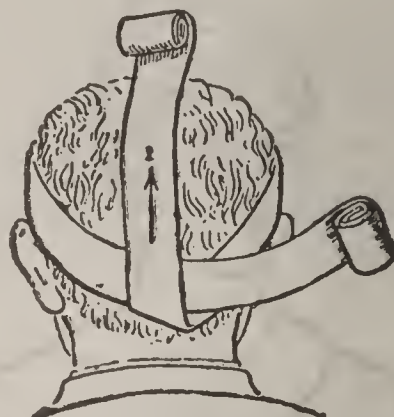


FIG. 15.—Beginning the Capeline Bandage, viewed from behind.

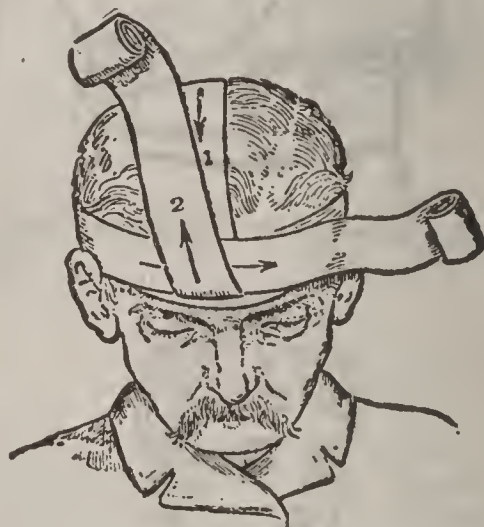


FIG. 16.—Capeline Bandage, from the front;



FIG. 17.—Bandaging the Eye.

Let one be rather longer than the other. The larger roll should always circle round the head, the smaller should after the first turn travel backward and forward. The horizontal turns serve to fix the vertical, which forms a divergent

spica. Stand behind the patient with the larger roller in the left hand, the smaller in the right. Lay the bandage against the root of the nose, and carry the rollers horizontally directly backward. Change hands at the occiput, and let the horizontal turn cover in the vertical one, which should now be carried forward right over the nose, at the root of which it is fixed by the circling horizontal turn. The vertical turn is now carried back again to the occiput, slightly to one side of the middle line, and is once more fixed posteriorly by the horizontal turn—and so on. Care must be taken not to diverge too rapidly, and to come well down to the glabella in front and below the occiput behind at every turn. In this way, a most firm and secure bandage is obtained, which defies every attempt to take it down. It is, however, somewhat heating, and the superimposed circling turns are rather constricting, and apt to induce headache. Gauze bandages do not give rise to this objection.

The divergent spica may be used for the head with a *single* roller, if one have assistance. A couple of horizontal turns to fix the bandage are made. The roller then passes at right angles from occiput to glabella, and at each angle is fixed by the assistant's fingers, which must be firmly applied, and which will serve to confine the extremities of each turn of the divergent spica. Finally, a concluding couple of turns replace the fingers, secure the ends of the bandage of the vault, and safety-pins, transfixing all the folds, are inserted in front and behind.

(11) *How to bandage a stump.*—In a similar way, one may bandage a *stump*. Here the thumb and fingers serve to grasp the ends of the divergent spica, which passes over the face of the stump. Final circular turns and pins hold all together.

(12) *How to bandage the fingers.*—As a rule, the digits receive sufficient support with the ordinary bandage for the hand. Small dressings may be secured with a few turns of worsted. If thought necessary, a narrow bandage for the prevention of œdema is put on by taking a turn around the wrist, passing to the tip of the finger in question, gently spiraling to the web, and so back to the wrist. One may also go from finger to finger, taking a turn round the wrist between each. For the thumb, a figure-of-eight is desirable.

Looped bandages.—(1) *Looped bandages for the heel (right foot).*—Having covered in the fore part of the foot, and ascended to the instep (as formerly described), carry the roller over the tip of the heel back to the instep, and dip down



FIG. 18.—Looped Bandages for the Heel.

to the sole. Now carry the bandage round the side of the heel under the malleolus, then to the tendo Achilles, and back to the instep. Repeat looping round the internal malleolus in the reverse direction.



FIG. 19.—Looped and Reversed Bandage for the Forearm.

(2) *Looped and reversed bandage.*—This form was, previous to the introduction of Martin's rubber bandage, a favorite in the treatment of varicose veins of the leg. It gives great support, and

clings with such tenacity that it does not readily become loose, or come down while the patient walks. Let us imagine that the right hand or foot has been already covered in, as formerly described, and that the few spiral turns usually made at the wrist or ankle have been completed.

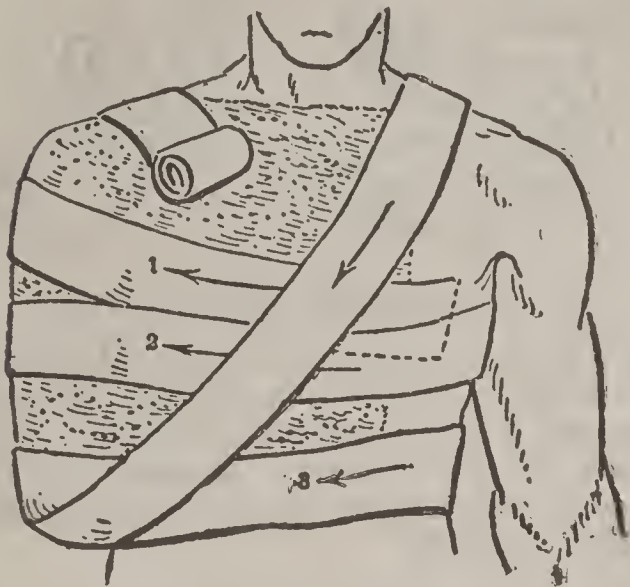


FIG. 20.—Bandage for Securing Dressings after Excision of the Mamma, or for Fixing the Upper Limb—First Part.

In place, then, of making a reverse at once, the spiral is continued to the posterior aspect of the limb. Here the sur-



FIG. 21.—Bandage for Securing Dressings, and for Fixing the Upper Limb—Complete.

geon, fixing the lower margin with the right hand, the left hand supinating, executes the reverse, and the roller is made to loop downward round the back over the last turn. It is thus looped around the limb, and ascends parallel with the first turn, crossing the upper part of the

second. Reaching the back of the limb, the wandering spiral is brought back with a reverse similar to the last, and again we loop down, around, up, and reverse. Whenever we reach the back of the limb, ascending, a reverse is required. Sweep the bandage around the limb with boldness. Never mind how far it seems to stray in making the ascent, since the reverse will bring it back again with ease. As usual, let all the margins be parallel, and only expose one-third of each turn.

(3) *Bandage for dressing after excision of the breast (right).*—Apply the dressing, cover the sound breast with

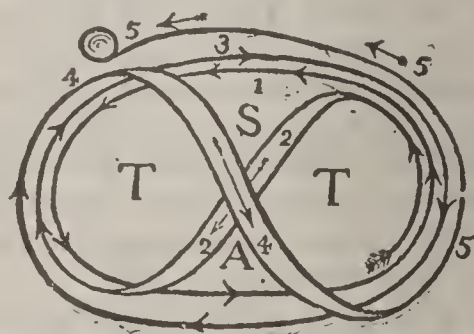


FIG. 22.—Diagram of Looped Bandage of Perineum seen from below.—(T) Thighs; (S) Scrotal Triangle; (A) Ani Triangle.

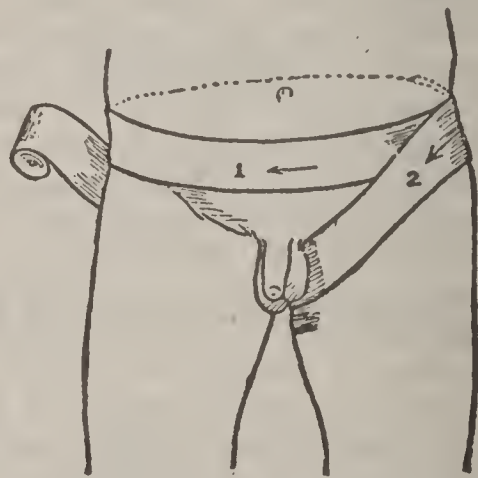


FIG. 23.—Looped Bandage for Perineum—First Turns.

antiseptic wool. Lay the tail of the bandage over the sound breast. Ask the patient to bend the knees and arch the back, and sweep the bandage underneath the back to the starting-point. Again carry the bandage around and to the front at a *lower* level, so as to confine the margin of the dressing. Pass posteriorly up to and over the sound shoulder, come down in front under the elbow, and up behind the arm over the right shoulder. Now loop in front, obliquely downward, across the chest; and upward, posteriorly, to the left shoulder. Descend in front of the arm under the elbow, over

the back to the right shoulder and down over the hand. Pins must be inserted at the crossings, or the whole basted.

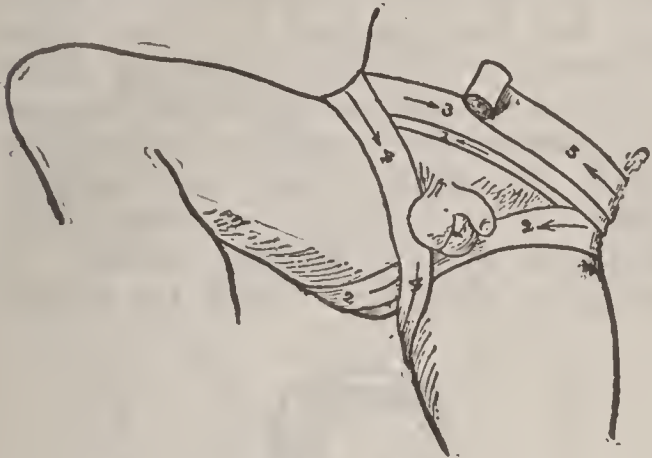


FIG. 24—Looped Bandage for Perineum—Crossing of the Loops.

(4) *Looped bandage for the perineum.*—This is used in the application of dressings to the scrotum, etc. Lay the tail midway between the left anterior superior spine and the great trochanter. Sweep round the pelvis at the same level



FIG. 25.—Forming Loop for Lithotomy Position.

back to the starting-point; thus fixing the bandage. Dip down into the perineum over the left groin; pass in front of the anus, and carry the bandage upward in the line of the right gluteal fold to the hollow between the right anterior superior spine and great trochanter. Sweep round the pelvis toward the left and back to the right side again. Dip into the perineum over the right groin, up over the left buttock; circle round toward the right, and begin once more at the left side (Fig. 24).

The "lithotomy" position.—For operations on the perineum, the well-known "lithotomy" position is the most suitable. The patient, laid on his back and deeply under the influence of an anæsthetic, is pulled down on the table till his breech just projects beyond it. A

clove-hitch (*see below*) is secured to each wrist, the thighs are flexed on the abdomen, and the legs on the thighs; and now, by seizing the free ends of the clove-hitch, the wrist is brought down to lie opposite the external malleolus, and secured to the foot by firm figure-of-eight loops, as in Figs. 26, 27. During the operation, care must be taken to maintain the pelvis firm and square, with the



FIG. 26.—Lithotomy Position—Fixing Hand to Foot.



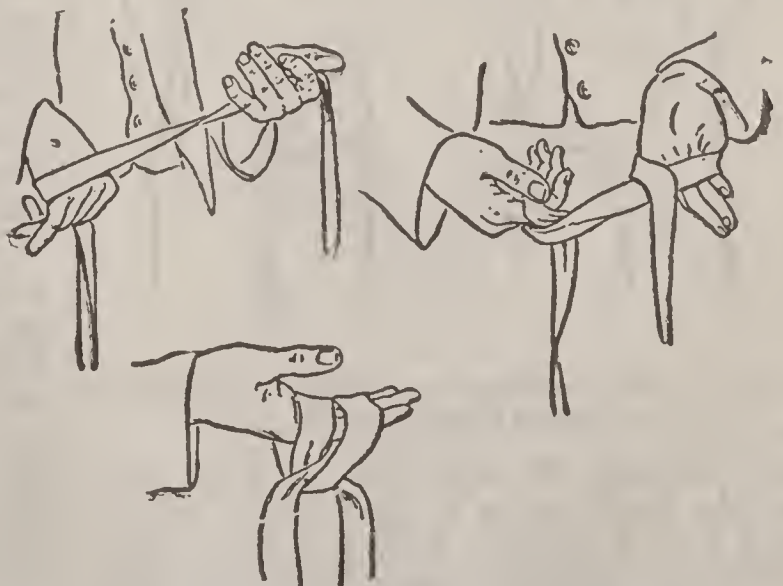
FIG. 27.—Lithotomy Position—Hand and Foot Fixed.

thighs in the same position on each side. The assistant secures the legs by holding the sole with both hands, the knee resting in the middle.

The "clove-hitch" is made as follows: Grasp the bandage, etc., with the left hand supine and the right prone, as indicated in the figure, now pronate and supinate the two hands respectively (Figs. 28, 29), and slide both loops on to the left hand (Fig. 30).

Another plan is to make two successive loops in the same direction, and place one behind the other.

(5) *The T-bandage* is employed for the perineum. The horizontal limb passes around the pelvis; the vertical



FIGS. 28, 29, 30.—Forming the Clove-Hitch.

limb—single, double, or split—serves to retain rectal dressings, with the advantage that the split tails may come up on each side of the scrotum.

(6) *The four-tailed bandage* is used in fracture of the lower jaw.

(7) *The many-tailed bandage* (or bandage of Scultetus), consists of a central strip or backbone of bandage, to

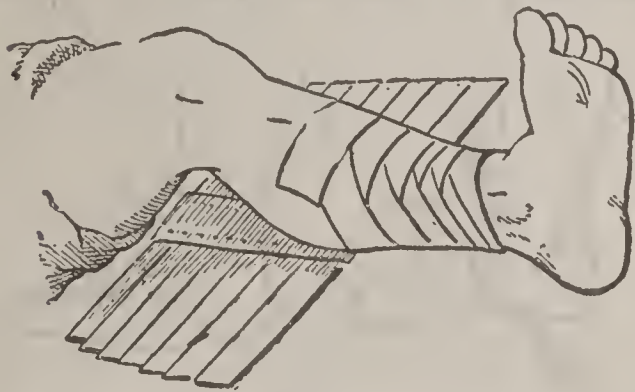
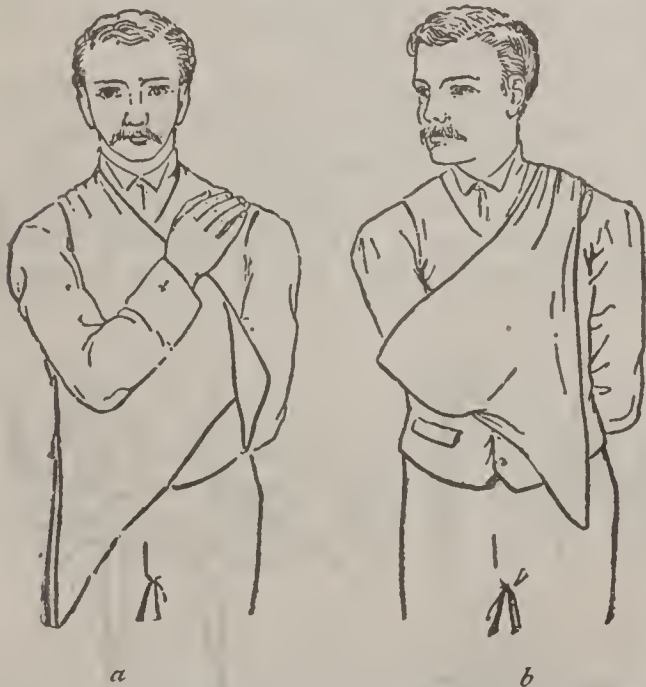


FIG. 31.—Many-Tailed Bandage.

which some eighteen shorter imbricated strips (Fig. 31) are stitched at right angles. The limb is laid on the bandage so that its axis corresponds with the central strip and, beginning at the periphery, the strips are gently and firmly folded over as seen in the diagram. A pin at each side, securing the two last strips to their predecessors, serves to fasten all safely. By taking out the pins,



FIGS. 32 and 33.—Triangular Handkerchief supporting the Elbow, *a* and *b*.

and flinging the tails right and left, the whole bandage is readily taken down, and a fresh dressing having been applied, the strips may once more be folded over so that the limb need not be disturbed in

the least. For burns and painful wounds, such a bandage is to be commended.

(8) *The triangular handkerchief*.—The use of slings, in place of the bandage, has been revived in recent years. Esmarch, of Kiel, has especially drawn attention to their use in military surgery. The handkerchief possesses many advantages. It can be speedily and easily applied. It is available for many varied purposes, and is readily washed. In using the sling, the base of the triangle



FIG. 34.—Triangular Handkerchief supporting the Elbow, *c*.

should always be applied to the part which requires support. Thus we see in Figs. 33 and 34, the elbow and wrist suspended. The loose end may be tucked up, and for neatness secured with a safety-pin; but on no account should the pin bear any weight—that is all borne by the longer ends of the handkerchief, which should be tied in a reef-knot.

Fig. 39 shows the sling adapted to retain dressings on the head. In a similar way, we may cover in the hand or foot. With one handkerchief rolled as a cravat, and applied so as to give a fixed point, a second may serve to secure a dressing, as in Figs. 37 and 38, where the shoulder and hip are seen covered in. Such examples may suffice.

(9) *The square handkerchief*.—A good head-dressing may be formed from a

square handkerchief (40 in. square), folded across 4 inches beyond its middle line, and laid over the head, as represented on the left side of Fig. 40. The two *outer*

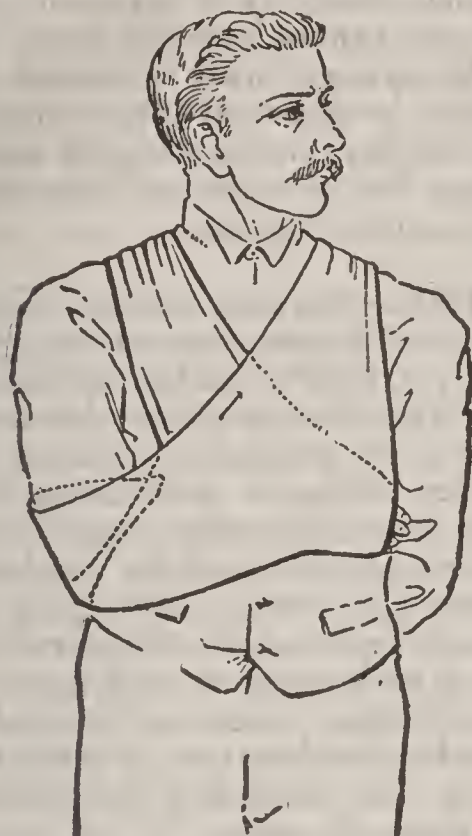


FIG. 35.—Triangular Handkerchief supporting the Forearm.

corners, that is, those of the smaller portion of the napkin, are first carried beneath the inner corners, and tied under



FIG. 36.—Triangular Handkerchief supporting the Forearm from the Opposite Shoulder, *after Esmarch*.

the chin. The edge of the inner and larger portion is then turned up over the forehead, and its corners are secured at the nape of the neck. A four-tailed handkerchief (Fig. 41), and one with six

tails, have also been used for a similar purpose.

(10) *Suspensory bandage*.—This refers to the suspension of the testicles, and



FIG. 37.—Dressing for the Shoulder with Handkerchiefs, *after Esmarch*.

may be called for in orchitis and epididymitis, varicocele, or when the skin of the scrotum is ulcerated or eczematous.

An open net-work bag to hold the testicle, attached to a waist-band, is sold by chemists and instrument-makers. Failing this, an extempore support may be made from a triangular piece of cloth. A waist-band is first applied, and the long ends of the triangular cloth are fixed



FIG. 38.—Dressing the Thigh with Handkerchiefs, *after Esmarch*.

to it. The straight edge of the cloth is brought under the scrotum, and the point carried over it and fixed above.

A pair of well-fitting bathing-drawers, padded with cotton-wool, if necessary, make an excellent suspensory bandage. Some use a T-bandage, the vertical part

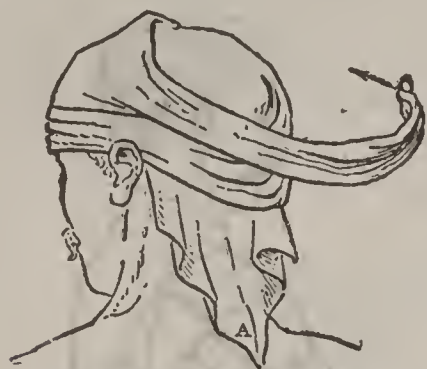


FIG. 39.—Triangular Handkerchief for the Head. The dependant Angle is to be turned up and pinned over the Vertex.

of which (of broad flannel) is carried from the back up over the scrotum, so as to raise it. An aperture may be cut for the penis to allow of micturition, without

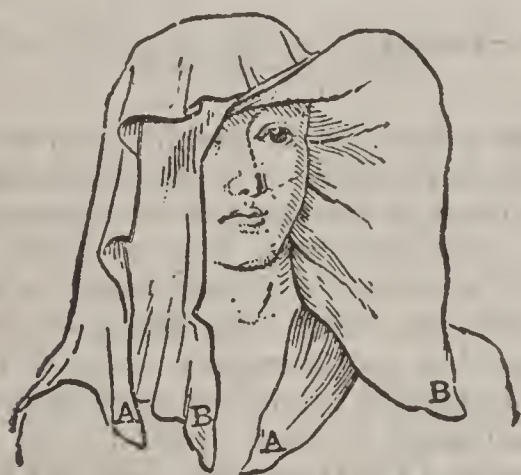


FIG. 40.—The Square Handkerchief for the Head.

the necessity of taking the bandage down.

Strapping the testis is frequently required to remove swelling after acute orchitis or epididymitis. Some lint, and



FIG. 41.—Square Handkerchief used for the Head, after splitting as at A.

about a dozen strips of sticking-plaster, $\frac{1}{2}$ -in. wide, and long enough to encircle

the testis in both directions, are required.

The affected testis is first isolated in the scrotum, by a circle of lint at its upper part, over which is a layer of plaster. The organ cannot now slip away, and it must be covered with successive layers of plaster, longitudinal and circular.

In a few days the swelling by subsiding will have left the plaster loose, when it must be applied again.

BATHS.—Bathing consists in the application of liquids, vapors, or gases—generally or locally—to the surface of the body. The fluid employed for the purpose may be simple, or variously medicated by different substances held in solution or in suspension; and more than one form of bath may be combined in the same application. According to its nature and method of administration, the bath may be heating or cooling in its effects; stimulant, tonic, sedative, depressant, or locally alterative; it also exerts a more or less cleansing and detergent action upon the skin.

Immersion in fresh water constitutes the simplest form of bath; and water in some form is the vehicle by which are applied most of the various other substances which distinguish the several medicated and composite baths.

A. Liquid baths.—The *cold bath* has a temperature below 70° Fahr. The immediate effect of its application is to produce a sensation of cold, gasping respiration (reflex action), and pallor of the skin, with subsequent reaction. Prolonged immersion increases the loss of temperature, and induces vital depression, not followed by reaction, and only slowly recovered from even on removal from the bath. The remote effect of the cold bath, if not too prolonged, is to increase the rate of tissue change and the excretion of urea and carbonic acid; and hence it acts as a general tonic and as a stimulant to the appetite.

The *tepid bath* ranges from 85° to 95° Fahr. It acts mainly upon the skin as a sedative, emollient, cleansing, and detergent agent; the pulse, respiration, excretion, secretion, and body-heat are practically unaffected.

The *warm bath*, at from 95° to 104° Fahr., slightly increases the activity of the circulation, and somewhat retards tissue metamorphosis; it is a valuable

soothing agent, but in other respects its effects on the system are almost inappreciable.

The *hot bath*, at a temperature of from 104° to 110° Fahr., affects mainly the nervous and circulatory systems: it greatly increases the frequency of both pulse and respiration, and is followed by a free perspiration. Special ends are subserved by such partial applications as the hip-bath and the foot-bath.

The effect of any bath upon the skin is much increased by brisk friction both during and after immersion.

The duration of any kind of bath must depend on the age and condition of the bather and the object which it is desired to attain. Cold baths are fitted for the vigorous and healthy, but should never be taken when exhausted, or immediately after a full meal, or if there be reason to suspect congestion of any internal organ. The weakly and debilitated may combine many of the advantages of both the tepid and the cold bath by immersion in, or sponging with, warm water, followed (while still standing in warm water) by the rapid application of a spongeful of cold water to the general surface, or at least to the throat and chest. Asthenic persons should avoid baths, or the immersion should be of the shortest possible duration, and those suffering from any degeneration of the heart or vessels should avoid all but tepid baths. The excessive employment of hot baths exercises a weakening effect upon the system.

The simple liquid bath may be variously medicated, as in the

Sea-water bath.—This is more stimulant and tonic in its effects than fresh water, and hence is useful in convalescence, in chlorosis, and in strumous disease. It may be given as a cold, tepid, or hot bath, according to circumstances. Sea-water contains about 3 per cent. of soluble salts, and (as regards the action of the solution itself) an efficient substitute can be obtained in inland places by dissolving bay-salt, sea-salt, or even common or rock-salt in fresh water. About 4 to 9 pounds of salt may be dissolved in 30 gallons of water, according to the degree of stimulant effect desired. Half a pound of bay-salt dissolved in 4 gallons of cold or tepid water makes a good salt-water sponge bath, to be used every

morning, and followed by vigorous rubbing with a flesh-brush or coarse towel.

Acid bath.—This is considered useful in certain cases of dyspepsia, with sluggish liver and constipation. For a general bath ℥jss of nitric acid and ℥j to ℥iij of hydrochloric acid are added to 30 gallons of warm water in a wooden or earthenware vessel. The patient should remain immersed for about ten to twenty minutes. The more convenient foot-bath is prepared by adding ½ ounce of nitric and 1 of hydrochloric acid to 4 gallons of warm water in a wooden or earthenware vessel; the feet should remain immersed for from twenty to thirty minutes, while the groins, axillæ, and hepatic region are sponged with the solution. This bath is to be used every alternate day for two or three weeks at a time.

Alkaline bath.—Add 3 ounces of carbonate of potassium, or 6 ounces of carbonate (*not* bicarbonate) of sodium to 25 or 30 gallons of hot water. It is used in chronic squamous skin diseases, chronic rheumatism, and in lithæmic cases, etc., and should be prepared in a wooden, earthenware, or enameled bath, as ordinary paint is rapidly affected by it.

Corrosive-sublimate bath.—This is made by adding hydrargyri perchloridi 3 iij and acid hydrochlor, 3 j to 30 gallons of water. This bath is sometimes useful in secondary syphilis and in certain skin diseases.

Creosote bath, used in squamous skin diseases; creosote 3 iij, glycerine ℥iv, aq. Cxxx.

The following soothing and emollient baths are serviceable in squamous and irritable conditions of the skin; the ingredients are in each case to be added to 30 gallons of water:

Bran bath: Boil 1 pound of bran in 1 gallon of water; strain the liquor, and add it to the bath.

Borax bath: Borax ℥iv, glycerine ℥iij.

Gelatine bath: Dissolve 1 pound of common glue in hot water, and add the solution to the plain bath, or to the bran bath, as above.

Starch bath: Starch 1 pound.

Starch and conium bath: Add extr. conii ℥j to the starch bath.

The *iron bath* (ferri sulphat. ℥ss, aq. Civ) is valuable for strumous or rachitic

children; it should be used in an earthenware or wooden vessel.

The *mustard bath* is a valuable stimulant; it is made by inclosing 2 to 4 ounces of ordinary mustard in a piece of muslin or thin linen and swishing it about in 4 gallons of hot water until the latter becomes yellow. This may be used as a general bath for infants suffering from collapse, convulsions, severe bronchitis, etc.; as a foot-bath for adults in congested conditions of the lungs and brain, or to invigorate a languid circulation; and as a sitz-bath in some cases of amenorrhœa, etc. A child may remain in such a bath until the skin becomes distinctly reddened.

The *pine bath* is prepared by adding a decoction of pine-needles—or, more easily, by dissolving some of the commercial pine-extract, or pine-essence, in hot water; it is mildly stimulating, and is employed in hysteria, gout, and rheumatism.

The *sulphur bath*: Potassium sulphide $\frac{3}{4}$ iv to $\frac{3}{4}$ viij in 30 gallons of water; a little sulphuric acid may be added. Used in certain skin diseases, in scabies, lead colic, and lead palsy.

All the above baths should be taken warm—*i.e.*, at a temperature of from 95° to 100° Fahr.—and their duration must depend upon the condition of the patient and the object of the treatment.

B. Vapor baths.—In these the skin is exposed to the action of steam, either alone or combined with the vapor of other substances, which are volatilized at the same time. The vapor bath may be applied, by means of a suitable apparatus, to a limited portion of the body only; or to the whole surface except the head; or the patient may inhale the vapor within a closed apartment, the whole surface being at the same time exposed to its influence, as in the common Turkish and Russian baths. In the vapor bath a higher temperature can be borne than in the hot-water bath, though for a shorter time, since the circumambient vapor interferes with heat radiation from the body. The chief value of the simple vapor bath lies in its power of provoking very profuse perspiration, thus relieving the lungs and kidneys and effectually cleansing the skin. An effective form of the

Simple vapor bath is readily extemporized by placing a pan containing 3 or 4 inches of boiling water beneath a cane-

bottomed chair, on which the patient sits naked; a large blanket, which may be covered by a mackintosh, is thrown over all, and fastened round the neck; one or two red-hot bricks are then placed in the water, and generate abundant vapor. When the perspiration slackens, the skin should be energetically rubbed with a warm dry flannel, and the patient should retire to bed, clothed in a flannel night-gown.

The *calomel bath* and the *mercuria vapor bath* are administered in the same manner—either *locally*, the mingled fumes of the volatilized mercurial salt and of water vapor being directed to some particular region of the body by means of a suitably constructed apparatus; or *generally*, as follows: The patient sits on a cane-bottomed chair, beneath which are placed two pans, each heated by a spirit-lamp; a flannel-lined oil-cloth or waterproof sheet is thrown over all, and is fastened round the patient's neck. One pan contains boiling water, and the other 3 j to 3 iij of the bisulphide or of the gray or red oxide of mercury, or 20 to 30 grains of calomel. The skin is thus exposed to the combined action of hot air, steam, and of a volatilized salt of mercury. After a few minutes perspiration breaks out, and soon becomes excessive. At this stage both lamps are extinguished, and the patient, when moderately cool, puts on a night-shirt and goes to bed. If the full action of mercury be desired, the skin should not be rubbed after this bath. Such combined vapor baths have been largely used in the treatment of secondary syphilis.

C. Gaseous baths are administered after a method similar to that of vapor baths.

The *hot-air bath* may be employed in either of two ways, the difference depending upon whether the patient does or does not breathe the heated air. A simple form of the latter kind of hot-air bath can be arranged by seating the patient on a chair, etc., exactly as described for the vapor bath, except that a spirit-lamp only is lighted beneath the chair, no water being employed; or the hot vapor may be introduced by a tube from a suitable apparatus beneath the bed-clothes, which are tucked in round the neck of the patient, and secured from contact with his body by some sort of framework or "cradle."

When taking a hot-air bath of the first kind, the patient, after undressing, enters first a room called the *tepidarium*, the air of which is at a temperature of from 112° to 117° Fahr., and remains there until free perspiration breaks out; he then passes to the *calidarium* or *sudatorium*, which is heated by hot pipes to about 130° or 140° Fahr., there he remains for from ten to fifteen minutes: he is then rubbed down and shampooed, after which he is bathed with water at about 85° Fahr., in the *lavacrum*; then the whole body is soaped and rinsed, and finally the patient reclines on a couch in the cooling-room or *frigidarium*, until the skin is again quite dry, when he proceeds to dress.

Hot-air baths can be borne of a much higher temperature than vapor baths; they do not so much impede respiration, they provoke more profuse sweating, and raise the temperature of the body to a greater extent.

Hot-air and vapor baths are useful in inducing increased action of the skin, and in catarrhal, neuralgic, and rheumatic conditions. They are effective in reducing some forms of obesity, temporarily at all events, and may be applied locally to rheumatic limbs and enlarged joints with advantage.

The hot-air and vapor, or Turkish, bath is contra-indicated if there be any obstruction to the circulation, if there be fatty degeneration of the heart or vessels or a tendency to vertigo or syncope, and in advanced life, as well as for women during pregnancy and menstruation.

The *sulphurous-acid bath* is a means of applying the fumes of burning sulphur to the body. The patient is seated on a cane-bottomed chair, and a blanket or an oil-cloth is thrown round him, the head remaining uncovered. On the floor beneath the chair stands a pan containing a little water. In this is placed a smaller vessel containing brimstone in small pieces, over which a little spirit of wine is poured, and then ignited. The sulphur takes fire, and burns, with the production of sulphurous-acid gas. After using this bath, the patient should at once be removed to another apartment, while the doors and windows of that in which the bath has been taken are opened.

The *sand bath* is a useful method of applying dry heat—by means of heated

sand—to enlarged and stiffened joints in cases of chronic rheumatism.

C. E. SHELLY.

Local hot air baths, 250° F. up to 400° F., are used with benefit in rheumatism, ankylosis, infantile paralysis, gout, nephritis, effusions, dropsy, etc. (*see* p. 1558).

BED-SORES attack the skin over hard prominences, *e. g.*, sacrum, ischial tuberosities, trochanters, condyles of knees, elbows, and the heels. First the skin reddens, then an abrasion may form, then a slough; in bad cases even the spinal canal may be opened.

Causes.—Predisposing are debility, continued fevers, especially typhoid, paralysis, old age; exciting causes are continued pressure, irritation of fæces and urine, the under sheet and night-shirt not being kept smooth by the nurse, etc.

Prognosis.—Depends chiefly upon whether the cause can be removed or not.

Treatment.—Preventive measures are good nursing, dry, smooth drawn sheets, water beds or cushions, frequent change of position. The buttocks, etc., should be rubbed twice a day for five minutes with camphorated spirit, or with a mixture of olive oil and brandy (equal parts); or bathe the part with hydrarg. perchlor., in sp. vin. rect. (gr. ij.—℥ j); prominences should be covered with amadou plaster; when an abrasion forms, apply collodion and try to take off the pressure; when a slough is forming, use stimulants, *e. g.*, resin ointment, balsam of Peru on cotton-wool. Prone position sometimes necessary.

C. B. KEETLEY.

BEES, STINGS OF.—*Treatment.*—Rubbing with olive oil, strong liquor ammonia, indigo, eau de Cologne, vinegar, flour, etc.; remove the sting if it can be found; ice.

Symptomatic Indications.—*Camphor*, by inhalation; *Aconite*.

BERI-BERI.—A disease widely spread over certain tropical regions. It is endemic in certain areas, but those who are the subjects of it recover on removing to a non-infected district. It is believed by some to be due to a bacillus, but it is certain that diet has a large share in its causation, and it has been shown that deficiency of nitrogen and an excess

of carbo-hydrates in the food are conditions most favorable for its appearance. One form of the disease is thought to depend upon the presence in the alimentary canal of parasites, especially the *dochmius duodenalis*, and possibly also the *trichocephalus dispar*. It appears in a chronic and acute form. The first symptoms are a sense of fatigue and numbness in the legs, with loss of the knee jerks, followed by paralysis of the extensors, first of the feet, then of the hands, and muscular tenderness. The pulse is very rapid. There is neither fever nor albuminuria, but the patients are anæmic, and at the base of the heart hæmic murmurs are often audible. There may be anasarca of the legs, followed by effusions into the pleuræ and pericardium; or dropsy may be absent, in which case the skin is very dry, and the muscles are seen to be wasted. The acute form of the disease is generally fatal, death often occurring from dropsy; but in the chronic form recovery frequently takes place. A person who has once had an attack is liable to another the next year. The disease is much more common in men than in women.

Treatment.—A strict attention to the diet is the best preventive; the dropsy should be treated on general principles.

BILE, THE.—The bile is secreted by the liver, and is poured out by the bile ducts into the duodenum. It is a golden-yellow or yellowish-green, clear, slightly viscid fluid, with an intensely bitter taste; its reaction is feebly alkaline, and its density is from 1026 to 1032.

The quantity is increased by digestion, reaching its maximum in from five to eight hours after food has been taken; the secretion then diminishes, but never entirely ceases, except under pathological conditions.

Increase of pressure in the circulation of the liver is followed by increase of the secretion; while lowering of pressure, as in sudden obstruction of the portal vein, is followed by its diminution or suppression. The diabetic puncture in the floor of the fourth ventricle causes diminution of the flow of bile.

Most purgatives increase the secretion—*e. g.*, aloes, rhubarb, jalap, colocynth, cream of tartar, sodium sulphate; but this is especially the case with podophyllum, corrosive sublimate, salicylate

of soda, iridin, and euonymin. Calomel produces less decided effects; lead diminishes the secretion.

Great variations are met with in the composition of bile. The following is the mean of five analyses of human bile:

Water,	{	. . . . .	91.68
Inorganic matter,	{	. . . . .
Organic matter,	. . . . .		8.32
Mucus,	. . . . .		1.29
Taurocholate of sodium,	. . . . .		0.87
Glycocholate of sodium,	. . . . .		3.03
Saponified fat,	. . . . .		1.39
Cholesterin,	. . . . .		0.35
Lecithin,	. . . . .		0.53
Fat,	. . . . .		0.73

The most important constituents of bile are its *pigments* and *acids*.

The bile pigment is *bilirubin*, derived by oxidation from the pigment of the blood-corpuscles, oxy-hemoglobin. By further oxidation bilirubin is converted into a series of coloring matters, of which the green pigment, *biliverdin*, is the ultimate stage.

The bile acids are *glycocholic acid* ($C_{26}H_{43}NO_6$) and *taurocholic acid* ($C_{26}H_{45}NSO_7$). They occur in the form of salts of sodium.

The functions of the bile are said to be: (1) To precipitate the soluble peptone—a very doubtful function, as the action of the pancreatic juice, which reaches the intestine at the same time, must be to redissolve the peptone; (2) to emulsify and promote the absorption of *fats*, a much more useful property; it is probably on this account that liver oils are more readily digested than ordinary fats; (3) a diastatic action on starch, which is not constant, is often very slight, and can only be observed in the bile of an animal freshly killed.

In passive congestions it is probably diminished, in active hyperæmia increased, while in all diseases which destroy the liver tissues diminution of bile must follow.

In severe vomiting bile is sometimes quite *blue*, but this is merely the result of an oxidation change of the normal pigments.

Albumen has been found in the bile in Bright's disease, but the meaning of this is not clear.

In acute yellow atrophy the bile may be colorless.

In dropsy of the gall-bladder the con-

tents may be quite colorless, but this can hardly be called *bile*. R. SAUNDBY.

BILHARZIA HÆMATOBIA (DISTOMAHÆMATOBIUM).—A species of trematode worm, cause of the hematuria that is endemic in Egypt, Africa, Arabia, and elsewhere. The sexes are distinct, the female being nearly twice as long as the male, but much more slender. The mode of introduction of the parasite is uncertain; probably it enters the body in the drinking water, but some are of opinion that it invariably enters through the urethra in bathing. The worm probably resides in the veins in the region of the bladder and prostate. It has, however, been found elsewhere, notably in the portal veins. Ova have been found in the capillaries of the lungs, kidneys, and skin, and are passed by the sufferers from this disease in enormous numbers in the urine. Their presence in and upon the mucous membrane of the bladder gives rise to the formation of inflammatory granulation tissue.

The prominent *symptom* is hematuria, and patients are usually anæmic. At the beginning of the disorder small quantities of almost pure blood are passed toward the end of micturition, and later on blood-clots of considerable size. There is pain in the region of the neck of the bladder and in the urethra, especially during micturition; pain in the buttock is also common. The urine is turbid, containing crystals of oxalate of lime and shreddy filaments, branched and curling at their ends, with minute white or yellowish opaque specks in their midst. Under the microscope the filaments are seen to be homogeneous fibers, with mucous cells, forming a stroma in which some ova are imbedded. The sediment to the naked eye consists of: (1) Minute, opaque, roundish masses, white, yellow, or red, (2) brightly blood-stained cylinders, often branched, and (3) flat blood clots; microscopically, free ova will be found, together with pus and blood-corpuscles and every variety of epithelial *débris* from the urinary tract. The egg is a bright, translucent body, ovoid in shape, with a minute spike at one end, and is readily seen, even under a low power. The shell is transparent, and the embryo is plainly visible within, being generally adherent at one or more points to the shell; it is com-

pletely surrounded by cilia, by means of which it moves with great rapidity when free. Diluting the urine with ten times its bulk of water suffices to hatch the ova, but the embryo speedily dies in undiluted urine. The disease may come on at any age, even as early as three years; it is much more common in the male sex. Children who are attacked usually recover by the time they reach maturity; this is not so likely to occur in adults, but the disease often becomes quiescent.

The *treatment* should be directed to the improvement of the general health of the patient rather than to any attempt to kill the worm by internal or local treatment. In countries where the disease is known to be endemic it will be advisable to avoid bathing, and only to drink water which has been boiled and filtered.

JOHN ABERCROMBIE.

BILIOUS is a popular, not a scientific term. A person is said to be bilious when he has vomiting or diarrhea, or both, the vomit and motions being highly charged with bile, and with these symptoms there will be anorexia, a furred tongue, and a muddy, jaundiced tint of skin. The theory which the name implies, that such a person is suffering from excessive formation of bile, has no foundation in fact. A rigid attention to diet, with perhaps abstention from food for half a day, would form the most important part of the *treatment*. Salines and alkalies may be administered with advantage.

BICYCLE.—**Bicycling.**—The bicycle, from a medical point of view, is to be classed as a hygienic rather than as a therapeutic agent, but is to be studied as a factor in both the production and cure of disease, particularly with reference to gynecology. Taken with discretion and in moderation bicycle riding is a healthful exercise and of marked benefit in many cases of nervous disorders, atonic conditions, nervous and atonic dyspepsia, torpidity of the liver, constipation, in some forms of dysmenorrhœa and incipient lung disease. In many cases of atonic and nervous disorder I have prescribed the use of a wheel, and have, in my own case, used the bicycle (Columbia) with benefit in nervous dyspepsia. As the effect of bicycle riding is to accelerate the circulation and greatly increase the action of the heart, it is contra-indicated

in cases of advanced lung disease, weakness of the heart, anæmic conditions, and also in genito-urinary diseases. Riding to excess, or upon unsuitable wheels or saddles, has given rise to prostatitis, urethritis, vulvitis, vaginitis, cystitis, and appendicitis. In each case, particularly with invalids and delicate persons, advice must be given in accordance with existing conditions.

BLACK DEATH.—See PLAGUE.

BLACK VOMIT.—See YELLOW FEVER.

BLADDER, CANCER OF.—Epithelioma is very rare, and slow in its progress. Scirrhus is more rare, except as an extension from neighboring organs. Encephaloid is more common.

Symptoms.—Frequent and difficult micturition; pain in neck of bladder, often extending to loins and hips as well as perineum; hemorrhage usually sudden and copious; frequent and continuous oozings are more characteristic of villous growth (Thompson); enlargement of pelvic and lumbar glands; sometimes cancer cells are found in urine; growth may be felt per rectum or by catheter; cachexy.

Prognosis.—Encephaloid cases last, on an average, twelve months; Brodie has known a duration of seven or eight years.

Treatment.—Attend to general health, state of bowels, appetite, etc. Use anodynes, especially subcutaneous morphia injections, with no niggard hand; morphia suppositories; alcoholic stimulants. For the hemorrhage, cold, rest, and injections, silver nitrate, gr. ss. to $\frac{3}{4}$ j., iron, and other local astringents. Recumbent posture in some cases. Some tumors in the female bladder are accessible for operation.

BLADDER, CATARRH OF.—Chronic inflammation with muco-purulent secretion.

Causes.—Generally either stricture, calculus, or enlarged prostate; often paralysis; atony, ulceration, tumors, cancer; a sequel of acute cystitis; may arise from disease of neighboring parts, anus, rectum, vagina, and uterus; gout, gonorrhea, foreign bodies, and, in fact, any irritant which can affect the bladder,

Symptoms.—Frequent micturition;

urine ammoniacal, fetid, mixed with stringy mucus, deposits phosphates; the general health gradually gives way; pain, generally dull and radiating along perineum, anus, urethra, etc.

Pathology.—The mucous membrane is thickened and congested, and the sub-jacent muscular tissue hypertrophied.

Prognosis.—Recovery may take place in recent cases, but old cases generally die, eventually worn out, or else in a typhoid state.

Treatment.—1. Local: wash out bladder with warm water, or solution of acetate of lead (1-6 gr. to 1 oz.), argent. nitric (1-8 gr. to 1 oz.), nitric acid (m 1-2 to $\frac{3}{4}$ j; the strength may be gradually increased. P. P. White, of Dublin, uses 4 grs. borax to 8 oz. of "very hot water." When the urine is fetid, carbolic acid (mj to $\frac{3}{4}$ iv). Manipulate very gently, and inject only 2 or 3 ozs. at a time, Counter-irritation; croton oil or iodine to pubes; linseed and mustard poultices to pubes. 2. Internal remedies: Anodynes by mouth and rectum. Aperients: buchu, uva ursi, pareria brava, triticum repens, iron. Dr. Gross strongly recommends copaiba and cubebbs when the secretion is excessive. Demulcents: decoctions of marshmallow, linseed, Irish moss, elm-bark, or barley. The urine should be made neutral if acid. Diet is very important: light, nutritious, farinaceous. Milk and fish. Rest horizontally; warm clothing; warm climates. In severe cases the lithotomy-incision has been made by Gross, Wheelhouse, Teevan, and others.

BLADDER, DILATATION OF, without hypertrophy, sometimes exists.

BLADDER, FOREIGN BODIES IN.—*Treatment.*—Urethral forceps, lithotrite, operation as for median lithotomy.

BLADDER, HYPERTROPHY OF, arises from obstruction to the passage of urine, and from continued irritation. Commonly coexists with catarrh. Its existence can be inferred from that of its causes. Treat the catarrh and remove the causes.

BLADDER, INVERSION OF.—Four cases have been recorded. Occurs in female children only.

BLADDER, IRRITABILITY OF THE.—Always a symptom only, though its importance has given it the rank of a disease.

Causes.—1. Disease of the urinary apparatus; vesical catarrh, stricture, prostatic disease, foreign body, tumor or calculus in bladder, disease of kidney or ureter, gonorrhea; 2, state of urine, most common in elderly males; 3, diuretics, cantharides; 4, venereal excesses, onanism, a long and narrow prepuce; 5, indigestion, ascarides, hemorrhoids, fistulæ, prolapsus ani, pruritus ani; 6, nervous disorders, hysteria, depressing emotions, excessive mental exertion; 7, debility from many causes; 8, exposure to cold; 9, ovarian and uterine diseases.

Symptoms.—Frequent micturition, but the total amount of urine passed not excessive.

Prognosis.—Good, when the cause can be removed. The disease is intractable in weak, scrofulous subjects.

Treatment.—Remove the cause if possible; any way, treat the cause. Ext. belladonna, gr. one-sixth per diem; copaiba; tinct. cantharidis; buchu; pareira brava. Farinaceous diet.

BLADDER, NEURALGIA OF.—Very rare. Sometimes reflex, and depending on conditions of the liver, kidney, nerve-centers, etc.

BLADDER, PARALYSIS OF.—A name applied to loss of power of the bladder from nervous affections. Weakness from injury or disease of its muscular walls is called atony (which see).

Causes.—Injuries or diseases of the spinal cord and brain; reflex paralysis from operations, especially those for hemorrhoids; shock; debilitating diseases, especially continued fevers; sexual excesses, especially in old men; mechanical injury, *e. g.*, in protracted parturition; over-distention; severe inflammation; hysteria.

Symptoms.—Firstly retention, and then incontinence also. Paraplegia often present. The distended bladder forms an abdominal tumor.

Prognosis.—Depends chiefly on cause. Sometimes fatal, even when promptly relieved.

Treatment.—Pass a full-sized catheter; only partially empty bladder at first if the distention be great; regular cathe-

terism twice a day; cathartics; tonics; strychnine; cantharides; iron; quinine; arsenic. Electricity. Counter-irritation: cold douche. If possible, avoid catheterism in hysterical cases; try ordinary remedies for hysteria.

BLADDER, PUNCTURE OF.—1. Suprapubic: incise skin for half an inch in middle line, just above pubes; then plunge in curved trocar downward and backward; leave a soft catheter in the wound. 2. Per rectum. Guide a curved trocar on the left index finger in the rectum till the point can be placed against the bladder, in the middle line, just behind the prostate. During this first step, keep the trocar quite sheathed; then project the point, and plunge the instrument into the bladder; leave in a soft catheter.

BLADDER, STAMMERING OF, or rather, of urinary organs.—A condition in which, without any more visible organic disease than exists in stammering of the vocal organs, the sufferer cannot micturate freely at will. The stammering is usually aggravated by anything which directs the patient's attention to the act of micturition, or which makes him "nervous," or by temporary disorder of the digestive or urinary organs.

Treatment.—Strengthen the general health, attend to digestion and state of urine. Teach patient to pass a catheter for himself, so that he may be free from fear of retention.

BLADDER, TUBERCLE OF.—Seldom or never occurs except with tubercle of other urinary organs.

Symptoms.—Those of ulceration in a tuberculous patient.

Treatment.—That of tuberculosis: anodynes; rest.

BLADDER, WASHING OUT.—This may be done either with a double current catheter or with Clover's apparatus, with Bigelow's apparatus, or with a siphon tube. C. B. KEETLEY.

BLADDER, WOUNDS OF THE.—The bladder may be injured by stabs or gunshot wounds through the abdominal wall or even through the sacro-sciatic foramen, through the rectum, vagina, or urethra, and by the pelvic bones in cases of fracture. The part covered by the per-

itoneum may be involved (so that the urine enters into the peritoneal cavity) or the anterior surface and the base. In the latter case the urine either becomes extravasated into the cellular tissue, and causes sloughing, or escapes by the rectum or vagina, leaving a fistulous channel.

Gunshot injuries are not so fatal as might have been expected; the urine escapes externally through the wound made by the bullet, and its retention and decomposition are thereby prevented. The same occurs when the bladder is wounded by foreign bodies pushed into it through the rectum or vagina, or when, in consequence of pressure during parturition, the septum sloughs and gives way. When there is no external wound affording an easy exit for the urine, it accumulates, decomposes, and acts as a most virulent septic poison.

Bladder, Rupture of the.—This can only occur when it is distended. If it is healthy, and the urethra free, it cannot happen without external violence, such as a blow over the pubes, or sudden compression of the abdomen. But if there is an insurmountable obstacle to the flow of urine, as occasionally happens in childbirth (though here the rent is oftener due to bruising and sloughing), or if the bladder is in a state of advanced cystitis, with its walls thinned, sacculated, and even ulcerated, the simple contraction of the abdominal muscles is sufficient. Under circumstances such as these the effort of straining at stool, or attempting to lift a weight, may cause an extensive rent.

The rupture may be *intra-peritoneal* or *extra-peritoneal*. If there is antecedent cystitis the weakest spot gives way, wherever it may be, and the opening is more or less circular, with sloughing and everted edges; but if the bladder is healthy, and the violence sudden and external, it is most common for it to extend from one to three inches along the upper part of the posterior wall from the urachus vertically downward. In this case it partakes of the nature of a lacerated wound.

Symptoms.—A feeling of something giving way, pain, shock, inability to stand or walk, desire, but want of power, to micturate, and removal from the bladder with the catheter of blood only, or a small quantity of bloody urine. The de-

ficiency of urine, and loss of power to micturate often continue throughout. In intoxication this accident is peculiarly liable to happen from the distention of the bladder, and the absence of the protecting contraction of the abdominal muscles; but every symptom may remain in abeyance for hours. In general the pain and collapse are intense, there is the most urgent desire to pass urine without being able to void any, and peritonitis rapidly ensues.

Intra-peritoneal rupture.—Immediately after the accident the bladder collapses, the urine enters the peritoneal cavity, and the intestines fall down on to the surface of the rupture.

Treatment.—First to free the peritoneal cavity of the urine that has already entered it; secondly, to prevent the entry of any more.

In rare instances the peritoneum shows itself remarkably tolerant of urine so long as it is healthy, and, above all, aseptic. But it does not do to rely on this. It is much safer to make an incision in the middle line of the abdomen under antiseptic precautions, and carefully sponge the pelvis out.

The other indication is more difficult. Sewing up the rent has been practiced, but it is doubtful how far this is necessary if a free drain is provided through the perineum. When the bladder collapses the rent contracts very much; its sides are more or less valvular, owing to the alteration in the relative position of the mucous membrane and the muscular coat; the small intestines soon become glued to the edges; very little urine is secreted at first, and stitching the bladder requires an immense amount of manipulation. But free drainage is essential. This cannot be done effectually by catheters. The bladder must be opened either by the lateral or the median method of cystotomy; a tube must be introduced and kept open so that every drop of urine, as it falls into the bladder, may escape at once. It is conceivable that in this way the wound in the bladder may heal, having perfect rest, and that, if peritonitis does not come on from the urine that has already escaped, the patient may recover. But the prognosis is very unfavorable.

Extra-peritoneal rupture.—When the rupture of the bladder involves the extra-peritoneal part, the same general line of

treatment must be followed: there must be free exit for the urine that has already escaped, and no more must be allowed to accumulate in the bladder. As a rule, incisions are required in the suprapubic region.

The general treatment of such accidents is the same as that for acute traumatic peritonitis. Opium should be given freely; food of every kind withheld for twenty-four hours; the thirst allayed by allowing the patient to suck fragments of ice, while the body is kept fairly warm and absolutely quiet.

BLADDER, TUMORS OF THE.—

Tumors of the bladder have a tendency to assume a polypoid or villous character, even when they are malignant. Two explanations have been suggested for this: one that it is due to the alteration in the support they receive when the bladder is full and when it is contracted; the other that it is an inherent peculiarity connected with the development of the bladder from the allantois.

Varieties.—They are either simple or malignant. The former include papillomata, mucous polypi, fibromata, and, as a great exception, myomata. The latter carcinoma and sarcoma.

Papillomata are generally single and sessile, but they may be multiple or pedunculated. The most common form is a circumscribed tumor covered over with villi projecting from the surface of the mucous membrane and freely movable. More rarely there is a shaggy villous coating to the whole interior. In structure they consist merely of delicate connective tissue, containing loops of vessels covered with a prolongation of the vesical epithelium. The mucous membrane round them is perfectly healthy, and the growth does not involve the deeper-lying strata. The trigone seems to be a favorite situation for these, and, indeed, for all tumors of the bladder.

Mucous and fibrous polypi are much more rare. The former may be multiple, and resemble in character the polypi found in the lower part of the nasal fossæ. The latter are true fibroid tumors which have become pedunculated.

Sarcoma is not common, but certain tumors are occasionally met with, to which the name "transitional" has been applied, as they present features to some

extent intermediate between papilloma and sarcoma.

Carcinoma of the bladder may be either epithelial or encephaloid. Scirrhous has been described, but is very rare. The character of the growth is essentially the same, the chief differences being in the relative amount of struma present and the shape of the cancer cells, which, in correspondence with the epithelium of the bladder, may be squamous, polyhedral, or columnar. Ulceration sets in early, and often (as, indeed, sometimes happens with villous tumor) a coating of phosphates forms on the top, so that they feel like adherent phosphatic calculi.

Epithelioma is most common in the trigone, but it is never limited to the mucous membrane. Malignant tumors may always be distinguished, even though they are covered over with villi, by the way in which they infiltrate the neighboring tissues, both at the margin and at the base.

The symptoms of tumors of the bladder are hematuria, cystitis, and pain.

Both benign and malignant growths cause hemorrhage, especially after micturition, owing to the sudden relief of pressure, and whenever a catheter is passed. If it occurs in young patients, and is only occasional, particularly if it is very profuse, and continues off and on for years, the growth is most probably a papilloma.

The pain may be merely due to the cystitis, but in carcinoma there is not unfrequently a constant aching sensation in the loins and down the thighs. The cystitis depends upon the interference with the function of the bladder and the retention of urine. It may be very long in making its appearance, this depending probably on the exact position of the growth; but when it has once commenced it persists, and adds very seriously to the patient's discomfort.

The diagnosis must be made from the symptoms or from the presence in the urine of fragments that can be identified as portions of villi or of epithelial carcinoma. If the passage of a catheter is constantly attended by profuse hematuria, it is sometimes possible to extract a fragment of the growth by using an instrument with a large eye, and allowing the urine to stream out rapidly through it. In exceptional cases portions

may be withdrawn with a flat-bladed lithotrite. But, as a rule, the diagnosis can only be confirmed by digital exploration. The urethra in the female may be dilated easily under an anæsthetic, so that when firm pressure is made in the suprapubic region, the finger can explore the whole interior of the bladder. In the male the same can be done (if the perineum is not very deep) by opening the membranous part of the urethra in the middle line. In this way, the size, shape, number, and, to some extent, the nature of the growth may be ascertained, so that the adoption of further measures may be considered.

Prognosis.—The hematuria rarely proves fatal of itself, though it is of serious moment from the way in which it reduces the patient's strength. In old cases the cystitis becomes extreme, and is followed by the ordinary complications, atony, retention, pyelitis, and surgical kidney. If the growth is malignant, nothing can be done beyond relieving the symptoms of the time. Excision of a portion of the wall has been practiced with success in the case of animals, but could only be of service in quite exceptional circumstances.

Treatment.—In recent years many attempts have been made, and with complete success, to remove non-malignant growths from the interior of the bladder. In the case of women this can be done most easily through the urethra, by means of properly contrived forceps which have the serrated crushing edge guarded by projecting wings, so that they may seize the root of the growth and crush it off without injuring the mucous membrane. In men it may be accomplished through an opening in the perineum or over the pubes. The former has the advantage of draining the bladder more thoroughly after the operation; the latter of giving a larger amount of room and more free movement. Probably each operation is suited to certain particular cases; the perineal one, where it is necessary first to perform an exploratory operation, or where the growth is attached to the trigone; the suprapubic under other circumstances. In certain cases it has been found advisable to make use of both together. If the growth is pedunculated it may be seized with forceps and crushed or twisted off; where it is sessile much may

be accomplished by freely removing all the superficial parts so that the subsequent cicatrix may obliterate the rest. Even when it is multiple, great relief has been obtained by scraping off small sessile growths with the finger nail. In very rare instances the growth has been extruded through the urethra or through the wound (according to the sex), ligatured, and cut off.

BLADDER ; EXTROVERSION OF THE ECTOPION.—Absence of the anterior wall of the bladder, with more or less deficiency in the corresponding part of the abdomen, involving even the symphysis pubis and the upper part of the penis. It is more common in males than females, and is due to the defective formation of the mesoblast in the body wall behind the umbilicus. At birth, the deficiency is made up by a thin membrane which dries up and is cast off.

Appearance.—The posterior wall of the bladder is exposed with the orifices of the ureters. Owing to the pressure of the viscera behind, it is gradually pushed forward until it projects as a rounded tumor above the pubes covered with mucous membrane, which, from the constant exposure and friction, becomes vascular, red, and ulcerated. The urine continually drains away, so that the condition of the patient is most distressing unless something can be managed in the way of a contrivance. The most efficient is a concave shield, fitting closely to the skin round the projection, and connected below with a urinal; but even this is rarely satisfactory.

Treatment.—The measures that have been devised to relieve this distressing deformity aim at either diverting the course of the ureters into the colon, or closing the gap, with the exception of the lower angle, by means of plastic operations. The former is very rarely successful: the latter may give considerable relief, but repeated operations are generally necessary.

The operation consists in dissecting up flaps of skin, and replacing them over the orifice (the edges of which have been freshened), so that there shall be a double layer: one, the deeper, with its cutaneous surface toward the cavity; the other facing the opposite way, so that the raw surfaces of the two may be in contact. The deep flap may be dissected up from

the abdomen above the cavity, and turned on itself downward; or if the gap is not very great, it may be formed from the groin with a long neck, and then twisted on itself so as to be adjusted in the same way. The superficial ones are either formed from the lateral portions of the abdomen, on either side of the deficiency, and brought over the reflected flap to meet in the middle line; or when the deep flap is fashioned from one groin, the superficial one is taken from the other and adjusted over it.

The flaps must be very carefully fitted to the freshened margins, and should be braced firmly together by means of hare-lip pins. Afterward, broad strips of plaster are brought over the abdomen to relieve the tension as much as possible, and the patient is kept quiet in bed, with the knees flexed and tied together.

Union rarely takes place everywhere, small fistulous channels being left, through which urine continues to drain away, requiring further operations. Even then the orifice, at the inferior angle, continues to yield, and it is generally necessary to perform some further operation to rectify the epispadias.

BLADDER, CYSTITIS OF.—Cystitis is either acute or chronic, though no hard and fast line can be drawn between them.

Acute cystitis is generally due to injury, whether mechanical, from instruments, calculi, or foreign bodies, or chemical, that is to say, from urine either putrid or containing cantharides or excess of uric acid. It is sometimes caused by an extension from neighboring parts, the urethra or peritoneum. Cold is an exceptional cause even in gouty subjects.

The *appearances* differ according to the severity. There may be merely hyperæmic swelling and softening of the mucous membrane, with an increase in the amount of the mucus and epithelium thrown off; or the congestion may be intense, with blood escaping into the interior or into the walls, so that they become stained and ecchymosed. The epithelium undergoes mucoid softening; the surface is raw and ulcerated, or covered with shreds of lymph; and the exudation that is poured out collects as pus in the urine, or forms a firm fibrinous coating (like a diphtheritic membrane) on the interior, or is heaped up in the sub-

mucous and muscular tissues until they are riddled with abscesses.

The *symptoms* are constitutional and local. The former vary from fever of the utmost severity (the patient sinking rapidly into a hopeless typhoid state), to a mere transient pyrexia. The latter are thoroughly characteristic. The bladder is inflamed and irritated; the contact of the urine excites it to such violent spasmodic contraction, that as soon as a few drops collect they are expelled at once; intense burning pain is felt in the perineum; pressure over the pubes makes it infinitely worse; and the urine is scanty, high colored, mixed with shreds of mucus, and in severe cases with blood. Gonorrheal cystitis is generally subacute, and limited to the neck of the bladder.

Prognosis.—The inflammation either subsides when the cause is removed, or else becomes chronic. If it is due to septic causes, especially if the acute attack is grafted on a chronic one, supuration may set in; the septic influence travels up the ureters and causes acute nephritis, or peritonitis follows from extension through the walls of the bladder, or the urine becomes infiltrated into the tissues, and causes sloughing.

Treatment.—If the bladder and kidneys are healthy, and the cause is only temporary, the inflammation soon subsides. The urine may be rendered less irritating by the use of henbane, alkalies, or alkaline carbonates; morphia suppositories should be given at night to relieve the stranguary; leeches should be applied to the perineum, and the bleeding should be encouraged by poultices. The patient should be kept warm in bed; should be given a hot hip bath night and morning; should have his bowels kept open, and be put on a mild, unstimulating diet, with plenty to drink.

If the urine is ammoniacal (particularly if the kidneys and bladder were previously diseased), the condition is very different. So long as the bladder is allowed to retain putrid fluid the inflammation must continue, and even if acute nephritis does not set in, the patient is poisoned by the absorption of septic matter. The bladder must be washed out with antiseptic solutions to check decomposition; or if this fails, an incision must be made in the perineum and the putrid fluid allowed to run off as soon as it enters the bladder. Sometimes this succeeds, but

more often the patient sinks from septic intoxication and renal disease.

Chronic cystitis is the result of the acute form, or follows from the same agencies when they are less severe and more persistent. Everything that interferes with the function of the bladder, that prevents it emptying itself thoroughly, or that sets up a condition of tension, irritates it and brings on an attack of inflammation, which, when the exciting cause is continuous, persists. New growths in the bladder (though many of these, tubercle, for example, are accompanied by inflammation under all circumstances), stricture, enlarged prostate, atony, paralysis from disease or injury of the spine, all tend to excite it.

A large quantity of alkaline mucus is thrown out; this mixing with the urine retained at the base of the bladder lessens its acidity. Decomposition is thus rendered more easy. A ferment gains access in some way, either through a catheter (for it has been known to occur within two days after the first introduction of an instrument), or by gradual extension upward in the mucus lining the urethra; the urea splits up; the urine becomes fetid and ammoniacal, and the cystitis is permanent.

Diagnosis.—Renal calculus and tuberculous pyelitis sometimes simulate cystitis very closely; and cystitis must be distinguished from irritability of the bladder due to other causes, such as (in women) a vascular tumor of the urethra, congestion or displacement of the uterus, prolapse of the wall of the vagina, or even hemorrhoids and other affections of the rectum.

Pathological changes.—When slight there is only hyperæmia and an increase in the secretion of the mucous membrane. When more severe, the interior is rough and irregular, stained slate color from old hemorrhages, with red or purple patches here and there from more recent ones, and darker lines corresponding to tortuous and dilated veins. It may be ulcerated, or, especially on the ridges, coated over with a fetid mixture of pus and phosphates. The sub-mucous tissue is infiltrated, hardened in some places, and full of small abscesses in others.

The ulceration is extensive where the exciting cause is tubercle or septic matter, acting on a bladder already diseased. If it is due to stone it is generally limited to the neck.

If the obstruction has come on slowly, and the bladder has worked long to overcome it, the muscular coat is irregularly hypertrophied so that the interior is thrown into ridges, separated by depressions, which in old cases become deeper and deeper until they form out-lying pouches with narrow necks. In these urine accumulates and decomposes, so that sometimes they are filled with phosphatic concretions. If, on the other hand, the obstruction has been sudden and extreme, the muscular wall is over-stretched, thinned, and atrophied.

The *symptoms* are those of acute cystitis, but much less severe. Pyrexia may be almost absent, but the constant pain, the want of rest, and, above all, the interference with the function of the kidneys, rapidly undermine the health.

Pain is felt in the perineum and over the pubes, becoming more acute as the bladder is distended and when it contracts, ceasing when it is empty. There is a constant burning sensation at the neck of the bladder, and an almost irresistible desire to pass water, it may be every minute. The urine is ejected spasmodically; it may be acid, with, as in gonorrheal cystitis, merely a floating cloud of mucus; or alkaline, ammoniacal, and fetid; or turbid, with phosphates and pus, and, if left to stand, separating into two strata, an upper, moderately clear, and a lower, which consists of a slimy, gelatinous mass, adhering to the vessel as it is inverted, and then suddenly slipping out.

When the local pain is very severe, and blood is constantly present, ulceration of the mucous membrane may be diagnosed.

Treatment of chronic cystitis.—The constitutional treatment of chronic cystitis is the same as that of acute. Rest and warmth are essential; the diet should be light and without stimulants; milk by itself for a time is often of great service; the bowels should be kept freely open, and irritation should be relieved by morphia and belladonna suppositories or henbane. Where there is profuse secretion of mucus, without the urine being ammoniacal, copaiba and other balsams may be given with benefit, or infusions of triticum repens, buchu, or uva ursi in large quantities. Alkalies, even when the urine in the bladder is alkaline, sometimes allay the irritation,

possibly because it is too acid when secreted by the kidneys. Benzoic acid and benzoate of ammonia have a tendency to increase the acidity, and so check decomposition.

General treatment is of no use so long as the local cause persists. If this can be removed, the urine, even when it is ammoniacal, often recovers of itself. When it cannot be done the decomposition of the urine must be checked by other means. The bladder must be washed out carefully night and morning. A saturated solution of boracic acid; four grains of iodoform suspended by mucilage in an ounce of water; or a solution of quinine gr. 1 ad $\frac{3}{4}$ j, or very dilute bichloride of mercury may be used. But not more than two or three ounces should be injected at a time; the fluid should be of exact temperature, and it should be allowed to flow in and out by its own weight. Before injecting a medicated solution it is as well to wash out the deposit of mucus. If by this means decomposition has been stopped, but the catarrh continues, tincture of iodine or acetate of lead gr. ss ad $\frac{3}{4}$ j, nitrate of silver gr. 1 ad $\frac{3}{4}$ j, may be used as astringents in the same way, with mild counter-irritation applied to the perineum.

As a final resource where the condition of the bladder resists all treatment, and the patient is tired out, *cystotomy* by the median perineal section may be tried. Sometimes, in this way, a cause that could not be detected by other means is found and removed, or, if not so successful as this, the bladder is given thorough rest and drainage, so that it sometimes recovers of itself.

Symptomatic Indications.—For simple cystitis *aconite* is usually the only remedy required to effect a cure. The usual febrile symptoms are present with the addition of those peculiar to the disease. When *aconite* fails, or the marked febrile symptoms are not present, the best remedy is *cantharis*. The pain in the bladder is violent and burning, with frequent desire to urinate, passing only small quantities of dark or bloody urine. The pain on micturition is frequently so violent as to extort screams. Cystitis from gonorrheal irritation requires *cannabis ind.* Violent burning in the urethra during and after micturition, and painful discharge of bloody urine drop by drop, characterize this remedy. For

inflammation of the neck of the bladder the best remedy is *digitalis*. The characteristic symptoms are frequent sharp, cutting pains in the neck of the bladder as if a straw was being thrust back and forth, with continual desire to urinate, emitting at each time only a few drops.

For chronic cystitis the principal remedy is *chimaphila*, particularly when hectic fever is present. For the chronic form of the disease which affects elderly people of sedentary habits *turpentine* is usually sufficient to effect a cure.

BLADDER, ATONY OF THE.—

The bladder is said to be in a state of atony when, the nervous mechanism being unaffected, its muscular power is so impaired that it is unable to empty itself. The retention may be complete, the bladder being unable to expel any of its contents; or partial, a certain residuum always being left behind, so that the available space in the bladder is considerably diminished. In the first case overflow is the prominent symptom; in the second, frequency of micturition.

When the retention is due to some affection of the nervous system, the bladder is said to be paralyzed.

Causes.—Overdistention is the most common immediate cause of atony; it may be due to voluntary retention, to stricture, or enlarged prostate; and it may occur in a perfectly healthy bladder, the muscular fibers being so stretched that they are unable to recover themselves. But it is more often met with when the nutrition is already impaired by other causes; in old age, for example, the muscular coat of the bladder becomes feeble and undergoes a kind of senile atrophy, in common with the rest of the muscular system, so that stricture of the urethra gives rise to a dilated atonic bladder instead of one that is contracted and hypertrophied. In chronic cystitis, again, the same thing happens when the muscular coat is involved; it becomes infiltrated with dense fibroid tissue, and is neither able to contract nor expand as it should; or else, after some time, the compensative hypertrophy gives way to fatty degeneration. Under circumstances such as these a very slight additional cause, even the introduction of a catheter, may bring on complete retention, due in

part to the nervous shock, in part to the atonic condition of the muscles.

The symptoms of atony are those of retention. It may be sudden and complete: the bladder becomes more and more full until something gives way. Or it may be gradual and partial, the bladder being unable to empty itself thoroughly. The former leads to what is sometimes called incontinence, the obstruction yielding, and the urine running away drop by drop, as it enters, leaving the bladder always full. The latter causes increased frequency of micturition, owing to the diminution in the capacity of the bladder. Cystitis, decomposition of urine, pyelitis, and surgical kidney are the invariable results of both, if the condition is left without remedy.

Treatment.—Atony, occurring in a healthy bladder as the result of overdistention on a single occasion, is sometimes incurable. Generally speaking, however, by giving the muscles perfect rest, drawing the urine off at frequent intervals, and by the use of tonics, especially when applied locally, the power gradually returns. Washing it out with cold water, care being taken not to induce cystitis; strychnia and nux vomica, either by the mouth or hypodermically, and galvanism (one pole in the rectum and the other over the lumbar spine) may also be tried.

When it is due to old age, fatty degeneration, or inflammation, the condition must be regarded as permanent. All that can be done is to postpone as long as possible the chronic cystitis and disease of the kidneys which are so prone to ensue.

Symptomatic Indications.—Atony of the bladder in general may be relieved by *arnica*, particularly when it is the result of overdistention. There may be either retention of the urine with tenesmus of the neck of the bladder, or there may be incontinence, the urine dropping out involuntarily. When the result of excessive sexual indulgence the remedy is *coniun* which is also indicated in weakness of the bladder in old men. The flow of urine suddenly stops, then continues after a short interval.

See URINARY DIFFICULTIES.

Paralysis of the bladder requires *cannabis ind.*, which strongly affects the nerves of the bladder; *secale corn.*, with sensation as if the bladder was imperfectly

emptied; *arnica*, from overdistention; *opium*, when of idiopathic origin; *gelseminum*, when the sphincter is paralyzed; or *causticum*, when there is frequent, difficult and painful micturition, the urine is light colored like water, or there are involuntary emissions of urine when coughing or at night.

Irritability of the bladder is most frequently relieved by *belladonna*, particularly when occurring in children or hysterical women. Micturition is difficult, the urine being passed drop by drop, or there may be constant dribbling, wholly involuntary. Sharp stitches of pain low down in the abdomen, in the direction of the perineum. Feeling in the back as if it would break. Irritability of the neck of the bladder and the urethra, occurring in old women, is relieved by *copaiba*. *Diurnal* irritability from exposure to wet or cold by *dulcamara*.

Catarrh of the bladder.—Recent catarrh from chill, with much pain, which appears and disappears suddenly, is relieved by *belladonna*, the urine is yellow and turbid, or the color of gold; sometimes depositing a reddish sediment. Burning heat in the region of the bladder, with retention of urine, with constant pressure on the bladder and desire to urinate, may be cured by *camphor*, which is also the best remedy when stranguary is present. If the catarrh is the result of exposure to damp, cold weather, or is aggravated every time the weather changes, relief may be obtained from *dulcamara*. The urine is turbid and white, or reddish and burning, depositing at times a red, at times a white sediment. Strong smelling, high colored or alkaline urine, with phosphatic or muco-purulent deposit, indicates *benzoic acid*. *Nux vomica* is called for when there is spasmodic stricture of the urethra, with retention of urine. There is painful, ineffectual desire to urinate, with discharge of a few drops of red, bloody, burning urine.

BLADDER, TAPPING THE.—May be performed either as a temporary measure to allow the spasm and congestion to subside, or when the urethra is obliterated to afford a permanent means of exit for the urine. In exceptional instances relief may be obtained by external urethrotomy, especially if it is wished at the same time to divide a stricture or open up the pros-

tate; but in general the operation means opening the bladder either above the pubes or through the rectum.

In *suprapubic tapping* the bladder is entered below the fold of peritoneum through the anterior wall of the abdomen. There is abundant room for this when the bladder is thoroughly distended, but in cases of old cystitis, where it is rigid and unyielding, it is advisable to keep close to the posterior surface of the symphysis, and to introduce a dilator into the rectum. When temporary relief only is required the aspirator may be used, a small incision being made in the skin with a scalpel, and the trocar pushed through it into the bladder downward and backward. No extravasation follows the withdrawal of the canula, as the mucous membrane glides on the muscular coat when the bladder collapses, and the orifice at once becomes valvular. If necessary this may be repeated more than once.

When a more permanent opening is required, a large trocar (with a linear, not a triangular, cutting edge) and a canula should be introduced in the same way. On withdrawing the trocar a soft elastic catheter may be passed down the canula, and left in when this is removed. After a few days the tissues become consolidated round the opening, and there is a short straight canal leading into the bladder, which may be fitted up permanently with an india rubber or silver tube provided with a stop-cock. Owing to the contraction of the sinus the amount of leakage round the tube is infinitesimal, and there is nothing to prevent this arrangement lasting for years.

In *tapping through the rectum* the patient is held by assistants in the lithotomy position, and brought well down to the edge of the bed. The forefinger of the left hand is then introduced into the anus, and the boundaries of the prostate are examined. The finger should reach well above its upper border, and should be able to feel distinctly a wave of fluctuation when the anterior wall of the abdomen is percussed over the pubes. Then a long curved trocar and canula is taken, and the point, guarded by the finger, guided to the spot where fluctuation is felt, exactly in the middle line. This corresponds to the trigone of the bladder. When this is adjusted the handle is slightly depressed and driven

smartly upward and forward in a direct line for the umbilicus. If it is wished to keep the opening patent either the canula or an elastic catheter must be left protruding from the anus. There is no doubt that in this way the bladder is drained much more efficiently than by either of the other methods, but it is not suited to cases of enlarged prostate, and as a permanent method it cannot be compared with suprapubic tapping. In many patients there is great difficulty in maintaining the canula or catheter in position even for twenty-four hours, owing to the irritability of the rectum. As a means of temporary relief it is as safe as suprapubic aspiration; there is very little fear of extravasation in either case, and one is as easy as the other; but while it is very successful if the patient is able to tolerate a tube in his rectum for some days, it has this disadvantage, that if he cannot a repetition of the operation is not advisable.

C. MANSELL MOULLIN.

BLEEDING. — Venesection.—Veins used: median-cephalic, median basilic, external jugular, saphena veins near ankle, veins of scrotum. Instruments required: bleeding-tape or bandage, bowl, lancet, pad, sponge, and water. Apply tape to middle of upper arm, tight enough to congest veins, but not to affect pulse. Hang arm down a little while; then choose spot and apply thumb just below it. Pass lancet gently and obliquely into vein, and enlarge opening without deepening incision; draw off enough blood. If necessary, make patient work his hand, opening and shutting it. Finally apply pad over wound; fix it with the tape; put arm in sling for two days. In opening external jugular, put the pad just above the clavicle, and cut in the direction of the fibers of the sterno-mastoid. Bathe the veins of the scrotum with warm water before and after opening them.

Arteriotomy.—Cut the temporal artery or its anterior branch half in two transversely; when enough blood has flowed, divide it completely, and apply a pad and bandage.

C. B. KEETLEY.

BLENNORRHEA (GLEET).—See GONORRHEA.

BLEPHARITIS. — See EYELIDS, DISEASES OF.

BLISTERS.—See ANTISEPTICS.

BLOOD, TRANSFUSION OF.—
See TRANSFUSION OF BLOOD.

BLUE DISEASE.—See CYANOSIS.

BOILS.—*Causes.*—Debility or plethora (but these causes are probably never sufficient when uncomplicated); change of diet; excessive perspiration; hydropathy; sea-bathing; air of dissecting rooms; training; spring and early summer season; diabetes; diseased meat; irritation of sexual organs; local irritants of various kinds, *e. g.*, edge of a frayed shirt collar; poultices.

Symptoms.—The local appearances are well known. There is rarely any fever. Sometimes premonitory symptoms, such as feeling of chilliness, bad temper, etc.

Pathology.—In the first instance, a boil is frequently indistinguishable from an acne-spot. Indeed, in a person suffering from an attack of boils, almost any acne-pimple can be irritated into a boil by persistent friction, or by exposure to some continuous irritant, such as the sea-water constantly wetting the wrists of fishermen. A boil is a local cellulitis, often spreading from an inflamed sebaceous follicle; and the reason of this spreading is, in most cases, not the specific nature of the original cause, but persistent local irritation. As it is quite as easy to protect from local irritation, and to check acne, as to cure the specific cause of boils, if there be one, I hold that this view of boils is of practical importance. The “core” of a boil is a central slough of cellular tissue.

Treatment.—*Local.*—Soap plaster. Poultices or water-dressings should be avoided, as they bring out fresh boils. Incision (complete) of very painful ones. Ext. belladonnæ and glycerine on lint. Blind boils may be aborted by the application of a strong caustic to the commencing vesicle; strong carbolic acid locally.

General Treatment.—Regulate the diet. When any poison appears to have been absorbed, use eliminative treatment, *e. g.*, purgatives, Turkish bath; moderate exercise; light clothing; arsenic; yeast, one tablespoonful three times a day. Bathe part where the boils chiefly appear with water as hot as it can be endured, and, above all, remove every cause of local friction or chafing.

C. B. KEETLEY.

Symptomatic Indications.—*Arcus lavis.*—Persistently recurring crop of boils. *Arnica.*—Prevents and cures. *Belladonna.*—In first stages; congestive condition. *Hydrastis.*—Small blind boils; great irritation and burning. *Phytolacca.*—Tendency to painful boils, especially on back and behind ears. *Hepar sulph.*—When suppuration is inevitable. *Silicea.*—Disperses in later stages; favors and expedites suppuration. Boils in cartilaginous tissues. *Sulphur.*—Tendency to boils. Prevents recurrence and checks tendency.

BONES, DISEASES OF THE.—**Inflammation.**—Bone being a complex structure, made up of elements of very different character, shows, when inflamed, a corresponding variety in pathological result. Firstly, we have the periosteum, composed of an outer layer of fibrous tissue, and an inner layer of small active cells. Secondly, we have the bone proper, with its abundant and comparatively inert matrix, impregnated with earthy salts, and its scanty supply of vessels and sparsely distributed cell elements. Thirdly, we have the marrow, a highly organized, exceedingly vascular tissue, with very numerous cells and little or no matrix. As one or other of these tissues is involved we get three leading varieties of inflammation: *periostitis*, or inflammation of the periosteum; *osteitis*, or inflammation of the bone proper; and *endosteitis*, or inflammation of the bony marrow.

As, however, in every variety of inflammation of bone the process owes its existence and continuation mainly to the medullary tissue, whether it is massed together in the central canal, or carried along the vessels in the Haversian systems, or continued outward under the periosteum, it will be readily understood that the varieties run into each other. Thus, periostitis usually accompanies osteitis, osteitis soon follows endosteitis, and so on. In the earlier stages the forms of inflammation are sufficiently capable of distinction, clinical as well as pathological. In their later stages the gross results may become so involved as to constitute in their totality diseases requiring separate description; such are *caries* and *necrosis*.

Periostitis.—By periostitis is meant an inflammation commencing in and

chiefly confined to the periosteum. It is met with in two leading forms :

1. *Simple local periostitis*, acute or chronic.

2. *Diffuse infective periostitis*, always acute.

Simple local periostitis.—By this is meant a simple inflammation of an area of periosteum, rarely dangerous to life, and tending to recovery by resolution or after development of new bone or the formation of abscess.

Causation.—The simple form of periostitis nearly always arises either from local injury or from extension of inflammation from the underlying bone or overlying soft parts. The injury may be from a sudden blow, such as a kick on the shin, or from prolonged irritation, such as the pulsations of an aneurism. Chronic osteitis is always accompanied by periostitis, and an ulcer on the skin that is not distant from periosteum, as on the shin or scalp, will cause some degree of periosteal inflammation.

Pathology.—The appearances of periostitis are simply those of inflammation of the two tissues which enter into its composition. Inflammation of the outer fibrous layer causes it to swell and become red or livid. It loses its purely fibrous character, and becomes pulpy and œdematous ; it strips more readily from the underlying bone and appears to be more intimately connected with the superimposed muscle. The layers of cells next the bone undergo proliferation, and these, with the inflammatory exudates, help to loosen the periosteal fiber from the bone. An excessive amount of proliferation in the “cambium” layer may elevate the fibrous layer some distance from the bone, stretching, or even tearing the vessels that pass between them, and so causing partial necrosis of the outer lamellæ.

The process may eventuate in several ways, which have been described as varieties, but are, perhaps, better described as simple *terminations*.

1. *Resolution.*—The inflammation may simply pass off in its early stages, no effects being perceptible beyond, perhaps, a slight production of new bone.

2. *Periosteal abscess.*—As a result of simple local inflammation an abscess, acute or chronic, may form between the fiber and the bone. This means that the vascular supply to the underlying

bone has been cut off, and death (necrosis) of the outer layer of bone so nourished follows. An acute abscess is usually simply traumatic, and contains ordinary liquid pus. A chronic abscess has usually some predisposing influence, such as scrofula, when its contents are of the well-known cheesy nature, or syphilis, when the matter is greenish-yellow and thick.

3. *Osteo-plastic periostitis.*—The development of new bone is one of the most characteristic results of periostitis, and nearly always follows its existence in the chronic or subacute form. It is simply an increase of the normal function following a morbid increase of histological activity. A low degree of inflammation is necessary to the production of new bone by periosteum. It is found especially underlying ulcers, in the neighborhood of deep inflammations of the bone, around a foreign body, and under many other similar conditions. If found accompanying an acute inflammation, it is never in the center of it, but in the more outlying areas, that the new bone is produced. These periosteal bony new growths are known pathologically as *osteophytes*, or more correctly as *periosteophytes*, and clinically as *periosteal nodes*.

Symptoms.—Pain of a bursting or throbbing character is the most prominent symptom of acute simple periostitis. The pain is increased by pressure over the part, and especially by tapping, and is nearly always worse at night. There is some defined swelling in the overlying soft parts; the skin is either normal in color or slightly dusky.

If acute abscess forms, the pain is intensified, and may be agonizing; the swelling increases, and the skin becomes red. In chronic abscess there is less pain, but the swelling will be more marked with vague fluctuation or boggi-ness. The skin in the early stages may be of normal color, but later on it becomes mottled, dusky, or red, ultimately showing the ordinary signs of perforation by abscess. In osteo-plastic periostitis, which is nearly always subacute or chronic, the swelling is hard and unyielding, and the pain may be slight and remittent. Pain is least marked in strumous periostitis; in syphilitic periostitis it is always most severe at night; in rheumatic periostitis the pain is shifting

and uncertain as to locality and duration.

Predisposing causes, local as from injury or irritation, or constitutional as from syphilis, struma, or rheumatism, will be looked for to help in the diagnosis.

Treatment.—In simple acute periostitis the patient must be put to bed, the part elevated as much as possible, and cold applied either by ice or evaporating lotions. Hot fomentations or lead and opiate lotions may be used instead. If the pain is very severe a full dose of opium, and a liberal application of leeches to the part, will probably give much relief. Should the pain still continue, and the febrile disturbance remain unabated after twenty-four hours or so, the danger of suppuration must be avoided by a free incision through the periosteum down to the bone, either subcutaneously by a tenotomy knife, or through the soft tissues by a scalpel.

When acute abscess has formed, immediate and free incision is necessary. In chronic abscess connected with syphilis, opening may be delayed until a fair trial has been given to specific treatment. In strumous periosteal abscess it will be well, after opening, to scrape the denuded surface with a suitable instrument, as the underlying bone will probably be found carious.

In chronic non-suppurative periostitis, where there is, in all probability, some development of new bone, repeated blistering is likely to be most successful, though the application of the oleate of mercury has had good results. Iodide of potassium is supposed to be beneficial in promoting bony absorption. Subcutaneous section in various directions, or the use of the gouge, especially if there is much pain, may occasionally be recommended.

Diffuse infective periostitis, acute necrosis, acute diffuse periostitis.—This is a grave constitutional disease, locally manifested by septic suppurative inflammation of the periosteum, resulting in more or less extensive death of bone, and frequently attended with all the signs of acute septicæmia.

Causation.—The affection nearly always occurs before puberty, and in boys more frequently than in girls. Various local causes have been assigned, such as injury and exposure to cold and damp; but the ultimate cause is probably con-

stitutional. It sometimes appears after the continued fevers, and frequently in connection with the strumous diathesis; but in a considerable number of instances it is met with in individuals who have shown no previous signs of disease.

Pathology.—The pathology of this disease is still obscure. Some surgeons maintain that acute necrosis is always a result of osteo-myelitis; others that it is a pure periostitis. It is certainly an inflammation of medullary tissue, and this may be localized under the periosteum as well as in the central canal. Practically such a distinction holds good; for we meet with a superficial acute necrosis of part of the outer shell, such as would be caused by a periostitis, as well as with a necrosis of the whole shaft, such as would be caused by an osteo-myelitis.

The distinguishing marks of this form of periostitis are the rapidity and certainty with which suppuration supervenes, and the uniformity with which micro-organisms are found in the pus. The purulent fluid forces its way between the periosteum and the bone, completely severing the connection between the two, tearing through the nutrient vessels, and leaving the surface of the bone to die. The condition may be described as a septic abscess confined under great pressure between periosteum and bone. The results of such a condition in death of bone and septic infection of the system are readily understood.

Symptoms.—The symptoms are nearly always urgent. A sudden access of high fever, often ushered in with a rigor; profound constitutional disturbance, local deep-seated pain, with swelling or signs of suppuration in the soft parts overlying a bone, point to acute diffuse periostitis. At the outset local signs may be slight or absent; but, as the disease progresses, they become more urgent. Delirium is frequently present from an early stage.

The site is usually in one of the long bones, and especially in the tibia, femur, or humerus. The signs of inflammation, obscure at the beginning, in a very short time become marked with redness, puffiness, and œdema of the skin, quickly to be followed by evidence of suppuration. At this stage symptoms of septicæmia, often of the most aggravated form, may supervene; and the patient may die in a few days, or linger for weeks with abscesses in the joints or in other

parts of the body. Not unfrequently, however, and especially if the disease has been recognized and properly treated from the beginning, a favorable result ensues.

Treatment.—The only treatment likely to be of benefit is early and free incision of the periosteum, wherever pain or swelling may localize the affection. As a tendency to septicæmia already exists, the strict observance of the practice of antiseptics will be advisable. If done early enough, such incision is usually followed by a marked improvement in all the symptoms. Early incision not only minimizes the risks of blood poisoning, but saves the bone from extensive denudation and consequent necrosis.

Supporting or even strongly stimulating constitutional treatment will be called for in all cases. No special drug is likely to be of benefit. The question of amputation, though it may arise, is not so likely to be pressing as in the allied disease of acute osteomyelitis.

Osteitis.—By osteitis is meant an inflammation in the substance of true bone, varying in intensity and duration, and ending in resolution, or in thickening of its tissue, or in various forms of degeneration.

Causation.—The simple forms of osteitis are usually caused by injury. Frequently a diathesis or cachexia, such as scrofula, syphilis, or rheumatism co-exists with special forms of osteitis, and is credited with being either the active or the predisposing cause. Exposure to climatic influences (cold, damp, malaria) has been known to produce the disease.

Pathology.—The effects of inflammation in bone are produced almost entirely through its medullary tissue. The bone cells proper take little, if any part. Each Haversian system, with its artery, vein, nerve, lymphatics and delicate cellular tissue in the central canal, and its concentric lamellæ, arranged like the leaves of a roll of music around this canal, may be regarded as an ossicle or long-bone in miniature, repeating in itself in detail what occurs in bulk in the whole bone. The first steps are vascular engorgement, inflammatory exudation, and cellular hyperplasia in the soft tissues lying in the canal. This increased activity is associated with a rapid solution and removal of the bone substance. Where

the bone is not compact, but areolar, the same thing goes on, but with more rapidity and vigor on account of the greater proportionate amount of the soft tissue. Bony rarefaction and cellular hyperplasia, always the initial result, may go on indefinitely to reach the dignity of a special variety of osteitis; *rarefying osteitis* or *caries*. Should the inflammation be very acute, the rapid cellular overgrowth causes strangulation of the confined vessels, and the bone which depends on them for vitality dies; *necrosis*. In the more chronic forms of inflammation the bone which is absorbed is replaced by new bone, often in excessive amount, causing ingrowths or outgrowths, with general increase in density; *osteo-plastic osteitis*, *osteo-sclerosis*. Occasionally, again, the inflammatory process results in a localized collection of pus in the midst of the bony tissue, which increases by absorptive distention of the outlying bone; *abscess of bone*.

Each of these processes, as being terminal varieties of more clinical importance than the simple initial inflammation, will receive separate consideration.

Symptoms.—The most important sign of simple osteitis is pain of a deep-seated boring or gnawing character, which is liable to exacerbations and remissions. The pain is usually worse at night, and is always increased by unrest or exercise. An elevated position of the inflamed part relieves the pain; this is well seen in inflammation of the bones of the leg or foot, where the pain, aggravated by walking, is at once relieved by elevation. There may be slight dusky redness of the overlying skin, but sometimes there is abnormal paleness from œdema. Swelling of the soft tissues is usually slight; enlargement of the bone is late in appearing, and is chiefly an effect of extension of inflammation to the periosteum.

It is always difficult to diagnose simple osteitis from simple periostitis. In osteitis the deep boring character of the pain, and its continuation in varying intensity over long periods of time, without much apparent effect on the soft tissues, are the leading guides. In periostitis the pain is more superficial, and steadily increases in severity without intermissions, while swelling rarely fails to manifest itself at a comparatively early

stage. Percussion, or tapping with the finger, may be of assistance in forming a diagnosis. Tapping over the area of an osteitis causes a deep thrill of pain to shoot through the whole bone, which may last for some time afterward; in periostitis tapping causes a temporary aggravation of the superficial pain only. Pressure considerably aggravates the pain in periostitis; it may not affect, or may even relieve the pain in osteitis.

Treatment.—The part must be put at rest, and elevated as much as possible. In the early stages of simple acute osteitis, the local abstraction of blood by leeching or cupping will usually relieve the pain and benefit the disease. Lead and opiate lotions, applied hot, are soothing. If the pain is very severe and the fever is high, drilling the bone in several directions, through a small incision made with a tenotomy knife, will nearly always afford relief and often effect a cure. Such drilling gives rest to confined and compressed exudations, relieves engorgement of vessels, and provides drainage. In chronic cases, rest, with repeated blistering, or the application of counter-irritants, is beneficial. The last resort in every case is removal of part of the surface of inflamed bone, by trephine or gouge. No case ought to be allowed to drift into caries or necrosis or abscess, without a trial having been given to trephining or gouging.

The constitutional treatment is generally that of the fevered state. Benefit has been derived from the administration of mercury to the extent of ptyalism. If the pain be very severe, opium is indicated. Any diathesis, rheumatic, gouty, syphilitic, or strumous, which may be supposed to influence or predispose to the complaint, is treated by its proper remedies.

Varieties and terminations of osteitis:

1. *Rarefying osteitis.* Known also as *inflammatory osteo-porosis*, and most frequently as *caries*.

2. *Osteo-plastic osteitis.* Known also as *sclerosis of bone*.

3. *Abscess of bone.*

4. *Necrosis*, or death of the bone. This, as being also a result of endosteitis, will be described after that disease.

Caries; rarefying osteitis; inflammatory osteo-porosis.—By caries we mean a chronic inflammation of bone

attended with absorption or rarefaction of bony tissue, and increase of the cellular elements, which are liable to degenerate and become purulent.

Causation.—Constitutional weakness of some sort is usually the cause of an osteitis becoming rarefying or suppurative. The patient's health may have been weakened by want of proper food, or bad hygienic surroundings; most frequently a specific disease, particularly scrofula or syphilis, may be credited with the causation.

Pathology.—The essential features in the pathological anatomy of caries are absorption and replacement by proliferating medullary tissue of the systems and trabeculae of bone. The compactness and density of the bone tissue are diminished, making the bone appear more porous when macerated, and more soft and friable when fresh. Pathologically it is impossible to distinguish between a simple rarefying osteitis and a suppurative disintegrating caries; the one is a more advanced stage of the other.

Rarefying osteitis is most common in cancellous bone; that is, wherever red marrow is found. Its favorite sites are in the ends of the long bones, in the bodies of the vertebrae, and in the bones of the feet and hands. Bearing in mind the undoubted similarity in structure and functions between red marrow and lymph-glandular tissue, and the fact that in scrofula both tissues frequently undergo changes that are almost identical and often associated, we can scarcely avoid the conclusion that caries is an effect of scrofulous lymphadenitis. The implication of bone is simply an accident of lymph-glandular tissue being placed in its meshes; the active cause must be sought in the inflamed marrow. Many other considerations, not the least important of which is the discovery of giant cells and tubercular bacilli in certain cases of caries, confirm the belief that strumous gland disease and fungating caries are in most respects identical.

Simple rarefying osteitis, owing no constitutional cause, and simply induced by traumatism, is not very common. In its purest form it is seen as a result of constant traumatic irritation, such as might be produced by the pulsations of an aneurism. There is here simple cellular overgrowth at the expense of the bony trabeculae; the changes peculiar to

the commoner strumous forms are absent.

The minute changes in rarefying osteitis are somewhat varied. There is always an excess of cellular growth, or granulation material of a somewhat degenerate type. The cells everywhere crowd the trabecular spaces, fill the Haversian canals, and occupy new channels, which are formed in all directions through the compact bone. The bony tissue disappears in front of these granulations in different manners. In most situations it passively falls to pieces in small granules or portions of lamellæ along the natural lines of cleavage. Frequently it is absorbed in hollows or lacunæ (*Howship's lacunæ*), in each of which may be found large vigorous-looking cells (osteoclasts), and occasionally the loop of a small blood vessel. Sometimes in the larger hollows are found masses of coherent protoplasm, containing several nuclei, and known as giant cells. Special forms of giant cells, not occupying lacunæ, with long processes, and often containing rod-shaped bacilli, are found among the granulations in tubercular caries. In every case the bone corpuscles are essentially passive, simply undergoing fatty or granular degeneration in the enlarged and corroded lacunæ.

These minute changes may produce different gross results. Sometimes the granulations remain quiescent, or undergo a harmless fatty change, and there is no formation of pus; dry caries or *caries sicca*. More frequently the granulations invade neighboring tissues, sprouting through the skin or into a joint; fungating caries, or *caries fungosa*. In the more active forms an area perishes, and this, set free by the action of the living granulations around it, is left as a piece of dead bone in the center of the inflamed district; necrotic caries, *caries necrotica*.

Occasionally one or more abscesses form in the heart of the fungating granulations to become united in one pus-containing cavity, to be presently described as *abscess of bone*.

Generally speaking, the final changes in rarefying osteitis resolve themselves into one or other of three groups:

(1) Simple resolution and return to health, as in some cases of hip-joint disease.

(2) Caseation, fatty degeneration, or even calcification of the inflammatory products; conditions which may remain quiescent for years, but are rarely permanently harmless.

(3) Most common of all is breaking up of the granulation, and the formation of an open sinus through which the purulent matter and bony detritus are discharged.

The naked-eye appearances of carious bone are characteristic enough. The whole tissue is softened, so that it may be cut with the knife or crushed between the fingers. Semifluid, fatty, or purulent material exudes from the surface on section or pressure; and small collections of pus or cheesy material are often found throughout the diseased substance. When macerated the increased porosity and fragility of the true bony material becomes very evident; a macerated carious bone may not weigh one-tenth of that which it ought to weigh when healthy.

Symptoms.—The earliest signs of caries are simply those of chronic osteitis; it is impossible to distinguish the one from the other till evidences of supuration appear. When, with a history of osteitis, redness, swelling, and obscure fluctuation come on in the soft parts, we may suspect caries. The same history, with the disease localized near a joint, and followed by signs of inflammation in that joint, also indicates caries. Unequivocal signs appear after the abscess has burst or has been opened, when bare softened bone may be felt with a probe at the bottom of the abscess cavity. When the first collection of matter is discharged the abscess walls collapse, leaving a sinus leading down to the diseased bone, through which watery pus and bony detritus are discharged. Such discharge, if of long standing, is usually very fetid. The granulations lining the sinus and overlying the diseased bone are usually of an unhealthy flabby nature, and merge imperceptibly into the surrounding skin, which is usually swollen and of a dusky red color, overlapping the sinus with thin, irregular margins. Occasionally, and particularly in caries of the bones of the hands and feet, the compact outer shell is considerably expanded and thinned out by the fungating granulations inside, forming one of the conditions which used to be called *spina*

ventosa. Such a condition is essentially a large chronic abscess in bone.

In caries of bones lying at some distance from the surface, as the spine, the hip, or the femur, the sinus may pursue a long and tortuous course through the soft tissues. In such cases, also, two or more sinuses may be found leading to the same diseased area.

Treatment.—In the treatment of caries attention to the constitutional element is of special importance. If the cause is scrofula, cod-liver oil and the iodide of iron are the most valuable medicinal remedies. Of equal value, however, are a varied and nourishing dietary, plenty of fresh air, and, if possible, an existence chiefly out of doors. For syphilis similar hygienic measures with iodide of potassium are indicated.

Locally there is but one treatment of value for carious bone: removal of it. Blisters, setons, absorbents, and the like, are all useless; the only plan that promises success, if the disease resists constitutional treatment, is to remove the sluggish granulations entangled in the bony meshes, along with the bone that retains them. Most frequently this can be done without interference with neighboring tissues; but occasionally, as when the disease involves a joint, the articulation may have to be removed with the bone, or even the whole limb may have to be amputated.

The removal of carious bone is best conducted with the limb bloodless. The diseased bone is exposed by an incision, linear, or T-shaped, or crucial, as seems most convenient. If the bone is very soft a Volkmann's spoon may suffice for its removal, but usually a gouge will be required to complete the excision of the diseased portions. An osteotrite or similar instrument will sometimes be of use. Scraping or gouging is to be proceeded with till marked increase of resistance shows that healthy bone has been reached. In removing diseased portions that lie at a considerable distance from the surface, or dangerously close to important structures, the gouge forceps will be found a useful instrument. The unhealthy granulations along the sinuses are to be thoroughly removed by scraping, and the whole of the disease replaced as far as possible by healthy raw wounds.

In cases of great distention of the

bony shell, as in scrofulous caries of the long bones of the hands or feet, it may be advisable to remove by scissors considerable slices of the bone and skin, leaving an open gutter to heal from the bottom by granulations. In a few instances it may be possible, with strict antisepticism, to get primary healing through filling of the cavity with blood clot; in the majority, however, we must expect a very gradual cure by the growth of granulations from the bottom of the scraped cavity.

The open tracts and cavities left after scraping are plugged with lint soaked in some trustworthy antiseptic, such as terebene or chloride of zinc solution. This prevents bleeding, which is sometimes free, and destroys any remaining fetor. The plug may be removed at the end of twenty-four hours, and replaced by a simple external absorbent and antiseptic dressing. Perfect drainage supplemented by occasional syringing, and the insufflation of iodoform, will expedite the process of cure.

Osteo-plastic osteitis; osteo-sclerosis; sclerosis or thickening of bone.—By this is understood a form of chronic osteitis, attended by a development of new osseous tissue, which adds to the density, and sometimes as well to the size of the bone affected.

Causation.—It is impossible to specify any distinct causative influence. In most cases it is simply the curative process of an ordinary osteitis run to excess. A foreign body, such as a bullet, embedded in a bone, may produce effects which are clinically apparent only as sclerosis. Syphilitic inflammations of bone are liable to result in thickening. An area of sclerosis is found surrounding an abscess in bones.

Pathology.—There is no special histological lesion in sclerosis; the condition is at all points identical with the condensation and thickening of bone which follow up a rarefying osteitis that is getting well. The result is a general increase in the amount of formed bone, with corresponding diminution in the size of the spaces. Sometimes the encroachment on vessels is so great that they are obliterated, and a piece of bone becomes necrosed, and is cast off.

Symptoms.—The symptoms are those of chronic osteitis, with, in addition, evidences of increase in the size of the bone.

Pain is not usually severe, and is fugitive and uncertain. Except in association with syphilis, we clinically do not meet with simple osteo-sclerosis; it is nearly always a sequence of some other and recognizable form of inflammation, traumatic or suppurative. Sclerosis is always associated with the latter stages of necrosis, and may be the cause of the wandering pains felt in the thickened and still inflamed bone. It exists for some time around the united end of fractured bone, and in this situation may be the site of pain lasting over several years.

Treatment.—No very definite rules for treatment can be laid down. Comparative rest to the part, and the application of counter-irritants or blisters, are most likely to be of use. Mercury and iodide of potassium are supposed to be useful in this form of inflammation of bone, chiefly, no doubt, through their influence on syphilis, which is frequently a factor in sclerosis. In cases attended with much pain, or signs of considerable inflammation, drilling in various situations may be of benefit.

Abscess in bone.—By this name is known a condition, usually chronic, in which a localized collection of purulent matter exists in the substance of a bone.

Causation.—The influences which make an inflammation become suppurative are probably the same for bone as for other tissues. Feebleness of constitution, and more especially the strumous diathesis, is made to account for most cases. In a few, however, mere acuteness of inflammation, without any signs of general disease, must be reckoned as causative. Micro-organisms have, in some instances, been found in the pus evacuated; this would suggest a septic source. A good many cases are supposed to originate in the breaking up of caseated tuberculous masses.

Pathology.—The early stages of abscess in bone are simply those of rarefying osteitis. When the cancellated tissue is completely absorbed, the cellular growth which is left simply degenerates into an abscess. The periphery of the abscess cavity is occupied by granulations which contribute to its enlargement by absorption of the surrounding bone and secretion of pus. In the more outlying areas, away from the focus of inflammation, there goes on an osteo-plastic osteitis, or thickening of bone, which tends to limit

the extension of the abscess and to make its progress extremely chronic. In spite of this limiting sclerosis, however, the site of the abscess slowly increases, till it may attain to a diameter several times greater than that of the bone in which it is situated. In the center of the abscess cavity a piece of necrosed bone may be found; but usually its contents are simple pus, curdy and unhealthy.

Symptoms.—In the early stages the signs of abscess in bone are those of deep seated chronic inflammation. The most prominent feature is pain of a severe boring or lancinating character, worst at night, and liable to exacerbations and remissions. There is usually tenderness, localized in one spot; and sharp taps on this spot considerably aggravate the pain. The pain may disappear for days or even weeks, but it always recurs, either spontaneously or after slight provocation.

At first there is no visible alteration in the overlying skin, but later a diffuse dusky redness, with some swelling, makes its appearance. When the abscess attains to considerable dimensions, the swelling and redness may be marked features; but relief is nearly always sought for and obtained before this. Some rise of temperature and other signs of abscess confined under tension will probably be found.

In the majority of instances the disease is found in the head of the tibia. The amount of matter present is usually very small, seldom more than a dram, and very rarely so much as an ounce.

Treatment.—The treatment of abscess in bone is simply that of abscess elsewhere, evacuation. The limb is made bloodless by elevation, or by Esmarch's bandage, and the bone exposed by a suitable incision. The periosteum may or may not be elevated; on the whole it is perhaps best to remove it, as rapid growth of new bone over the abscess cavity is not desirable. The bone will probably be thickened and indurated, so that perforation will be somewhat difficult. Various methods of piercing the bone are in use. Trephining, gouging, perforation by bone-drill, and linear osteotomy by Hey's saw, have all been recommended and successfully used. As good a plan as any would probably be by the combined use of the drill and the gouge, the drill being used to dis-

cover the situation of the abscess, and the gouge to enlarge the opening. A large drill is attached to an engine, such as dentists use, and is pushed through the bone in the direction in which the abscess is supposed to lie. If pus does not flow through the hole first pierced, the drill may be pushed in several other directions till matter is met with. A probe is now placed in the hole made by the drill, and the gouge or trephine, guided by the probe, is made to remove a piece of bone sufficiently large to permit of the cavity being scraped, and to provide free drainage. Good results have been got from the use of Hey's saw alone; a longitudinal section of the bone, by saw, is very likely to enter the cavity, but most surgeons would prefer to enlarge the opening so made. The objection to the trephine alone is, that after a tedious operation, and the removal of a large piece of bone, the abscess cavity may not be reached. The preliminary use of the rapidly working bone-drill obviates this risk.

The cavity thus freely exposed is cleared of its contents, and scraped or mopped out with some powerful antiseptic. Syringing with antiseptic lotions, insufflation of iodoform, and provision for free drainage would probably represent the best subsequent treatment. If the abscess is not putrid, the complete antiseptic method will give the best results. The process of cure must in any case be slow, as the dense bone surrounding the cavity gives only scanty blood supply to the granulations by which the cavity must be filled, and through which the new bone must be developed.

Endosteitis; osteo-myelitis; medullitis; inflammation of the marrow or medulla of bone.—Inflammation of the bony marrow occurs in two leading forms; (1) Simple osteo-myelitis, acute or chronic; (2) Diffuse septic osteo-myelitis, always acute.

Simple osteo-myelitis is not of much clinical importance. In its acute form it is always the result of injury, and more particularly of fracture. Some degree of osteo-myelitis is essential to the healing process in fracture; in compound fractures the inflammation may be suppurative, and may extend some distance up the bony canal.

In its chronic form osteo-myelitis specially lays hold of the pink marrow at the

ends of the long bones. The important part which the marrow plays in all forms of bony inflammation has already been pointed out, and need not further be dwelt upon. All such inflammations in the marrow at the ends of the long bones are intimately connected with one form of so-called scrofulous joint disease.

Diffuse septic osteo-myelitis; acute diffuse osteo-myelitis; acute necrosis.—These names have been given to an acute septic inflammation diffused through the marrow of long bones, and usually terminating in death of the shaft.

It is closely related to and probably pathologically identical with the disease already described as acute suppurative periostitis, with the synonym also of acute necrosis. The clinical features differ according to the situation of the marrow affected, periosteal or endosteal. A third variety of septic osteo-myelitis, described by German writers as idiopathic and infective, is probably identical with the disease now to be described, and will not be separately considered.

Causation.—Diffuse septic osteo-myelitis occurs under two distinct conditions: firstly as a result of traumatism, where the medullary cavity is opened and visibly exposed to septic influences; and secondly, when it is found almost uniformly before maturity, and more especially in childhood, where there is no open wound, and no visible passage for the entrance of micro-organisms. The first variety is now most frequently met with in military surgery, as a result of gunshot wounds. In former times it was a common result of compound fractures treated in civil hospitals. Arising in children without visible traumatic cause, nothing is known of its remote ætiology, though its immediate origin is undoubtedly to be explained by the production of micro-organisms. In some cases it is a manifestation of general septicæmia, and its occasional occurrence in several instances in the same hospital ward suggests an infective origin.

Pathology.—When exposed to septic infection the marrow in long bones is only too favorably placed for the diffusion of violent inflammation. Confined within a rigid shell, and in free communication from end to end, by its abundant blood and lymph vessels, the medullary tissue, when inflamed, suffers double disaster from the rapidity of the spread of the in-

flammation and the impossibility of relief by swelling. Its soft sensitive tissues are strangulated by their own proliferation, and the bone, cut off from its most important blood supply, suffers death. In the compact bone, the incompressible veins may serve to carry infection to the system, and fatty embolism from a similar source is not unknown.

The naked-eye appearances of a bone affected with acute osteo-myelitis are striking and characteristic. The compact tissue is pink generally, or in patches; the cancellous bone is of a bright or dusky red color, and the marrow is transformed into a semifluid, often stinking material, made up of pus and diffuent fat, and exhibiting red streaks and patches representing injected vessels and extravasated blood. In some cases, especially in the non-traumatic variety, a subperiosteal abscess forms. This is usually found where the compact bone is thinnest, and its foramina most numerous; that is to say, above the epiphyses, near the joint. In this situation suppurative inflammation of the epiphysal cartilage is peculiarly liable to take place, leading to disjunction of the epiphysis from the shaft, and producing the condition known as "acute epiphysitis."

The usual termination of those cases which do not rapidly prove fatal from general septic infection, is in necrosis of the whole bone, or, more frequently, of the shaft between the epiphyses. The further history of the disease is then simply that of necrosis of bone.

The minute anatomy is a compound of cellular proliferation, vascular blocking, diffuence of fatty tissue, and general infiltration with micro-organisms. The bony tissue proper, suddenly cut off from its nutritive supply and rapidly dying, has had no opportunity of exhibiting the signs of inflammation, and is essentially unchanged.

Symptoms.—Almost from the beginning diffuse osteo-myelitis has all the symptoms of a grave disease. Its onset, often marked by a rigor, is signalized by high fever, with profound constitutional disturbance, and frequently delirium. There is severe pain in the part, which radiates in various directions; and considerable tenderness on pressure. Duskiness of the skin, with some diffuse swelling, soon appears, to be rapidly followed by the formation of abscesses,

The patient either dies within a few days; or the symptoms merge into those of septicæmia, which, in its turn, proves fatal; or the course of the disease is diverted into that of an ordinary necrosis. Very rarely, on prompt and judicious treatment, the progress of the disease is cut short, and the patient escapes without either septicæmia or necrosis.

The distinguishing characters of the disease are its rapid onset, and the high fever attended with grave depression, very rapid pulse, and perhaps delirium. Locally the diffuseness of the pain, the duskiness and œdema of the soft tissues, and later on the occurrence of abscesses at central and outlying points, are characteristic features.

Treatment.—Immediately on its being recognized, diffuse osteo-myelitis ought to be treated by the making of one or more free openings into the medullary cavity. The openings are made after free incisions in the soft parts, with gouge or trephine, and must be large enough to permit access to the medulla, and to provide free drainage. It is a question whether the best treatment would not be to remove the whole of the suppurating medullary tissue by scraping, and wash out the cavity with antiseptic fluids. Free incisions are made through the periosteum in several positions, to prevent its being completely stripped should subperiosteal suppuration come on, as it is likely to do.

These measures represent all that can be done to check the ravages of the disease. The case is closely watched, and if symptoms of septicæmia supervene, amputation is the only resource. Done sufficiently early, before the strength of the patient is gone, amputation in this disease has had sufficiently encouraging results. The treatment proper to necrosis of the shaft when this takes place is described under Necrosis.

From the beginning constitutional treatment of a supporting or stimulating nature must be rigorously enforced, Ammonia, ether, bark, and alcoholic stimulants, with concentrated and easily digested nourishment, must be administered in large and frequently repeated doses.

Acute epiphysitis.—This is a form of acute osteo-myelitis, occurring in children, near the ends of the long bones, and resulting in disjunction of the epiphysis from the shaft.

Though, pathologically, it probably does not merit the position of a distinct disease, its clinical features are so distinctive and its importance so great that it generally receives separate consideration.

Causation.—Sometimes a blow or other injury is made to account for the disease, but most frequently no such cause can be assigned. It is probably always septic in immediate origin. This septicism may arise from general causes, or locally, from lymphatic infection carried from a sore to the bony marrow. It is found almost exclusively in children or young infants, and usually in such as are in feeble general health.

Pathology.—Its pathology is probably identical with ordinary septic osteomyelitis. It is peculiar in this, that the inflammation is most active and most destructive where histological activity is greatest, namely, in the parts close to the epiphyseal cartilage. Suppurative inflammation in the marrow of this region causes a rapid disintegration of the cartilage, with consequent disjunction of the epiphysis from the shaft. The end of the shaft is surrounded with pus and *débris* of medullary tissue, which may force its way into the contiguous joint, or through the skin, or in both directions. That the focus of the inflammation is in the active tissue, abutting on the epiphyseal cartilage, there need be no dispute; that it starts in the cartilage itself, or in the epiphysis, as is maintained by some surgeons, is exceedingly doubtful.

Symptoms.—As already stated, the disease is found in unhealthy children during the first few months of existence. It is situated most frequently in the femur at the hip joint, and with diminishing frequency at the knee joint, the shoulder, the elbow, and the ankle. Locally it presents the ordinary signs of an acute inflammation rapidly going on to suppuration, and at a very early stage affecting the joint. The child is evidently seriously ill, with high fever and great depression of the vital powers. When the disease has existed for a few days, grating on movement, with perhaps undue mobility, marking disjunction of the epiphysis, will probably be found. The disease rapidly progresses, and may be fatal within two or three days. In cases that are not rapidly fatal abscesses form and burst, and recovery may take place after a

tedious illness. The bone may become united, though its future growth is stunted. As the joint is implicated at a very early stage of the disease, it is easy to mistake it for a pure joint affection; indeed, it is frequently described among diseases of joints.

Treatment.—To support the child's strength and to provide free exit for the pus are the leading indications for treatment. Early and free incisions, with sufficient drainage and antiseptic dressings, give the best chance of cure. Indeed, with such treatment, it is surprising to find how great the recuperative power sometimes is. The disjoined fragment unites firmly to the shaft, the inflammation in the joint subsides, and the articulation may be left with free movement. If, after such treatment, signs of improvement are not apparent, amputation above the disease is the only resource left.

Necrosis.—By necrosis of bone is understood a death of the whole or some part of the bone without marked alteration in its structure, and following one or other of the varieties of acute inflammation.

Causation.—The immediate cause of necrosis is stoppage of the circulation, either through the vessels being torn by injury, or from their becoming blocked as a result of the inflammatory process. The remote causes are those of the form of inflammation which gave rise to it. An acute form of necrosis is liable to follow any of the specific fevers, especially scarlet fever; scrofula and syphilis predispose to the more chronic form. Among local causes, injuries, as blows, wounds, or amputations, hold the first place. A peculiar form of necrosis in the lower jaw is found among workers in phosphorus. In old people a variety, analogous to senile gangrene of the soft tissues, and known as senile necrosis, is met with.

Pathology.—Necrosis has already been mentioned as a possible termination of the three leading varieties of inflammation in bone. Generally speaking, the variety of necrosis is determined by the nature of the inflammation. Thus periostitis, as a rule, causes a superficial necrosis of the outer layers of compact bone (*peripheral necrosis*); osteitis most frequently results in death of a portion of the cancellous or compact tissue (*central necrosis*); while endostitis, if acute, causes

death of the whole shaft (*total necrosis*).

In every case the immediate cause of necrosis is thrombosis in the blood vessels, induced either by injury or inflammation. The piece of dead bone thus cut off from its vital connections is essentially a foreign body, and acts as an irritant upon the surrounding tissues, causing the formation of an abscess. The suppurative process thus set up, with the concomitant separation and disintegration or extrusion of the bone, along with certain conservative processes in the outlying tissues, constitute the chief features of the disease.

In detail the pathological process is as follows. The outlines of the dead bone are marked off by a limiting area of thrombosis in the living tissue. Behind, up to, and in this thrombotic area, the ordinary process of rarefying osteitis is set up. The inflammation is most active in the immediate proximity of the dead bone, and here the rarefaction soon proceeds to complete absorption, thus setting the dead bone free from the living. The granulations which sprout from the rarefied bone now act upon the dead bone as well, causing its absorption or, rather, disintegration. The gap, gradually increased between the living and the dead and now loosened bone, is occupied by granulation tissue, bony detritus, and pus.

Concomitantly there goes on a conservative development of new bone. This takes place in the periosteum, in the granulation tissue which occupies the medullary canal, and in the rarefied compact bone which lies around. The periosteum in such a case will have been stripped from the bone and elevated by the burrowing pus, so that there is always a little space between the periosteal new bone and the dead portion. The new growth starts in the periosteum, covering the living bone at some distance from the line of necrosis, and in the course of time, with the exception of some openings, through which pus is discharged, completely ensheathes the loosened necrosed bone, or sequestrum, as it is called. In the granulation tissue which replaces the medulla in the hollow of the shaft new bone is also developed, which may not only completely plug the opening, but extend along the cavity in the necrosed bone till the ends meet, forming an in-

ternal callus which is covered by the dead bone as a sort of ferrule. The new bony growth in the surrounding compact bone, thinned by rarefying osteitis, is of the nature of an osteo-plastic osteitis filling up enlarged cavities rather than increasing general bulk.

The dead bone lies bathed in pus, in an abscess cavity which is lined by granulations mostly springing from young areolar bone. This pus, containing a large amount of bone salts, reaches the surface through openings called, in the bone, *cloacæ*; and, in the soft tissues, sinuses or *fistulæ*. The dead bone is now known as a *sequestrum*, and the process of separation as *exfoliation*. The abscess cavity may increase or diminish in size round the steadily diminishing sequestrum. As a rule the new bone grows in upon the sequestrum more slowly than the sequestrum diminishes, so that the longer the case has lasted, the more loosely does the sequestrum lie in its cavity. Occasionally, however, the growth of the new bone is so exuberant that the sequestrum is imbedded in it, and fixed so as to become almost immovable. Sometimes, again, the cavity around the sequestrum seems to enlarge instead of diminishing.

Symptoms.—The symptoms of necrosis follow an aggravation of the symptoms of the inflammation in periosteum, bone, or medulla which gave rise to it. The pain, fever, and swelling increase till evidences of suppuration appear with formation of an abscess, which bursts through the skin if it is not opened. A probe, introduced through the opening so made, strikes upon bare compact bone of normal density. The signs of acute inflammation now subside, and the abscess opening becomes a fistula surrounded by red granulations, and discharging quantities of liquid yellow pus. Most frequently there are two or more such *fistulæ*. A probe, introduced along one or other of these openings, strikes on the bare sequestrum, which may or may not be loose, according to the duration of the case.

Necrosis is most liable to be confounded with caries. Necrosis is distinguished most readily by the hardness and smoothness of the bare bone struck by the probe introduced through the fistula; in caries the bone is rough, and so soft that the probe may be pushed through it. In necrosis, the granula-

tions, red and healthy-looking, pout at the openings, and the surrounding skin is of normal color and consistency; in caries the openings are small, not usually filled with granulations, and the surrounding skin is undermined and reddened. The discharge in necrosis is usually yellow, healthy-looking pus; in caries it is watery, pale, and unhealthy. In necrosis there is considerable thickening, rough and unyielding, caused mainly by the periosteal new bony growth; in caries, if there is any thickening, it is caused by œdematous swelling of the soft tissues, or by mere expansion of the bone, and is not usually nodular on the surface.

Treatment.—The indications are to get rid of the sequestrum, and to support the strength of the patient while the tedious process of suppuration is going on. For the latter, fresh air with out-door existence where possible, and the administration of cod-liver oil and iron with plenty of good food, are the chief requisites. Any constitutional dyscrasia, such as scrofula or syphilis, must be treated by their proper remedies.

Locally, the treatment is simply removal of the sequestrum. If the dead bone is small and superficial, it may escape through the sinus or be simply lifted out of its bed before the encapsulating new bone is developed. But as the new bone closes round the sequestrum, the chances of spontaneous removal diminish, and some operation is usually necessary to take it away.

Sequestrotomy, as the operation for removal of a sequestrum has been called, is not usually performed till the dead is freed from the living bone and lying loose in its bed. In some cases of limited and superficial necrosis the sequestrum may be readily removed by forceps with or without a simple skin incision. In most cases, however, a more complicated proceeding, involving division of the new bone, is necessary.

In an ordinary case the operation is as follows: The limb is rendered bloodless by elevation or by Esmarch's method, and a rubber tourniquet applied. The most convenient sinus is selected, and the underlying cloaca exposed by suitable incision through the soft parts. If the cloaca is large enough to admit of its passage, the sequestrum is seized by a special forceps called necrosis forceps,

and removed. If the cloaca is not large enough, it is enlarged by gouge or trephine, and, at the same time, the extraction of the sequestrum may be facilitated by dividing it in the middle by bone forceps and removing it in halves.

The granulations lining the cavity from which the sequestrum has been removed are scraped out, and the whole cavity swabbed or irrigated with a strong antiseptic fluid. If there is bleeding the cavity must be plugged with strips of boracic lint, or of lint sprinkled with iodoform, or some such similar dressing.

If, as frequently happens in cases of total necrosis, the new bone is small in amount and liable to become fractured, a splint must be applied and worn for some weeks. In most cases rest and elevation of the part will be advisable, though it will rarely be necessary to confine the patient to bed.

In cases of extensive necrosis where septic absorption, with high fever, is rapidly sapping the patient's health, and where an immovable sequestrum, with advanced suppuration in the soft parts, renders mere sequestrotomy an operation not likely to be successful, amputation may be called for. Accidental injury to vessels or other structures by an extended sequestrum may be a reason for amputation.

Quiet necrosis, or necrosis without suppuration, is the name given to a form of necrosis in which the signs of inflammation are slight or absent, and the sequestrum either disappears or is encapsulated without the formation of an abscess which opens externally. The dead bone is passively tolerated or quietly removed without any external signs. This form of necrosis is very rare.

Phosphorus necrosis of the jaws is a peculiar form of necrosis which attacks the jaws of workers in phosphorus. The immediate cause is supposed to be the action of phosphorus acid on bone that abuts on carious teeth. An osteitis is thus set up which spreads outward under the periosteum, and, becoming suppurative, elevates that tissue from the bone, thus causing its death. In this, as in other forms of necrosis of the jaws, there is always an excessive development of new bone around the sequestrum, rendering the process of cure tedious and difficult.

Care in seeing to the cleansing of the

teeth, and the use of the red amorphous phosphorus instead of the yellow variety, have been found to diminish the susceptibility to the disease.

Diseases of nutrition.—A small and comparatively unimportant class of diseases of bone, depending neither on actual inflammation nor on specific constitutional dyscrasia, are described as diseases of nutrition. They may be subdivided into *hypertrophic* and *atrophic* varieties.

Diseases of nutrition attended with hypertrophy.—**Simple hypertrophy of bone.**—Most cases of enlargement of bone originate in inflammation from injury. Examples of simple overgrowth are best seen in cases where the ordinary pressure to which a long bone is exposed has been removed. The general increase in length which frequently occurs when a young person is confined to bed for a time is an example of this sort. Another example may be seen in the increase of length which a radius, dislocated at its upper extremity and unreduced, may undergo. In the rare cases of simple overgrowth of one or more fingers or toes, or even of a whole limb, the bone simply participates in the general hypertrophy. It is doubtful if the enlargement which follows rickets is to be regarded as simple hypertrophy.

Osteitis deformans.—This is a rare and extraordinary affection of the bones, probably inflammatory, attended with increase of bulk and frequently with distortion of shape. It occurs specially in persons after the prime of life, is accompanied with considerable pain, and usually attacks several bones simultaneously or in succession. No specific cachexia has been found associated with the disease, and, though it may last over a number of years, it may produce little or no impairment of health. Locally the bone is enlarged in all its dimensions, rarefied in its compact portions, and thickened and roughened under the periosteum. The clinical features are elongation of the limbs from the bony overgrowth, and distortion in the shape of the spine, pelvis, skull, and thorax, as well as of the limbs, from the weakness caused by rarefaction.

No treatment has been found of benefit. The disease, after continuing for years, may become spontaneously arrested, leaving the bones increased in

bulk and in density. In a few cases malignant growths have appeared in the hypertrophied bones.

Leontiasis ossea.—This is a curious disease, limited to the bones of the skull and face, and marked by an increase in their thickness, so great that the patient is usually killed by compression of the brain or blocking of the nose and pharynx. The condition seems to be an enormous overgrowth, with increased sponginess of the diploë. It always commences in early life. Billroth speaks of a similar affection found in the flat bones generally, and likens it to elephantiasis of the skin. The cause is unknown, and all treatment has been ineffectual.

Diseases of nutrition attended with atrophy.—**Simple atrophy.**—Any diminution of nutritive supply may be followed by simple atrophy of bone. In old age thinning of the compact bone and rarefaction of the cancellous portions take place in the bones generally, rendering them liable in favorable localities, such as the neck of the femur, to fracture from slight causes. Interference with the blood supply, as in cases of fracture where the medullary artery is torn through; destructive inflammation of the epiphysial cartilage in young growing bones; diminution of function, as in ankylosis of the elbow, and all such influences, are followed by bony wasting.

Fatty atrophy.—In all cases of atrophy of bone yellow marrow more or less completely replaces red marrow. In health, where there is no cancellous tissue, as in the center of a developed long bone, the marrow is almost pure fat. It is the same in disease; as the cancellous bone disappears the marrow in its meshes becomes fatty. This condition is especially seen in the long bones around joints that have been long inflamed and out of use. In such cases the red marrow may have completely disappeared, its place being taken by a tissue that is little more than fat; the compact bone is reduced to a mere shell, and the cancellous bone is a delicate and friable tissue that can be cut with the knife and crushed between the fingers. The condition is seen in its most typical form in the bones of the thigh and leg after long-standing strumous diseases of the knee-joint.

Fragilitas ossium.—Though this term

is applicable to several conditions associated with diminished strength of bone causing a tendency to fracture on slight provocation, it has also a special significance as applied to children. A child may occasionally be found who has suffered fracture of almost every bone in the limbs and not a few of the body before it has reached the tenth year. Running on a stone pavement, playing leap-frog, striking a smart blow, have been known to cause fracture in such cases. Some of the bones may have been broken several times in succession, uniting in the ordinary way and with average rapidity. No cause has been discovered beyond an excessive tenuity, with perhaps increase of density in the bony tissues. The children are usually fragile, but not diseased.

A brittleness of bones may be caused by various diseases, such as aneurism of bone, new growths, necrosis, osteomalacia, and atrophy.

Constitutional diseases of bone.—Affections of bone which are associated with definite and palpable constitutional disease, and which may appear in any or every bone of the body. They are scrofula, with all its allies tubercle, syphilis, and osteo-malacia.

Scrofula and tubercle in bone.—The want of definiteness which for years has attached to the meaning of these terms is seen, perhaps, at its worst, in diseases of bones. At present the tendency is to consider them pathologically identical, giving them the same causation (the bacillus tuberculosis), and combining the wide clinical divergencies on the assumption that they are different stages in the same affection.

From a purely clinical point of view we can distinguish at least three forms of disease of bone, scrofulous or tubercular, as we may prefer to name them, which may be described under this head. These are the miliary tubercle; the mass of degenerate cheesy material often described as caseating tubercle; and that form of low rarefying osteitis usually described as scrofulous caries.

The miliary tubercle or nodule occurs in the marrow lying in cancellous bone, either as a part of general miliary tuberculosis or as started by local infection from a mass of caseating inflammatory material. As met with here, its structure and behavior are the same as else-

where. As a part of general miliary tuberculosis it is a fatal disease; as originating in infection from caseous products it may be either the forerunner of general tuberculosis or the indication of advancing and grave local disease in the bone.

The mass of degenerate inflammatory material, known as caseating tubercle, is also chiefly met with in the cancellous ends of the long bones. In structure and behavior—as well, in all probability, as in pathological origin—such masses are closely allied to those met with in scrofulous lymphatic glands. They may exist for prolonged periods, producing but few symptoms, and any change that they undergo is likely to be further retrogressive. The importance of such collections is enhanced from their proximity to joints and their tendency to implicate these in their degenerate changes. Such masses contain in their substance little or no bony tissue. The osteitis which preceded it will have greatly thinned, or completely destroyed the cancellated trabeculæ.

The best known and by far the most important form of scrofulous bone disease is the variety of caries to which it gives its name. Indeed, most examples of caries own scrofula as a predisposing cause. None of the bones are free from it, though it has decided predilections for certain sites. It is found most frequently in the bones of the hands and feet, in the bodies of the vertebræ, and in the cancellous ends of the long bones. As caries of the carpus and the tarsus among the young of the poorer classes, it is, perhaps, the most common of all diseases of bone, running a very slow course, attacking one bone after the other, rarely capable of cure, and ultimately demanding amputation. As “strumous dactylitis” in children, it attacks the long bones of the hands and feet, expanding the compact shell, and transforming the medullary contents into fungating granulation material. Attacking the bodies of the vertebræ, it is well known as Pott’s disease, or angular curvature of the spine. In the ends of the long bones it has a special importance, as being a frequent cause of one of the most intractable forms of chronic joint diseases.

In these instances the affection lies in the medullary cavity. Sometimes, how-

ever, it appears under the periosteum as a "strumous node," producing an abscess and superficial caries.

Symptoms.—The symptoms of simple miliary tubercle in bone are those of general miliary tuberculosis. A number of miliary nodules around a caseating focus produce no symptoms beyond its cause. A mass of tubercular caseated material usually produces slight or no symptoms till it breaks up and suppurates, when the symptoms are simply those of scrofulous caries.

In scrofulous caries the onset is uncertain and the progress slow. Otherwise, the symptoms are simply those of ordinary caries, already described, *plus* the signs of the scrofulous diathesis. In strumous dactylitis the disease is somewhat peculiar in causing expansions of the bony shell, forming a chronic abscess within the bone, which, even after an exit for its contents has been provided, may continue to discharge indefinitely. Elsewhere perforation of the compact bone usually takes place before expansion is perceptible.

Treatment.—Constitutionally the scrofulous element is treated by the ordinary remedies. Locally, before suppuration has commenced, counter-irritation by blisters or the actual cautery, the application of Scott's dressing, or the oleate of mercury, with elastic compression by rubber bandage, have been of benefit. Most frequently, however, suppuration takes place, and our efforts are then directed to the removal of the fungating granulations, with the carious bone, after the manner above described. In disease of the tarsus or carpus, excision or amputation is usually necessary. In strumous dactylitis amputation is usually performed; but if a good portion of the expanded bony shell is removed, with the attached skin, and the cavity dressed from the bottom by some stimulating antiseptic material, cure may be got without amputation. In every case, before perforation has taken place, Listerism in all its details will be attended with the best results.

Syphilitic diseases of bone.—Syphilitic diseases of bone may be considered under two heads, as they originate from acquired syphilis, or from congenital syphilis. See SYPHILIS.

Osseous lesions in acquired syphilis.—These occur as periosteal inflammations, frequently resulting in caries and necrosis,

and as chronic osteitis, producing general thickening. They are recognized as tertiary manifestations.

Pathology.—Syphilitic bony disease is most frequently met with as localized collections of small-celled inflammatory material between the periosteum and compact bone. Such collections may be regarded as gummatous tumors. They elevate the periosteum, forming hard, rounded elevations, and are known as *periosteal nodes*. Under appropriate treatment these nodes may disappear; but frequently they go on increasing in size; the lowly organized inflammatory material breaks down and suppurates, forming a gummatous ulcer with sluggish granulations, which extend some way into the bone, rarefying and disintegrating it. This is *syphilitic caries*. In bones which depend mainly upon the periosteum for their blood supply, as the flat bones of the skull or face, such elevation of the periosteum by gummatous material may kill the bone by deprivation of nourishment, and the result is *syphilitic necrosis*. The least common form of syphilitic bony disease is where there is a general low form of diffuse inflammation, resulting in a hypertrophic thickening of the mass. This is known as *syphilitic osteitis* or *sclerosis*.

Symptoms.—In addition to the ordinary history of syphilitic infection, certain local peculiarities suggest the specific origin of these complaints. The periostitic node is found most frequently on the tibia, the ulna, and the clavicle, and appears under the skin as a hard, rounded, and tender swelling. Pain is almost uniformly worst at night. If the swelling increases much in size and is about to suppurate, it extends chiefly at the margins, leaving a soft, often depressed, area in the center covered with purple congested skin. When the skin breaks, the unhealthy granulations lie in a bed of carious bone, which is diagnosed in the ordinary way. On the skull, and especially on the forehead, syphilitic bony disease manifests itself usually as small areas of necrosis, leaving, when the dead bone is removed, similar punched-out ulcers, which extend through the outer table, and frequently the inner table as well. In the neighborhood of such ulcers that have been of any duration, there is usually some considerable amount of bony thickening. The middle line of the

hard palate is frequently affected, causing the formation of an opening between the nasal and oral cavities. The nasal bones and parts of the jaws are also often involved. Nodes may grow inward on the brain, producing cerebral symptoms. In syphilitic sclerosis, which by preference affects the long bones, shifting pains, with diffuse thickening, are the only local signs.

In suppurative syphilitic bone disease the discharges are usually fetid and the wounds foul and unhealthy. In necrosis of the bones of the face the fetor is met with at its worst.

Treatment.—The treatment proper to the constitutional disease is to be fully and systematically carried out. Till the constitutional treatment has had a fair trial, no operative treatment is to be instituted. Not only nodes, but even collections of semi-purulent material may melt away under the administration of iodide of potassium or mercury, or both combined or alternated. If an abscess must be evacuated, it must be done through as small an opening as possible, as there is a tendency for large sluggish sores to follow injury to the skin. Local measures for the removal of carious or necrosed bone need not be carried out with so much energy in syphilitic as in strumous disease. For the dressing of the open sores nothing is better than iodoform. Surgical cleanliness in its most perfect form must be minutely observed.

Osseous lesions in congenital syphilis.—These are met with chiefly in two forms: as atrophic changes in the bones generally, and in special situations; as hypertrophic growths (nodes or osteophytes) in various situations, but more especially in the skull.

Atrophic changes in congenital syphilis are found most frequently in the bones of the skull, in the long bones, and in the teeth.

In the skull the disease shows itself in very young children as a wasting of the bones at the sites of decubitus, that is to say, behind the eminence of the parietal bone, in the occipital bone, and in the squamous portion of the temporal. The bone is either much thinned, so as to become like parchment, or is transformed into a gelatinous material, in which no bony tissue can be felt. This condition is known as *crania-tabes*.

In the long bones the changes appear

usually in the neighborhood of the epiphysal cartilage, and consist mainly in an excessive deposit of lime salts in the cartilaginous matrix, along with an overgrowth of the young medullary tissue, which absorbs and replaces the bone. The bone is thus made at once brittle and soft, liable to bend in bulk or to break in portions. It sometimes results in suppuration. When the disease is at its height the infant will not move the limb; it seems to hang paralyzed and inert, and this appearance, with the wasting of muscle that always supervenes, has given to the condition the name of *syphilitic pseudo-paralysis*.

In the teeth the condition is that first described by and named after Mr. Jonathan Hutchinson. It is a pegging and notching of the permanent upper central incisors. The teeth are too small for the spaces they have to fill, they tend to become pointed, then cutting edges are hollowed out and crescentic, or notched and tuberculated. The lateral incisors are sometimes pegged also, and the canines are often too pointed. The cause is probably an old stomatitis interfering with the development of the tooth bulbs.

Hypertrophic changes in congenital syphilis are met with as localized subperiosteal development of porous bone in the bones of the skull and in some of the long bones.

In the skull they are known as *Parrot's nodes* or *osteophytes*. They appear as broad, flattened bosses, usually four in number, upon the four bones that surround the anterior fontanelle, but are found also skirting the sagittal and coronal sutures. They are composed of spongy vascular bones with wide spaces. Such growths may attain to considerable thickness, as much as half an inch; and they may extend laterally so as to cause premature closure of the sutures. They very rarely break down and suppurate. They nearly always appear between the sixth and the twelfth months.

In the long bones such nodes are usually found on the tibia or the humerus, appearing at about the same age and following the same course. Their site is near the epiphyses, and most frequently in the neighborhood of the knee and elbow joints.

The treatment of the osseous lesions of congenital syphilis is simply that of the

constitutional disease. Local measures are not called for.

Mollities ossium ; osteo-malacia ; malacosteon.—This is a constitutional disease characterized by a general softening of the osseous tissue, rendering it liable to be bent or broken.

Causation.—Almost nothing is known of the origin of this rare and extraordinary disease. In some few cases it is inherited. It is twelve times more frequent in females than in males, and among females more than two-thirds of the cases appear during the child-bearing period. Most usually it occurs during and after adult life ; but it has been met with at, and even before, puberty. Theories as to its being caused by a dissolving action of carbonic acid or lactic acid want confirmation.

Pathology.—The essential features of the disease are replacement of the medullary tissue by a dark red grumous semi-fluid material, and rarefaction and absorption of bone. The disease advances centrifugally, beginning usually in the yellow marrow, and extending upward and downward into the red marrow in the cancellous bone, and outward into the compact tissue. Rarely, however, does it attack the subperiosteal outer lamellæ ; in the most advanced cases, where the greater part of the bone may have completely disappeared, there nearly always remains a thin shell of comparatively healthy material which maintains the shape of the original bone. Into the substance of this pulpy, vascular material hemorrhages frequently take place, and small cystic cavities with fluid contents and well-defined walls are often formed.

The salts are dissolved out as if by an acid, leaving a layer or zone of animal substance, which in its turn is broken up and diffused in the new growth.

Symptoms.—In the early stages the symptoms will be little more than obscure, shifting pains in the bone often described as rheumatic. No other sign of disease beyond, perhaps, general malaise and emaciation, may appear, till a spontaneous fracture or bending of bone takes place. An examination of the urine, revealing the presence of an excess of phosphates with lactic acid, will now suggest a diagnosis, which will probably soon be confirmed by the occurrence of other fractures and distortions. On the slightest provocations any of the long bones may

bend or break, and the chest, pelvis, and spine may be distorted by the normal pressure they have to bear. In the pelvis the deformity, consisting of a diminution of the oblique diameters from pressure inward by the heads of the femora, is a frequent cause of difficult parturition, occasionally necessitating operative interference. The softened ribs may permit the chest to collapse, and the patient may die from physical inability to breathe. In the worst cases the most extraordinary appearances may be produced from the exaggerated distortions.

A few cases recover ; some live to a good old age while the disease continues ; most, however, are fatal.

Treatment.—No treatment specially aimed at the pathological condition has been found of the slightest avail. Treating symptoms we may give tonics and plenty of nourishment to maintain the strength, with opium to relieve pain ; while to prevent fractures and avoid distortion we may enjoin rest in the recumbent position.

Tumors of bone.—Primary malignant growths ; sarcoma.—Recent investigations seem to show that all primary malignant tumors of bone belong to one or the other of the varieties of sarcoma. Scirrhus, encephaloid, and epithelioma invade bone almost never except as secondary growths.

Sarcomatous tumors in bone are of the ordinary varieties, *i. e.*, round-celled, spindle-celled, mixed, and myeloid. Bone is frequently developed in their substance (osteoid sarcoma), but ossification is not confined to any one variety of growth. The best clinical classification is into *central* and *peripheral* sarcomata, that is, growths arising in the medulla in the center of the bone, and growths arising under the periosteum.

Central sarcoma of bone arises usually in the cancellous tissue at the end of the shaft. As it grows it pushes the compact bone in front, expanding and thinning it. It extends along the medullary cavity in both directions, but rarely passes the articular cartilage to enter the joint. The thinned outer shell may be perforated at various points, and the overlying soft tissues are then invaded. In this state spontaneous fracture is liable to take place. All forms of sarcoma are met with in the center of bones. Central sarcomata ossify less frequently than

peripheral. They may attain to enormous dimensions, and are peculiarly liable to recur in internal organs after removal. Like sarcomata elsewhere, they rarely invade the lymphatics.

Peripheral or subperiosteal sarcoma of bone arises, as its name implies, between the periosteum and the bone. It burrows between these tissues, invading the bone from the outside. Here also all varieties of sarcoma are met with. Ossification is more common in peripheral than in central sarcoma. In the substance of periosteal sarcoma there is frequently developed a variety of osteophyte, composed of spicules, or closely-set lamellæ, or hollow tubes, which are probably developed around the periosteal vessels as they are dragged out of the underlying bone by the growing tumors. Occasionally a thrill or bruit may be detected in the growth.

Symptoms and diagnosis.—The early symptoms of central sarcoma are very similar to those of deep osteitis, namely, deep-seated pain of a gnawing or bursting character, with some tenderness. When swelling comes on, the rapidity of its increase, with absence of redness of the skin, or other signs of inflammation, point to sarcoma. When the growth has attained to considerable dimensions, and the outer shell of bone is much thinned, manipulation may produce a peculiar sensation of crackling. The skin stretched over the swelling is white and glossy, with blue veins coursing under it. Where the growth has escaped from its bony shell, the soft, boggy, semi-fluctuating nature of the tumor may be detected. Occasionally there is a bruit or even visible pulsation.

In periosteal sarcoma there is less pain. The growth feels soft and boggy from the beginning, and in the early stages may even be mistaken for abscess. By deep pressure an overlapping margin of tumor substance may be felt, and this, with its firm connection with the underlying bone, will help to distinguish it.

In both central and peripheral sarcoma, a history of injury is curiously frequent, so frequent, indeed, that traumatism must be considered as predisposing, if not causal.

It is possible to mistake sarcoma in the neighborhood of a joint for strumous disease. In those cases where cartilage is found in a sarcomatous growth, it is

sometimes impossible to diagnose it from enchondroma. Generally speaking, enchondroma is harder, and more tubercular on the surface, while it increases in size less rapidly. Clinically, it is usually impossible to distinguish the histological varieties of sarcoma.

Treatment.—The only treatment for sarcoma in bone is to remove it. Such removal must nearly always involve amputation of the limb. In periosteal sarcoma it may be possible to remove the growth, and as much of the bone as may be implicated, but very rarely is it wise to be content with this. In endosteal growths amputation must always be performed. If the growth is small and circumscribed, it may be possible, by amputating through the bone above the growth, to remove the whole of the disease. But in most cases it will be wise to amputate through the joint above the disease. The disease extends along the medulla with such rapidity that only in the early stages it is likely to be unaffected, and thus the greatest security against recurrence is got by disarticulating the bone. When the intermuscular fasciæ are affected, amputation through the joint is still more necessary.

Myeloid sarcoma is supposed to give the best results after amputation through the bone; spindle-celled sarcoma ought always to be treated by disarticulation. In either case secondary recurrence, especially in the internal organs, and particularly in the lungs, takes place in many instances after operation.

Secondary malignant growths in bone.—All secondary malignant diseases in bone are endosteal, unless they are direct extensions from contiguous growths, when they may be periosteal.

Sarcoma in any situation may produce secondary disease in bone by infection from a distance. Carcinoma in bone is practically always secondary, most frequently it is metastatic, though in certain situations, as in the ribs from cancer of the breast, it is not uncommon as a direct extension of the disease. Encephaloid, as secondary to disease of the liver, is not uncommonly found in bone. Epithelioma of bone is rare; it always originates by direct invasion from the soft tissues.

Osteo-aneurism; pulsating growths of bone.—Midway between the benign and the malignant tumors of bone is the

class clinically known as pulsating. Of such there are at least three distinct varieties.

1. Soft sarcomata, in which, from the great number of large vessels, or from dilatations in their walls, a general distention of the mass takes place at each beat of the heart. Vascular thrills, or even perceptible pulsations, are not infrequently met with in ordinary myeloid or spindle-celled sarcomata; the variety under consideration is merely one in which pulsation is an abnormally prominent feature.

2. Certain vascular erectile tumors, composed of numerous interlacing small vessels, similar to ordinary nævus of the soft tissues. Such are usually found on the skull, forming soft, reddish elevations, which pulsate under the skin.

3. True aneurism of bone, which although in many cases confused with pulsating sarcoma, is now generally admitted to exist. It is simply a cavity in the interior of bone, containing blood, partly fluid and partly clotted, which visibly pulsates. It is in fact an ordinary aneurism, which happens to be located in the interior of a bone.

Symptoms and diagnosis.—A growth in the substance of a bone, which distends it, which pulsates, and which perhaps emits a bruit, may be sarcoma, or true aneurism. If the pulsation is distinctly expansile, and the vascular thrill very palpable, and the bruit is loud and well marked, we may suspect true osteo-aneurism, though we can seldom be certain. Compression of the main artery checks the pulsation; if it is a vascular erectile tumor it visibly diminishes in size; if a pulsating sarcoma, it simply becomes less tense; if a true osteo-aneurism, there is no diminution in bulk, but relief of tension will render palpable certain openings in the expanded bony shell. The last is exceedingly rare, and unless the signs are very definite indeed, we must conclude that the disease is a pulsating sarcoma. An accurate diagnosis is usually impossible.

Treatment.—Deligation of the main artery of the limb has in most cases been performed for pulsating sarcoma, but cannot claim many successes.

A few cases of cure by ligation for simple osteo-aneurism have been recorded. In vascular erectile tumors of the scalp, or scapula, or other flat bones,

ligation of the arteries entering them may produce cure. In pulsating sarcoma, amputation, on the lines laid down for ordinary sarcoma, is the only resource.

Non-malignant growths.—These are either localized overgrowths of the tissues that normally enter into the formation of osseous tissue (cartilage, fibrous tissue, or true bone); or they are cystic developments, simple or parasitic.

Osteoma; exostosis.—With very few exceptions, all bony tumors grow outward; the few that grow inward are probably inflammatory. Practically, therefore, all osteomata are exostoses; enostoses may be ignored. They are of three sorts:

The *ivory osteoma, or exostosis*, is usually found on the surface of the skull, frequently on its cerebral aspect, as a smooth, hard, rounded growth, composed of exceedingly dense bone of a consistence resembling that of ivory. Most probably it is a true periosteal growth. The bone is arranged in parallel laminæ; the bone corpuscles are small and have long, slender processes; and the blood vessels are small and sparsely distributed. As it gets older the bone increases in density, sometimes to such an extent that its vascular supply is cut off, causing a quiet necrosis and separation, as in the stag's horn.

The *spongy osteoma, or exostosis*, is found arising either from the neighborhood of the epiphysis of a long bone, or from the fibro-cartilaginous insertion of some large mass of muscle. It is developed in cartilage, and is areolar or spongy, and not laminated, except on the surface. Usually it appears before puberty, and it may go on growing for an indefinite period. Its structure is that of ordinary cancellous bone. A layer of cartilage usually overlies the spongy osteoma, and in it may be found the microscopic appearances of ordinary intracartilaginous development of bone.

Hereditary multiple osteomata occur in children, and may affect most of the bones of the body. As the name implies, the disease is usually inherited. The tumors appear as hard, nodulated growths, situated mostly near the ends of the long bones, though they are found on other situations. They may be very numerous, and may go on increasing in number and in size for years, causing no harm, except through interference with

movement of the joints. They are covered with cartilage, and are of the nature of spongy exostoses. The disease is very rare.

Symptoms and diagnosis.—Unless it interferes with neighboring tissues or organs, the signs of osteoma are purely physical. A hard, rounded, or irregular tumor firmly attached to bone, painless, and non-inflammatory, and with a history of very slow growth, are its leading characteristics. The situation of the ivory osteoma on the skull, its smooth, rounded surface and small size are diagnostic. The most common situation of the spongy osteoma is on the linea aspera of the femur; it is found also on the supracondyloid ridges of the humerus, and on the inner side may be confounded with a supracondyloid process. It is found also under the nail of the great toe (ungual exostosis), elevating the nail and causing much pain and inconvenience by pressure from boots.

Exostosis is most readily confounded with enchondroma of bone, and particularly with ossifying enchondroma. The latter grows more rapidly, and is more irregular on the surface than the former.

Treatment.—Unless it disturbs the function of neighboring organs or produces some conspicuous deformity, an osteoma need not be interfered with. Situated close to important structures, as in the orbit, or on the inside of the skull, or near a joint, its removal is attended with some difficulty and risk. The growth is taken away by means of saw, chisel, gouge, or bone forceps. It has been found that unless removal is complete and thorough, recurrence sometimes takes place.

Enchondroma.—This is the most common of innocent tumors of bone. It is met with most frequently near the extremities of the long bones, and no doubt originates in many cases from the epiphyseal cartilage. It is found either as a diffuse growth infiltrating the whole bony structure, or as a circumscribed outgrowth from the compact shell. The former is most common in the larger bones, the latter, often multiple; in the long bones of the hands and feet. Centers of ossification, or, more accurately, of calcification, are met with most frequently in the circumscribed enchondroma, and sometimes these are so thickly set as to constitute calcification

of the whole mass. All the ordinary pathological changes found in enchondroma generally are met with in enchondroma of bone. The tumors are usually slow in growth, but sometimes they increase with great rapidity, and may attain to enormous dimensions.

Symptoms and diagnosis.—A painless or but slightly painful hard or semi-elastic tumor of slow growth, attached to bone, nodulated on the surface, not invading the skin, and presenting none of the characters of malignancy, is probably an enchondroma. A thin shell of periosteal bone sometimes surrounds it, when characteristic crackling on manipulation may be detected. If small and calcified it may be indistinguishable from a pure osteoma, though the irregular bosses on its surface are usually distinctive.

Treatment.—In the circumscribed variety, complete removal of the growth, with gouging of the bony surface from which it springs, will probably effect a cure. If the growth is central, extending up the medullary canal, the limb must be amputated above the disease. Generally speaking, removal of the growth will cure in enchondroma of the bones of the hands and feet; in enchondroma of the long bones amputation of the limb will be called for.

Fibrous and fibro-cystic growths.—As originating from the gums (epulis) or from the periosteum covering the bones in the nasal cavities (fibrous polypus), fibrous tumors of bone, or rather of periosteum, are not uncommon. Elsewhere they are almost unknown. Instances of fibro-cystic growths, mostly in the femur, have been recorded, but they are so rare as to be clinical curiosities.

Cysts in bone.—With the exception of dentigerous cysts, simple cysts in bone are extremely rare. Most of those described as sanguineous cysts were probably sarcomata. Hydatid cysts may be found in bone as in every other tissue, but their occurrence is very uncommon.

JAMES GREIG SMITH.

Symptomatic Indications.—The best remedies in the beginning of treatment of the diseases of bone are silicea and calcarea carb.; *silicea* being the principal remedy for caries, exostosis, necrosis, and for almost all diseases of bone with fistulous openings and discharge of thin pus and bony fragments; *calcarea* being the better remedy in curvature of the spine

and long bones; swelling of the joints, osteitis, with swelling; caries and necrosis of scrofulous individuals. Delayed closing of the fontanelles may be appropriately treated by either remedy. For caries with free suppuration, and hectic condition, *phosphoric acid* is an excellent remedy, and is also well adapted to rachitic children with pale, sickly look, great debility, painless diarrhea, and tottering gait. Pain in the periosteum of the bones, as if scraped, is a prominent symptom of phosphoric acid. Pain in the bones, as if broken, is a guiding symptom to *mercurius*, which is an extremely useful remedy in periostitis and other diseases of bone of a scrofulous character, vying in this respect with *nitric acid*, the most important medicine for the treatment of diseases of the bones of mercurial, syphilitic, or scrofulous origin. The pain of nitric acid is as if from a splinter on contact, or as though a band was around the part. Caries and exostosis in particular parts may require remedies which exert a specific influence upon the part affected, as *asa fetida*, which is useful in exostosis, caries, and necrosis of the extremities softening of the bones. There is bluish redness and swelling of the affected parts; ulcers with bluish hard edges, which are very painful to the slightest touch; discharge of thin, very offensive pus: *aurum*, for caries of the nasal bones, with ozæna and fetid smell; caries of the cheek-bones and exostosis of the skull. *Phosphorus*, exostosis of the skull, with tearing and boring pains, and swelling of the clavicle: *mezereum*, periostitis and swelling of the bones, especially on the tibia, with the most violent nightly pain in the bones. Other remedies which are frequently useful are *cinchona*, in caries with profuse suppuration: *calcareæ phos.*, for symptoms similar to those of the carbonate, and especially after fractures when the callus does not ossify: *ruta grav.*, in periostitis or caries in consequence of external injuries, with erysipelatous inflammation of the external parts; pain in the bones as if broken; and *symphytum* for periostitis, softening of bone. In necrosis it aids in the detachment of sequestræ.

BOUTONNIÈRE OPERATION.—A term applied to a proceeding in which a "button-hole" is purposely made in some part. It is done throughout the soft palate, to facilitate the extraction of polypi, and into the urethra from the perineum, in

order to expose the commencement of an impermeable stricture.

BRAIN, ANÆMIA OF.—Two varieties. In the one the quantity of blood sent to the brain is less than the normal, in the other the quality of the blood is lessened.

Causes.—Of the first variety any cause which diminishes the usual blood supply; as deficient action of the heart, direct loss of blood, as from hemorrhage, impaired nutrition, or it may be pressure upon an artery, or any other cause which prevents full access of the blood to the brain. The second variety may be due to disease of some organ concerned in hematosiis or a general cachexia, *e. g.*, hemorrhage or other exhausting discharge; chronic dysentery and diarrhea; malarial and other fevers, rheumatic, strumous, and cancerous diathesis; diseases of the bones and joints; congestion of internal organs; pressure upon or obliteration of the arteries supplying the brain; excessive mental exertion; the action of mental emotions, as fear; certain medicines, tartarized antimony, calomel, oxide of zinc, and the bromides, also tobacco; insufficient nutriment; shock from physical injury; and the passage of a galvanic current of too great intensity through the brain. (Hammond.)

Symptoms.—The mental symptoms may take the form of torpor, or drowsiness, and coma, or there may be excitation, restlessness and delirium. There is frequently vertigo and pain in the head, often confined to a limited portion of the head; syncope; paleness of the face, coldness of the extremities; cold and clammy skin; frequent, weak, thread-like pulse; feeble and accelerated breathing; dilated pupils responding slowly to strong light; pain on using the eyes; ringing in the ears; nausea and vomiting; convulsions of an epileptic character may occur, and general or partial paralysis with derangement of sensibility, formication, numbness, hallucinations, and illusions are not infrequent. Systolic and diastolic bellows murmur at the base of the heart, may also be present and arterial and venous murmurs.

Prognosis.—Favorable in the gradually developed form; grave, when the disease is the result of sudden and profuse loss of blood, particularly when the patient is pulseless and convulsions have occurred.

Treatment.—Should be directed against the cause. If it result from hemorrhage, that should be stopped. If from exhausting discharges, loss of vital fluids, endeavor to check them. If the digestion is at fault, correct it; if the surroundings are depressing, they should be changed. Good food is imperative. Alcohol, wine, or liquors are advisable, or where for any reason they cannot be given, other tonic and stimulants may be resorted to; quinine, gentian and colombo are useful as adjuncts. Nitrite of amyl may be inhaled in chronic cases in doses of four to six drops three times a day. Avoidance of excitement, or over-exertion should be insisted upon. Galvanism is useful if the tension be low; not more than two or three cells should be brought into action, and the current should be passed only for a few seconds at a time. (Hammond.)

Symptomatic Indications.—The most important remedy in the treatment of cerebral anæmia is *phosphorus*, particularly when the disease is the result of loss of animal fluids. Depression of spirits, great nervous debility, are the characteristic symptoms of the remedy. *Phosphoric acid* is useful when the anæmia is the result of mental causes, as grief, chagrin. The leading symptoms of phosphoric acid are illusion of the senses, delirium, drowsiness, and sopor. Anæmia from feeble cardiac action or deficiency of blood may be relieved by *ferrum*. The face is usually pale or of a greenish color, but becomes a fiery red from the least emotion or exertion. *Bromide of ammonia* is frequently useful, especially when the anæmia is the result of diminished caliber of the blood vessels or of vasomotor spasm. Anæmia from mental exertion, venereal excess, or sedentary life calls for *calcarea carb.* The indicating symptoms are hypochondria, hysteria, nervousness and insomnia. For anæmia in old people or delicate persons, with nausea, and numbness of the limbs the best remedy is *baryta carb.* The delirium, and illusions of anæmia, coma vigil, or convulsions are relieved by *bella-donna*.

BRAIN, ABSCESS OF.—Abscess of the brain is nearly always secondary, the idiopathic form being almost unknown. It is more commonly met with in the white matter than in the gray, and

its most frequent seats are the centrum ovale, the temporo-sphenoidal lobes, and the lateral lobes of the cerebellum.

The *causes* of cerebral abscess may be either *local* or *distant*. Inflammation of the bones of the skull resulting from direct injury, such as a blow or fall on the head with fracture, followed perhaps by caries or necrosis, and suppurative disease of the middle ear are by far the most common local causes of abscess. In the latter case there is usually a history of purulent and possibly fetid discharge from the ear of some years' duration, generally with perforation of the tympanic membrane and caries of the temporal bone. But there may be disease of the middle ear without perforation, discharge, or disease of the bone. By some means, imperfectly understood—it may be by the perivascular and lymphatic canals—infection is carried to the brain, and an abscess results, its most common sites being the temporo-sphenoidal lobe and the cerebellum. Disease of the nose and of the ethmoid bone, syphilitic or not, is also a rare cause. Among causes operating from a distance are certain diseases of the lungs and pleuræ, especially bronchiectasis, gangrene, and empyema, and also general pyæmia. Cerebral abscess, however, is not, on the whole, a common complication of pyæmia.

Symptoms.—The disease may run an acute course, or the abscess may be present for some months without giving rise to obvious symptoms. When the abscess follows an injury, after a varying period there may be a severe headache, localized to the seat of injury, vomiting and pyrexia, with rigors. The temperature, however, in the majority of cases is low, and the pulse slow, a marked contrast to the conditions usually found in meningitis. Optic neuritis is often present, but is less common and less severe than in cases of cerebral tumor. When abscess follows disease of the middle ear and is situated in the temporo-sphenoidal lobe the symptoms are often very obscure. A purulent discharge may have suddenly ceased, and for some days following the patient may have complained of headache, gradually increasing in severity. He then becomes drowsy and stupid, but there is rarely any definite paralysis. If the so-called motor area be involved, convulsions may occur asso-

ciated with hemiplegia or monoplegia, but sensation is not affected unless the disease involves the posterior part of the internal capsule. There may be delirium, but the mental condition is more often one of torpor and indifference to surroundings; this passes on to stupor, which deepens into coma, with brown dry tongue and relaxation of sphincter, when, if not relieved, the patient dies.

In the *chronic* form the condition may be latent for a period varying from a few months to several years, symptoms being absent so long as the abscess remains encapsuled, or there may be occasional complaints of headache with irritability of temper, and sometimes convulsions resembling ordinary epilepsy. The latent period ends suddenly or gradually, the change being marked by increased headache, and possibly by the occurrence of rigors. The symptoms now become those of the acute form.

Localization of the lesion.—The symptoms of abscess in the motor cortex and in the neighborhood of the temporal bone have already been indicated. Further indications may be obtained by testing the grasping power of the hands with the dynamometer. Abscess in the frontal region may cause no symptoms beyond mental dullness or melancholia. If the speech center be destroyed, there will be aphasia, but this symptom may also be present in the case of a large abscess in the left temporo-sphenoidal lobe, compressing the third frontal convolution. In the corona radiata, hemiplegia or hemianæsthesia may be produced by destruction of the motor or sensory fibers, but abscess in the basal ganglia often causes no special symptoms, unless the internal capsule be involved. The cranial nerves are liable to be affected with abscess situate at the base of the brain. The signs of abscess in the lateral lobes of the cerebellum are often very obscure. If the middle lobe be affected, the gait may be staggering.

The *diagnosis* is difficult, as the disease may vary in duration from a week in the acute form to many months in the chronic variety. In the acute form, when there is a history of injury or fracture, and when this is followed by localized headache, with tenderness, pyrexia, rigors, vomiting, and perhaps local convulsions in the limbs, the diagnosis is comparatively easy: but in the chronic form, where the symptoms

are slight or absent, and the terminal symptoms occur suddenly, it may present great difficulties. In any case of long-standing disease of the ear in which sudden cessation of a discharge is followed by headache and increasing drowsiness, the presence of a cerebral abscess is highly probable.

The chronic form has mainly to be diagnosed from tumor of the brain. In the latter the symptoms are more slowly progressive, while the rapid development of severe cerebral symptoms, after slight indications of brain disease have existed for some time, is in favor of abscess, especially if accompanied by considerable fever and rigors.

Injury points rather to abscess, but it also gives rise to tumor in some cases, as already stated in the diagnosis of abscess from meningitis, the state of the pulse and temperature is of great importance; the two conditions may, however, be combined.

Pathology.—In the first stage the vessels are much distended, and there is an exudation of leucocytes into the tissues around. The nerve elements then undergo degeneration. The leucocytes increase and form an abscess, which may be ill defined and surrounded by softened brain substance or may present a distinct capsule. This is formed primarily of delicate nervous tissue which may subsequently develop into a thick fibrous envelope. It is in this way that an abscess becomes encapsuled and latent. The capsule may be completely closed, or in a case of fracture of the skull it may communicate by a fistulous canal with a spicula of bone. The contents of the abscess are usually of a greenish color, and may have a peculiarly fetid odor. Cerebral abscess may be either single or multiple; in the former case it is usually of considerable size, equal to that of a walnut or a hen's egg. Multiple abscesses are generally smaller.

The *prognosis* is always very grave, unless the abscess can be evacuated by surgical operation; in very rare cases it may become firmly encapsuled, but when well-marked symptoms have occurred such a result can hardly be hoped for.

Treatment.—Generally speaking, a fatal termination is certain unless the contents of the abscess can be evacuated.

In the case of injuries to the head the skull should be trephined over the seat of

the fracture or blow, unless there be definite localizing symptoms, in which case the indications they afford are a safer guide to the seat of disease. If, on exposing the brain, the surface appear healthy, a grooved or hollow needle should be passed into its substance with the hope of striking the abscess. When found, the pus must be evacuated and a drainage-tube inserted.

In a case recently operated upon by Mr. J. B. Sutton at the Middlesex Hospital, an abscess in the temporo-sphenoidal lobe, secondary to caries of the temporal bone, was first opened by trephining in the usual position for abscess so situated, but the drainage not being free a second trephining operation was performed, and the bone forming the roof of the auditory canal removed. By this means the abscess was struck again at its lowest point, and its contents were discharged through the canal.

It is possible that when the petrous bone is diseased and the dead bone can be felt, this latter operation will prove the most successful, as the abscess, if found, is necessarily opened at its most dependent part, and free drainage is secured through the auditory canal. The carious bone can also be removed at the same time.

If the abscess be in the cerebellum, its most frequent site is opposite the opening of the internal auditory canal. It may be drained by trephining the occipital bone beneath the inferior curved line and passing a trochar and canula forward and slightly inward through the substance of the cerebellum. C. E. BEEVOR.

BRAIN, ATROPHY OF.—*Natural History.*—Diminution of brain substance, without induration or softening. The disease is usually congenital, or the consequence of some severe hydrocephalic disease, or of old age, or of long-standing exhausting disease, especially in children, serum being effused in the space between the brain and its coverings, in order to supply the deficiency in bulk. Sometimes also one side may be more atrophied than another; the membranes appearing to be greatly shriveled after the fluids escape; the convolutions are thin, and the sulci wide. The sufferers are generally idiotic, and possess but little use of their limbs.

True atrophy of the brain consists in

a diminution of the size or number of the brain elements, without a previous destruction of them, or shrinking of cicatricial-like tissue. Two forms are to be distinguished: (1). Incomplete development, or congenital deficiency; (2) retrogression, or disappearance of brain elements. In the first form the development may be so incomplete that either there is perfect idiocy or life cannot be maintained. There occurs also during fetal life, and the first year of childhood, an arrest of growth on one side—the opposite side continuing to grow. Such cases may live and attain a certain degree of mental development. After the development of the brain is complete, atrophy may set in primarily as senile marasmus, or it may be a result of exhausting and wasting diseases. Local disease in the brain is also a cause of secondary atrophy, such as the lesions of apoplexy, softening, or encephalitis.

Weakness of intellect or decided idiocy are the usual accompaniments of atrophy. The organs of special sense, especially the eye, are very obtuse, and the peripheral nerves over the paralyzed half of the body are diminished. Paralysis and atrophy of the body on the side opposite the atrophied hemisphere are usual symptoms of the lesion. Paralysis is generally complete and combined with contractions of tendons. The bones are atrophied as well as other parts. Epilepsy is usual, and although the disease is not of itself fatal, intercurrent lesions usually very readily cause death.

WILLIAM AITKIN.

BRAIN, CONGESTION OF.—Varieties two. Active and passive.

Causes.—Active congestion is the result of any cause which induces activity of the circulation, as mental anxiety, intellectual exertion, emotional disturbance, exposure to high temperature, etc. The passive form results from any cause which brings about torpidity of the circulation, as compression of the veins running from the brain, diseases of the heart, tricuspid insufficiency, stenosis of the venous orifice, diseases of the lungs, emphysema, extensive pneumonia, etc.

Symptoms.—Symptoms may be divided into two classes: those of excitability, as headache, sensitiveness to light, wakefulness, illusions, and delusions, emotional disturbances, flickering before the eyes,

ringing and noises in the ears, jerking and automatic motions of the limbs, apoplectical, maniacal, soporific, convulsive, and aphasic attacks; those of depression, as insensibility to light, noise, or pressure, heaviness, and immobility of the limbs, frequent pulse and slow, irregular and snoring respiration.

Prognosis.—Favorable; most cases recover within a few days.

Treatment.—For the active form local bleeding by cups to the nape of the neck, or leeches to the inside of the nostrils may be advisable. In severe cases resort may be had to the actual cautery. As auxiliary measures, cold water or ice may be applied to the cranium or nape of the neck, mustard plaster to the epigastrium, and warm water to the feet. Severe muscular exercise should be forbidden, and the head kept elevated during sleep. The constant galvanic current may be used, applying one pole over the sympathetic nerve in its course through the neck; the other on the back of the neck as low down as the seventh cervical vertebra; the current from about fifteen Smee's cells is sufficient, and should not be allowed to act for more than two minutes; if extreme vertigo is produced, lessen the number of cells. (Hammond.) Internal remedies, except in extreme cases, are usually sufficient to bring about a cure. In the early stage the principal remedies are the bromides, either alone, as the bromide of potash, which may be given in fifteen-grain doses three times a day, or bromide of soda $\frac{z}{3}$ i, fluid ext. of ergot $\frac{z}{3}$ 4, making a fluid solution, may be given in teaspoonful doses three times a day. After the symptoms of congestion have disappeared, which will usually be at the end of ten days, leaving only a little debility and depression, tonics and restoratives may be given. \mathcal{R} —strychniæ sulp. gr. i; ferri pyrophosphatis, quinia sulph. aa i; acid phos. dil., zingiberis syrapi, aa $\frac{z}{3}$ ii; M. ft. mist. Dose, a tablespoonful three times a day in a little water, or \mathcal{R} —zinci phosphidi grs. iiii; rosat. conserv., q. s. M. ft. in pil. No. xxx. Dose, one three times a day; instead of the conserve of roses grs. x. of the extract of nux vomica may be substituted if strychnia is not being administered in some other form. (Hammond.) Diuretics are useful when the urine is scanty and high-colored, and laxatives may be given if constipation is present.

In the passive form the cause of the condition should be counteracted if possible. Stimulants, as alcohol, or carbonate of ammonia may be given, and the bromides as in the active form. Hygienic treatment is valuable in both forms of the disease, and should be insisted upon. The food should be simple, nutritious, and easily digestible, being largely regulated by the patient's desires. Bathing, exercise, friction to the skin, are all valuable adjuncts.

See INFLAMMATION OF BRAIN.

Symptomatic Indications.—Congestion of the brain in complication with other diseases may require *cuprum*, when the congestion is the result of some acute eruption, with fretfulness or apathy, convulsive movements, and distortions of the limbs; restless or disturbed sleep: *helleborus*, usually in the last stages, when serious exudation has taken place; pale and puffed face; soporous sleep, with screaming and starting; lower jaw sinking down; automatic motions of one arm and leg: *opium*, lethargy, with stertorous breathing, eyes half closed; stupor after waking; delirious talking with wide open eyes; face purplish and swollen: *bryonia*, non-inflammatory congestion; pain in the head as though the skull would be pressed asunder; very irritable, with fits of anger; delirious at night, with desire to escape; wants to keep perfectly still as the least motion aggravates.

BRAIN, FUNCTIONS OF.—A knowledge of the functions of the different parts of the brain is absolutely essential for the purpose of exact diagnosis in cases of cerebral disease.

It will be advisable to describe the functions of the different parts of the brain under the following headings: Cerebral convolutions, corona radiata and internal capsule, and cerebellum.

It will be observed that in the above list no mention is made of the basal ganglia; formerly the corpus striatum was considered to be the motor and the optic thalamus the sensory ganglion, but the functions originally ascribed to these ganglia are really those of the adjacent parts of the internal capsule, and there are no definite symptoms by which a lesion involving the basal ganglia only can be recognized.

The cerebral convolutions contain areas for the representation of (a) move-

ments, (b) sensation, and (c) the special senses.

(a) The so-called *motor area* occupies the convolutions about the fissure of Rolando in each hemisphere—viz., the ascending frontal and parietal convolutions on each side of the fissure, the posterior part of the three frontal convolutions, and the parietal lobule, the continuation upward and backward of the ascending parietal convolution. In addition to these, there is the contiguous part of the marginal convolution along the mesial surface of the hemisphere.

Stimulation of this region by a weak Faradic current produces movement in various parts of the opposite half of the body.

To indicate clearly the order in which the motor areas for the different parts of the body are situated in the cortex, it will be well to begin at the mesial line, and then to pass outward and downward along the fissure of Rolando to the fissure of Sylvius; by so doing we shall find that the functions represented range in order from the least highly evolved to the most highly specialized—*i. e.*, starting with movements of the abdominal muscles, we end with the center for speech.

The principal area for the movements of the lower limb is situated in the highest part of the outer surface of the cortex, *i. e.*, the part next to the middle line. According to some observations made by the writer the representation of the different parts of the lower limb can be differentiated. The most important of these is the representation of the great toe, which is situated immediately in front and also behind the superior end of the fissure of Rolando; *i. e.*, the end nearest to the middle line. Further, the representation of the hip is in the most anterior part of the area, while that of the smaller toes is behind the fissure of Rolando.

Passing down the fissure of Rolando, we find the area for the representation of the upper limb next to that of the lower limb, occupying the ascending frontal and parietal convolutions as far down as a line drawn across the fissure of Rolando from the lower end of the intra-parietal sulcus to the upper end of the præcentral sulcus. This area corresponds to about the middle two-fourths of the fissure of Rolando.

According to Mr. Horsley the different segments of the limb are represented in the

following order from above downward: viz., shoulder (nearest to the middle line), elbow, wrist, fingers, index finger, thumb. The thumb can be made to flex alone by stimulation of the cortex in the ascending parietal convolution just above and in front of the lower end of the intra-parietal sulcus.

Just below the area for the upper limb there is a very narrow strip running across the fissure of Rolando between the præcentral and the intra-parietal sulci, stimulation of which was found to produce closing of the lids of the opposite eye.

The rest of the ascending frontal and parietal convolutions between the area last described and the fissure of Sylvius is occupied by the area for the representation of the buccal cavity and the throat.

Thus, in the upper half of this region we have elevation of the angle of the mouth of the opposite side, and below this retraction of the angle of the mouth, and in the part of the cortex next to the fissure of Sylvius we have from behind forward (1) opening of the mouth around the lower end of the fissure of Rolando; (2) movements of mastication and (3) contraction of the vocal cords, bilaterally represented in the cortex of each side. This last area—*i. e.*, for the larynx—brings us close to what is known as the speech center, situated in man in the posterior part of the left third frontal convolution, destruction of which by hemorrhage or softening is followed by aphasia.

Besides the areas mentioned above, there is another situated in front of the præcentral sulcus, and occupying the posterior part of the frontal lobe just in front of the ascending frontal convolution. This is for the representation of the movement of turning the head and eyes to the opposite side, and is the most extensive of all, as it reaches from the median line, above, almost to the fissure of Sylvius, below. Its large extent is perhaps due to the fact that all purposive movements of the limbs are preceded by turning the head and eyes in the direction of the desired movement. The middle of this area *i. e.*, the part in the hollow of the præcentral sulcus, is for the representation of the simultaneous action of turning the head and eyes to the opposite side, while nearer to the middle line the head tends to move alone; and below, nearer to the fissure of Sylvius, the eyes move without the head.

(b) *The area for the representation of sensory impressions* is considered by Dr. Ferrier to be in the hippocampal convolution, while Professors Horsley and Schäfer have found that the gyrus fornicatus, which is the continuation of this convolution, forward along the mesial surface, is also part of the area for the representation of anæsthesia. At present, however, no differentiation has been made out for the different parts of the body.

Besides definite anæsthesia, Mr. Horsley has noticed, in cases of lesion of the so-called motor area, a form of perverted sensation, in which an impression is always referred—say, in the hand—to a phalanx higher up than the one touched, and the person complains of subjective numbness, and there is loss or impairment of muscular sense.

(c) *The special senses*, as sight, hearing, taste, and smell, have been localized in the cortex. *Sight* is represented in the occipital lobe, and also in the contiguous angular gyrus in the parietal lobe. In the occipital region the corresponding half of each retina is represented, so that with a lesion of the left occipital lobe the left half of each retina would be affected, and consequently the person would be unable to see objects to the right of the middle line—*i. e.*, he would have right hemianopsia. In the angular gyrus Dr. Ferrier considers that the whole field of the opposite eye is represented, and also to a less degree the whole field of the eye of the same side; so that from a lesion of the left angular gyrus there follows extreme concentric diminution of the field of vision of the right eye, and a slight diminution of the left field; this is called “crossed amblyopia.”

Hearing has been localized in the first temporo-sphenoidal convolution.

Smell.—From experiments and from the facts of comparative anatomy, this sense has been localized in the inner surface of the tip of the temporo-sphenoidal lobe, but, unlike the other special senses, the olfactory center receives impression from the nostril of the same side, not the opposite.

The center for *taste* has not been differentiated from that of smell.

The part of the cortex which is in front of the excitable, so-called motor area, and which lies between this and the anterior extremity of the frontal lobe, is considered to have no motor function, but is thought

to be the seat of the highest mental processes. Lesions in this part do not produce paralysis, but symptoms of mental dullness or melancholia.

The corona radiata and internal capsule are made up of the fibers which pass down from the cortex to form the pyramidal tract in the pons and medulla. How many of these fibers end in the basal ganglia (corpus striatum and optic thalamus) is not known, but it is certain that a large number of the fibers pass directly from the so-called motor cortex to the pyramidal tract without any connection with the basal ganglia.

The internal capsule consists of an anterior and posterior limb joined at an angle. The anterior limb is for the most part inexcitable, but the greater part of the posterior limb (commonly described as the anterior two-thirds, but on the average it is more than this) is excitable, the fibers being arranged in the following order. Beginning in front we have—(1) opening of the eyes; (2) turning of the eyes to the opposite side; (3) turning of the head to the opposite; (4) opening of the mouth; (5) movements of the tongue; (6) elevation of the opposite angle of the mouth; (7) movements of the upper limb; (8) movements of the rectus abdominis and other trunk muscles of the opposite side; and (9) movements of the lower limb.

The fibers of the extreme posterior part, commonly called the posterior third of the hinder limb of the internal capsule, are considered to be sensory, and a lesion there produces not only hemi-anæsthesia of the opposite half of the body, but also affects the opposite special senses as well.

The exact functions of the different fibers of the *corona radiata* have not been accurately worked out—but they are probably intermediate between the positions for the representation in the cortex and in the internal capsule. The great point of difference between the symptoms resulting from lesions, such as tumors, in the cortex and in the corona radiata, is that local convulsions are not produced unless the cortex itself be involved, while lesions of the corona radiata are characterized by a slowly progressive hemiplegia. The hemiplegia which results from similar lesions in the cortex is of yet slower development.

Cerebellum.—Lesions of the anterior part of the middle lobe produce in cer-

tain animals a tendency to fall forward in walking, while injuries to the posterior part of this lobe cause the animal to fall backward. When the lateral lobe is injured or its middle peduncle divided, the animal has persistent movements of spinning round on its vertical axis, the movement occurring in a direction which, in the case of a man, with division of the left middle peduncle, would produce rotation on the vertical axis from left to right. If the lesion of the left lateral lobe and left middle peduncle be slight, the animal falls toward the opposite side—*i. e.*, the right. On the other hand, there are no symptoms of loss of equilibrium produced by lesion of the hemispheres unless the middle lobe be involved, and a lesion of the lateral lobes alone does not produce loss of function of the cerebellum. Lesions of the cerebellum do not in themselves cause any paralysis unless pressure be exerted on the pyramidal tracts in the pons or medulla. Tetanic fits with episthenos have been described, but it is uncertain whether they result from disordered functions of the cerebellum or from pressure on the pyramidal tract.

C. E. BEEVOR.

BRAIN, HYPERTROPHY OF.—

Only a few remarks are required with reference to the so-called hypertrophy of the brain in children. This is associated either with rickets or with congenital syphilis; and the increase in size and weight of the organ is probably due either to albuminoid infiltration of the white substance or to increase in the neuroglia. The tissue becomes unusually firm, pale, and dry; the convolutions being compressed, flattened, and closely packed. The head expands, but the enlargement is distinguished from that of chronic hydrocephalus by being much less rapid in its progress, never attaining any great size, and by having an elongated form from before back; while the fontanelles and sutures are not at all or but little apart, the former being often depressed, and not yielding fluctuation; and the eyes are sunken. Frequently there are no evident nervous symptoms, but if the head is closed before the brain enlarges, serious symptoms are liable to arise, such as severe headache, vertigo, mental failure, epileptiform attacks, paralysis, or coma.

FREDERICK T. ROBERTS.

BRAIN, INFLAMMATION OF.—

Varieties, two. That occurring in connection with meningitis and that occurring as an independent disease.

Causes.—Predisposing: age and sex, the disease being more frequent in males and old persons. Exciting: inordinate indulgence in alcoholic liquors, venereal excesses, over-exertion, mental, great emotional disturbance, exposure to extreme heat, etc. It may also arise by extension of disease from the inner ear, or may occur in connection with erysipelas of the head, severe attacks of scarlet fever, smallpox, or other eruptive disease.

Symptoms.—Premonitory: vertigo, headache, illusion of the senses, numbness, difficult speech. In some cases the onset of the disease is announced by an epileptiform convulsion. Disorders of motility, sensibility, of intelligence, and of the functions of organic life attend the establishment of the disease. There are pains in the head and in various parts of the body, formication, numbness and other abnormal sensations. In the beginning there is usually hyperæsthesia, which is followed by anæsthesia. There are disturbances of vision and hearing which may be followed by loss of both. Mental weakness is soon apparent, increased susceptibility to the influence of emotions being among the earliest signs, as shown in uncontrollable fits of crying or laughter. Enfeeblement of the memory follows, which may extend to a condition of complete dementia, with delirium and coma, or simply coma. The motor organs share in the disorder; the earliest symptoms being those of greater excitability, which may extend from twitching of the muscles to general convulsions, with or without loss of consciousness; this condition gives way to a diminution of motor power, with loss of muscular power and paralysis, the paralysis usually commencing in the extremities and gradually involving one side.

Fever is always present. There is a characteristic tremulousness which has been compared to the unequal vibrations of a cord moderately stretched. (Hammond). Respiration is but slightly affected in the beginning, but as the disease progresses it grows more disturbed, becoming irregular and stertorous, even to asphyxia. The functions of the body

are all disturbed, the appetite is capricious, the bowels constipated, and nausea and vomiting are almost constantly present. Retention of urine may be present owing to paralysis of the bladder or incontinence from paralysis of the sphincter, or constant dribbling from paralysis of both bladder and sphincter. The symptoms may be arranged in five classes, designated by the most prominent features of each, as the paralytic, the comatose, the epileptiform, the apoplectiform, and the maniacal. Death ensues from exhaustion or asphyxia, or by the bursting of the abscess into the ventricles or upon the surface of the brain. (Hammond).

Prognosis.—Grave; in the suppurative form usually fatal.

Treatment is palliative and symptomatic, being directed to the controlling of the pain, vertigo, or vomiting. Cannabis indica, in connection with the bromide of potash, may be used with benefit; the dose (Squire's extract) being from one-half to two grains in combination with twenty to thirty grains of the bromide of potash or soda three times a day. Mercury in the form of calomel may be given when a syphilitic origin of the disease is probable.

Symptomatic Indications.—In the first stages of active congestion or inflammation the principal remedy is *aconite*, particularly when the disease is the result from violent emotions or cold. There is sthenic fever; dry, hot skin, quick, hard pulse; great anxiety and fear of death. Next in importance is *veratrum viride*, which is indicated in acute arterial congestion; quick, hard pulse. Mental confusion; loss of memory; convulsion or paralysis; intense headache; numbness and tingling of the limbs are guiding symptoms. For arterial congestion from any cause, *belladonna* is a very valuable remedy. The face is red, the eyes hot and sparkling, with a furious look. The head is hot and the carotids throb visibly. The delirium is of a furious character, with desire to escape from bed; tries to bite, strike, or injure those about him. Drowsiness, with inability to sleep; starting and jumping during sleep. Recent passive congestion requires *gelsemium*; there is diplopia, vertigo, and venous congestion. *Gelsemium* is the remedy when children during dentition become drowsy, comatose, and convulsive. Sudden, intense congestion is frequently

relieved by *glonoin*, particularly when the result of exposure to intense heat.

BRAIN, SOFTENING OF.—Softening of the brain is the direct result of occlusion of the cerebral arteries from embolism and thrombosis.

Cause.—Predisposing: age; softening mostly occurring after age of fifty years. Exciting; any intense strain upon the brain, as long-continued intellectual exertion, severe and protracted emotional disturbance, exposure to intense cold, excessive use of alcoholic liquors, injuries, etc.

Symptoms.—When the result of embolism the onset of the disease is sudden, having in many cases the appearance of an apoplectic stroke, with loss of consciousness and coma. In other cases there is, however, no loss of consciousness, but delirium, aphasia, vomiting, paralysis, all of which may disappear within a few hours. When the result of thrombosis the onset is slower, with pains in the head, vertigo, numbness, loss of sensibility, which may extend over the course of one nerve only or over one side of the body, which is followed by paralysis of motion. Whatever the mode of origin the continuance is the same: there are hallucinations, delirium, aphasia, failure of the mental powers, convulsions, coma, and death. The symptoms are the same as those of cerebral hemorrhage and the distinction between them is extremely difficult to distinguish; in many cases, impossible.

Pathology.—Emboli consist of blood clots, masses of fibrine, connective tissue growths, or concretions which are formed in various parts of the system, mostly, however, about the heart or aorta in disease of those organs, and carried in the circulation to the brain.

Structural changes in the vascular walls give rise to thromboses which are formed on the spot where the occlusion is produced. If the seat of the occlusion is on the cardiac side of the circle of Willis, or the embolus is carried onward into the arterial system of the cortex, the substance of the brain is not affected, as its nourishment is provided for by the increase of the collateral circulation. If the occlusion occurs beyond the circle of Willis, or in a terminal artery of basal system, the brain substance supplied by the occluded artery appears swollen and discolored in different shades of red inter-

spersed with numerous dots of blood. (*Red softening*). After a longer or shorter time the red fades into yellow, partly from absorption of the coloring matter, and partly from fatty degeneration of the nerve tissue. (*Yellow softening*). A continuance of the degenerative change after several months finally converts the affected tissue into a semi-fluid milky substance. (*White softening*.)

Prognosis.—Grave; in general the disease results in death, but in the case of younger persons, of good constitution and temperate habits, there is a possibility of recovery.

Treatment.—The treatment must be directed against the cause and is largely symptomatic. If there is anæmic condition of a portion of the brain, the judicious use of stimulants and tonics is advisable, while the body should be kept warm by additional clothing, or the application of artificial heat; at the same time the recumbent position should be assumed. Mental exertion should be absolutely interdicted. If there be much headache, the bromides may be given in large doses. The convulsions and delirium are also best treated by the bromide of potassium in doses of thirty grains every three or four hours. In that form of softening which is obscure in its origin and gradual in its progress there is more hope of a favorable result. Phosphide of zinc in doses of a tenth of a grain with half a grain of extract of nux vomica in a pill, three times a day, with constant galvanic current three times a week, the latter to be derived from fifteen of Smee's cells and to be passed from forehead to occiput for three or four minutes at a time. A liberal allowance of wine, full and nutritious diet, carriage exercise, amusements, and the following preparation of phosphorus are all agents which may be employed with advantage:

℞ Olei Phosphorat, . . . ʒss
 M. Mucil. Acaciæ, . . . ʒi
 Ol. Bergamii, gtt.xv.
 M. Ft. Emulsio. Dose, gtt. xv ter die.
 (Hammond.)

Symptomatic Indications.—The main remedy is *phosphorus*, particularly in the idiopathic form. It is also valuable in secondary softening which results from deficient nutrition. *Hypericum* is often useful in relieving pain and other nerve symptoms.

BRAIN, TUMORS OF THE (Cerebral Tumors).—The *symptoms* resulting from the presence of a tumor within the cranium may be divided into general, and special or localizing.

The *general symptoms* are three: viz., headache, double optic neuritis, and vomiting. They serve to indicate that there is an intra-cranial growth, but give no clew to its exact position.

Headache is usually very severe and continuous; it may be either general or, if the disease be situated upon the surface of the brain, localized to one spot, in which case there may also be some tenderness on percussion.

Double optic neuritis may occur without impairment of vision (Hughlings Jackson), and is probably due either to extension of tissue irritation along the optic tract or to meningitis. The rapidity with which the neuritis passes into atrophy is an indication of the progress of the growth.

Vomiting often occurs daily; it is not preceded by nausea, and is of purposeless character, being without relation to the condition of the stomach. This symptom is most frequently present with growths situated in the medulla and cerebellum.

The *special symptoms* are those which enable us to localize the growth more exactly.

Tumors in the so-called *motor area of the cortex*, grouped around the fissure of Rolando and in the membranes overlying these parts, give rise to localized Jacksonian fits (epileptiform seizures), which begin with tonic spasm of the parts affected with the growth—*i. e.*, with movements of the face, arm, or leg, or with turning of the head and eyes to one side. There may be considerable intervals between the course of the fits, or several may occur in a single day. They are usually unattended by loss of consciousness, and may be followed by paralysis of the part of the body convulsed.

Growths in the *præfrontal region* in front of the motor area do not cause paralysis directly; they may give rise to general epileptic fits, and are attended by mental symptoms, such as melancholia and failure of mental powers.

Hemianopsia is a symptom of tumors situated in one *occipital lobe*, whether involving the gray matter or the central white fibers. If the lesion be of the *left lobe*, the patient is unable to see objects

to the *right* of the middle line, and *vice versa*. Tumors in the *central white matter* of the hemisphere below, but not involving the motor cortex, are characterized by a slow hemiplegia lasting over several weeks, but without Jacksonian fits. The paralysis is due to the fibers of the corona radiata being progressively involved, but there is no anæsthesia unless the growth extends backward behind the motor area.

Lesions of the *internal capsule and basal ganglia* are difficult to distinguish from disease of the corona radiata, as they have many points in common. The group of symptoms which would lead one to diagnose a growth involving the internal capsule is a hemiplegia rapidly affecting the different parts of the bodies, with hemi-anæsthesia and hemiopia. The latter symptoms are more likely to occur than when the lesion is in the centrum ovale, owing to the hinder part of the internal capsule being involved.

Tumors growing at the *base of the brain* are usually accompanied by paralysis of one or more of the cranial nerves. If situated in the *anterior fossa*, the optic nerve or its chiasma may be involved, producing unilateral loss of sight or temporal hemianopia. If in the *middle fossa*, the fifth nerve is especially likely to be affected; while tumors in the *posterior fossa* often involve the sixth nerve, causing paralysis of the external rectus only, or the facial or auditory nerves. When there is pressure on the spinal accessory and hypoglossal nerves, half of the tongue and palate, and the vocal cord of the same side, are paralyzed.

Growths in the *crura cerebri* produce hemiplegia of the opposite side, with paralysis of the third nerve on the same side; and tumors in the *substance of one-half of the medulla and pons* cause complete facial paralysis of the same side, conjugate deviation of the eyes to the opposite side (owing to the nucleus of the sixth nerve being affected), and hemiplegia of the opposite side.

In tumors of the *cerebellum*, involving the middle lobe, a characteristic symptom is a reeling gait, and in some cases nystagmus. Paralysis of the limbs is produced if there be pressure on the pyramidal tracts; tetanoid convulsions are also met with in cerebellar tumors.

The *diagnosis* has to be made from meningitis, hysteria, albuminuria with

uræmia, and from lead poisoning; but by a careful consideration of the symptoms given above a diagnosis can usually be made.

The *prognosis* as a rule is exceedingly grave, the most favorable cases being those in which the tumor is either tubercular or syphilitic, as such growths sometimes become arrested. The latter are most amenable to treatment. The recent progress of cerebral surgery has rendered the prognosis more favorable than formerly. The duration of life in cases in which the tumor either is not, or cannot be, removed by operation varies from six months to two years.

Ætiology.—With regard to *sex*, tumors of the brain are met with twice as often in males as in females, and are more common in childhood and young adult life than in advanced age.

Character.—According to an analysis of cases collected by Ladame and Bernhardt (quoted by Gowers), the tubercular variety is the most common; then come the gliomata and sarcomata; but in the fifty-four cases recently shown at the Pathological Society, sarcomata were the most numerous, gliomata and tubercular growths standing second and third in order of frequency. In addition to the above, psammomata, gummata, carcinomata, fibroids, simple and hydatid cysts, and cysticercus are also met with.

Situation.—The most frequent sites of tumors are as follows, arranged in order of frequency: Cortex cerebri and subjacent white matter, pons and crura, cerebellum, basal ganglia and ventricles, cerebral envelopes, cranial nerves.

Of the different forms of tumor it may be said that the *tubercular* grow in the lymphatic sheaths, and are most frequent in the cortex.

Gliomata occur in the cerebral and cerebellar hemispheres; less often in the basal ganglia and pons.

Syphilomata grow from the pia mater along the perivascular sheaths, and are met with in the cerebral cortex and pons.

Sarcomata grow from the membranes, from bone, or in the brain substance, and very frequently also in the basal ganglia.

Carcinomata are more commonly met with in the basal ganglia.

Parasitic growths occur in the white substance or in the ventricles of the cerebrum.

Gliomata and carcinomata are infiltrating; tubercular and syphilitic tumors and the sarcomata are not.

Gliomata are single, white tubercular and syphilitic tumors and sarcomata are often multiple.

Treatment.—In tubercular cases tonics and codliver oil are indicated, while in syphilitic cases a course of mercury and iodide of potassium should be thoroughly carried out. Where a diagnosis can be made of cortical, or even sub-cortical, growths, a surgical operation should be advised. Owing to the labors of McEwen and Horsley, the removal of cerebral tumors has been brought within the domain of surgery, and many successful cases have been recorded. After a course of treatment has proved unavailing, an operation should certainly be recommended if the growth can be localized; and even in the case of tumors deeply seated in the cerebrum or cerebellum, it is sometimes advisable to make an opening in the skull to relieve the pressure and the agonizing headache, even if the growth cannot be removed. Morphine, Indian hemp, choral and ice to the head are the chief remedies for relieving pain. C. E. BEEVOR.

BREAST, DISEASES OF THE.

—**Neurotic conditions of the mamma, uncomplicated neuralgia, and hyperæsthesia** almost always occur in young women. The neuralgic pains are sometimes very severe indeed, shooting down the arm and into the armpit. There may exist along with them an extreme sensitiveness of the gland or of the skin over it (hyperæsthesia), so that the slightest pressure apparently causes the most exquisite suffering. On examining the breast nothing can be detected unless it be a little general fullness. The exception to this statement is where neuralgic pain accompanies chronic lobular inflammation, but then, that is very specially a complaint, not of youth, but of middle life. In truth, the mammary neuralgia and hyperæsthesia of young women are always the results of some perverted ovarian condition, and the moral element enters largely into their nature also, so that to lay down accurate rules for their diagnosis is useless. Some general medical experience, and a certain knowledge of human nature, are all that is required rapidly to pick such cases out from among

those of serious import. The young practitioner may remember for his comfort that mammary pains in young women, where no distinct growth is to be felt, are not of much consequence, and that the more violent the pain and the more acute the sensitiveness, the less is the danger. As regards treatment, all local measures should be carefully eschewed, and the patient's mind should be diverted from the subject of her breast or breasts altogether; while tonics, cold baths, wholesome food, fresh air, hard beds, country exercise, abstention from novels, and rational mental occupation should be enjoined.

Acute inflammation of the breast: mastitis.—Acute inflammation in adolescents. In young unmarried women the breast is occasionally the seat of inflammatory attacks for which no very reasonable cause can be assigned. The subjects are most commonly girls of a weak constitution, or, if not so, they have for the time being got below par in their general health. This inflammatory condition may even go on to the formation of chronic or cold abscess. It is the special and characteristic disease of the mamma, so that any swelling in the breast of young women, say between the ages of sixteen and twenty, will in the great majority of instances be found to be an inflammatory lump or cold abscess. The diagnosis is the chief point.

Acute inflammation during pregnancy and lactation. It is most common in primiparæ, while those who do not suckle their own children generally escape it. It commences most frequently within the first month after parturition, as might have been expected, or again toward the end of a prolonged period of suckling, when the mother has been weakened by an excessive drain.

Among the *causes* of this affection must be reckoned the fact that the breast sometimes secretes its milk so rapidly and plenteously that its ducts become over-distended and irritated. More especially is this the case when, from weakness of the infant or its death, the breasts cannot be regularly and completely emptied. However, without doubt by far the commonest origin of mastitis is some mischief associated with the nipple, which is often cracked and sore, or may be shrunk and retracted, so that the child irritates it by vainly tugging at it, while the nip-

ple itself does not give a free vent to the milk. This irritation is probably propagated along the lymphatics. Occasionally the inflammatory process attacks the gland in its entirety, but usually it is located in a few lobules.

Symptoms.—About a fortnight or three weeks after delivery the patient experiences a little stiffness and soreness, very commonly at the lower and outer part of the breast. Presently she has a feeling of chilliness, or even a rigor. Then she becomes feverish, with a high temperature, hot skin, quick pulse, and loaded tongue, while thirst and headache are often present. The inflamed lobules become hard and knotty, while the breast throbs and feels as if ponderously heavy. The affected lobules soon run together into one hard swelling, over which the skin becomes tense and somewhat livid. If suppuration occurs there is often another rigor, with perspirations, while the skin over the mamma becomes œdematous, and pits on pressure.

Treatment.—Give the inflamed organ physiological rest. To this end, if the affection occur during lactation, the infant should no longer be allowed to suck, and this not merely as regards the affected breast, but as regards both. For the act of suckling the sound organ keeps active the secretion of milk in the other breast. By promptly removing the infant and feeding it artificially, the inflammation may be subdued in so short a time as to allow its return to suckling before the milk has entirely departed. In the meantime the breast must be regularly emptied of its contents by the pump, applied with great care so as not to irritate it. In the case of a robust and full-blooded young woman with a sharp attack of mastitis, accompanied by much pyrexia, it would be quite justifiable to employ local depletion of the breast by leeches, to keep the bowels free by a moderate dose of Epsom salts in hot water, given early in the morning, and to lower the pyrexia by very minute doses of antimony or aconite, given every hour, after the so-called homeopathic fashion. But in the majority of cases the patients are far too weak to permit of this treatment, and require from the commencement to have all their strength carefully husbanded. Tonics, rest in bed or on the sofa, with a light, easily digested diet should be prescribed, while the arm on

the affected side should be kept perfectly quiet.

As regards local treatment, the breast should be slung from the neck with a handkerchief to prevent all dragging. At least three times in the twenty-four hours it should be fomented for some minutes with a large conical sponge wrung out of very hot water. Extract of belladonna, reduced with water or glycerine to the consistence of thick paint, should then be copiously smeared all over it, after which it should finally be covered with lint wrung out of warm water, or hot lead and opium lotion, with light waterproof over all. Ice-bags may be applied in the early stages to check the inflammation.

Should it be pretty clear that an abscess is about to form, as indicated by localized redness of the skin at one particular point, with general surrounding œdema, poultices will give relief. On the other hand the acute condition may subside, leaving behind it a certain chronic state of induration, which can be dealt with by the remedies suggested under the next heading. It is of great moment that all traces of the inflammatory process should be thoroughly cleared away, as there seems little reason to doubt that a certain number of cases of carcinoma take their starting-point in some indurated lobule left after an attack of mastitis.

Chronic lobular inflammation.—*Causes.*—This is seen in married women, both among those who have borne children and those who have not, and is of frequent occurrence in unmarried women as well. The period when the menstrual functions are about to cease is undoubtedly the time of life at which it most usually occurs.

Detached lobules of the breast become hard, lumpy, and nodulated, and this, as a rule, slowly and with very little pain; only slight uneasiness and an occasional twinge. The disease commences as an inflammatory condition of the connective tissue, which becomes infiltrated with small round cells. These develop into fibrous tissue, which presses upon the acini and ducts. By this pressure their epithelium is rendered fatty, and they themselves become ultimately obliterated. The process, therefore, is a kind of cirrhosis, with its stage of increase in bulk, while the fibrous tissue is being developed, and its stage of shrinkage, when

the secreting glandular tissue has been obliterated.

Sometimes one of the affected lobules is intensely indurated, and this is what renders the complaint of great moment, inasmuch as, of all the non-malignant conditions which affect the breast, it is the one which presents the great difficulty in diagnosis from carcinoma. The two conditions, to the touch, are almost identical, and the patients are at a time of life when they may be subject to either. What are the points of difference? The inflammatory condition is more leathery, and not of such stony hardness as the carcinomatous. The integument over it is not adherent, and, when pinched up, does not present the punctuated pigskin appearance which is found over a carcinoma situated near the surface. It may, however, be a little dimpled from adhesion. Usually more than one lobule is involved, and this is a great help in diagnosis, as genuine tumors are always single. The whole breast, indeed, is sometimes so generally indurated that it feels like a hard nodulated cake. Moreover, the other breast very often presents more or less of the same condition. At the monthly periods the affected lobules sometimes undergo a distinct temporary increase in size, doubtless from congestion. The axillary glands are not altered, or, if they are, they are only slightly enlarged and not hard. The nipple is not retracted as it is when carcinoma is seated beneath it. Under appropriate treatment the inflammatory condition either remains stationary or recedes, but malignant disease steadily, though quietly, increases in spite of everything.

From fibroma, adenoma, or simple cyst, the chief diagnostic point is that the inflammatory condition, like carcinoma, wants definition, and passes by degrees into the healthy breast tissue, while the others are movable, definitely circumscribed tumors.

Chronic lobular inflammation accompanied by neuralgia.—It has just been stated that chronic lobular inflammation is seldom accompanied by pain, or, as a rule, only by an occasional shoot or twinge. But when the complaint occurs in women of a neurotic tendency, and specially if unmarried, there may be considerable pain of a neuralgic character. Doubtless much of this is mental, being

produced by extreme anxiety from dread of cancer, which magnifies every ache a hundredfold, while some of it is often caused by the patient feeling and handling the breast in order to find out whether the lump in it is growing or not. However caused, it is a most serious element in producing difficulty of diagnosis between the malady under consideration and fibrous carcinoma or scirrhus. Indeed, so great does the difficulty sometimes become, that it is quite justifiable to explain the exact state of matters to the patient and ask permission to make an incision into the lump. If it is inflammatory, no harm will have been done; if it is malignant, then the proper steps must be taken, for which eventuality the patient's consent should always be obtained before the anæsthetic is given.

Treatment.—The patient should use the arm on the affected side as little as possible. A riband should be worn round the neck into which the hand can at a moment be slipped so as to rest the arm. Morning and evening the breast should be well bathed with hot water, and then gently rubbed with linimentum potassii iodidi cum sapone, or with a 10 per cent. oleate of mercury. Stays should be removed so as to prevent all friction. Over the breast a layer of cotton wadding should be placed, and pressure with support applied. This is best done by four or five turns of elastic webbing bandage (such as is applied over antiseptic dressings), commenced below the breast and carried upward. In this way any amount of pressure consistent with comfortable breathing can be obtained. Small doses of iodide of potassium probably constitute the most efficacious form of internal remedy. To do any good, this treatment must be kept up in most cases for several months, but if the patient be thoroughly in earnest over it and carry it out completely, it will certainly be of service.

Mammary abscess.—*Superficial and intraglandular abscess.*—An acute inflammation of the mamma, having failed to undergo resolution, may end in supuration and abscess, the general symptoms of which are identical with abscess anywhere else. The pus may form immediately beneath the skin, constituting a *superficial abscess*, which is a comparatively mild affair, and seldom productive of much trouble. Or it may form deeper

down in the substance of the gland, constituting the true *mammary* or *intra-glandular abscess*. Sometimes suppuration occurs simultaneously at several points in the gland, and, if no proper vent is given to the pus, the whole organ may become riddled with sinuses and abscess cavities to the complete destruction of the patient's health.

Post-mammary abscess.—Here pus forms either primarily in the connective tissue between the mamma and the great pectoral muscle, or, originating in the deepest lobes of the gland, bursts into the connective tissue area. Necessarily it has great difficulty in getting to the surface. Sometimes it slowly burrows its way right through the gland, but more generally it spreads beneath it and escapes just below its circumference or toward the auxiliary border thereof. As it accumulates it pushes forward the whole breast, which in consequence has a prominent conical appearance with a uniformly smooth and tense surface. It should be remembered that post-mammary abscess may arise from the bursting of an empyema behind the breast or from the presence of a necrosed rib, both of which conditions, of course, need special management.

Treatment.—The first thing, if it has not been done during the inflammatory stage preceding the formation of matter, is to wean the child from both breasts. So soon as pus is recognized to be present, it should be let out. The breast being exquisitely tender, and the patients being sensitive women, with a horror of the knife, the surgeon too often commits the error of merely "puncturing" or "pricking" the abscess, in place of thoroughly evacuating it. The proceeding which will in the end prove by far the most satisfactory is to give the patient an anæsthetic, freely open the abscess from end to end, put in the finger and break down all softened tissues, thoroughly wash the cavity out, pack it tightly with lint dipped in carbolized oil, and put on a light poultice. As soon as possible poulticing should be left off, and water dressing applied, while the cavity is kept open by a little lint pledget or a drainage-tube. In justification of the early and very thorough evacuation of mammary abscess, I can only say that I have never yet seen one of those breasts which are riddled from end to end, as just described,

which was not the result of two things: imperfect opening and overpoulticing. In a case when the breast is undermined with sinuses, a great deal can be done by slitting open the largest of them, while, with a Volkmann's spoon, the rest are thoroughly scraped and cleaned out. After this they may be packed with lint steeped in turpentine, which has a remarkably sweetening and cleansing effect, while the breast is covered with lint dipped in an antiseptic lotion. After the abscess cavities and sinus tracks have been rendered healthy, much may be done by firm compression of the breast either by strapping or by the use of elastic webbing bandage. There are a few cases, where the breast is so hopelessly disorganized and the patient's health so reduced, that the best thing is to slice up all the tracks at any cost and pack them well. Even after the breast has, so to speak, been almost cut in pieces, it is surprising to note the rapidity with which healing occurs, and at the very complete use of the organ afterward for sucking purposes. In certain very bad cases the whole gland has been excised, but this seems quite an unjustifiable proceeding.

Tumors of the breast.—The table is based upon the classification suggested by Gross, and an attempt is made in it to reconcile the modern genetic and anatomical mode of division with the old clinical method, which possessed, as its starting-point, innocency or malignancy.

Many of these tumors are of such rare occurrence that nothing need be said about them, such as pure fibroma, lipoma, myxoma, chondroma, angioma, and neuroma. In the breast they are merely surgical curiosities. The description of them given under the general head of tumors will suffice.

As regards the remainder, there is little difficulty with the carcinomata, the pure sarcomata, and the pure adenomata. But there is a considerable group of tumors, the next in frequency to carcinoma, which are not composed of one tissue alone, but are mixed. The salient feature in this group is the fact that they all contain, in greater or less quantity, a certain amount of adenomatous tissue, that is to say, of a material which is exactly identical with an imperfectly developed piece of normal breast substance. To these mixed tumors the prefix *adeno* may

1. Neoplasms derived from the connective tissue of the gland, and representing this tissue in its fully developed state. .	Non-malignant . . .	{ Fibroma (fibrous tumor), Lipoma (fatty tumor), Myxoma (mucous tumor), Chondroma (cartilage tumor).
2. Neoplasms derived from the connective tissue of the gland, but representing this tissue in its embryonic or immature state	Malignant	Sarcoma.
3. Neoplasms derived from the epithelial or secreting elements of the gland, the general type of which they maintain.	Non-malignant when pure, but apt to become malignant when mixed with certain other tissues	{ Adenoma, either pure or mixed in varying proportions with fibrous tissue (adeno-fibroma), with cysts (adeno-cystoma), or with round, spindle, or giant cells (adeno-sarcoma).
4. Neoplasms derived from the epithelial or secreting elements of the gland, but atypical in their character . . .	Malignant	Carcinoma.
5. Neoplasms formed by a hypertrophy of highly organized structures .	Non-malignant . . .	{ Angelioma (vascular tumor) and Neuroma (nerve tumor).

be given. When fibrous tissue is in excess, the tumor is an adeno-fibroma; when the acini and imperfect ducts of an adenoma take on a cystic formation, the growth becomes an adeno-cystoma; when spindle, round, or giant cells form the bulk of it, it is an adeno-sarcoma. It is quite true that investigators are not agreed upon the point as to whether the adenomatous tissue found in these tumors is of absolutely new growth, or whether it is not merely ordinary gland tissue which has been caught up by a neoplasm (fibrous, cystic, or sarcomatous), reduced to an imperfect state, and incorporated with it; but the bulk of evidence is in favor of the adenomatous tissue being of new origin, while it is difficult to imagine a fibrous tumor, for example, which never takes up and incorporates structures in other parts of the body, acting in a special and peculiar manner when it happens to grow in the breast. I perfectly admit that this is only a working table, and that so much has yet to be made out about the early origin of breast tumors that nothing at present can be considered as finally settled; but, though not pathologically final, it is pretty nearly so from a clinical point

of view. It is reckoned that out of every 100 breast growths, about 83 are carcinoma, and 17 are sarcoma, adenoma (and its compounds), or cysts.

Adenoma and its compounds, adeno-fibroma, adeno-cystoma, and adeno-sarcoma.—*Pure adenoma.*—This tumor may most aptly be compared to a piece of mammary gland tissue from a pregnant woman in which a proliferating of acini and ducts is taking place as a preparation for lactation. The one difference is this, that in the gland nature arranges the acini into lobules, and unites their ducts so as to form a completed excretory apparatus, while in the morbid growth she stops short, failing to complete the process, and only making a confused mass of acini and ducts which have no coherent relation to each other. The microscope shows on section an infinity of spaces, some round, some flattened, some slit-like, lined with a cubical epithelium, sometimes in one sometimes in several layers. These spaces have a distinct membrana propria, which separates their epithelium from the surrounding connective tissue so that they do not infiltrate it, and this is one of the characteristic features of the growth. It is a

movable tumor, eminently distinguished by a nodulated or bossed surface. In consistence it is hard and resisting. It is of slow and equable growth, taking many years often to attain a troublesome size, and generally occurs in married prolific women about thirty or thirty-five years of age. There is no retraction of the nipple and no involvement of the lymphatic glands. After removal there seems a certain tendency to reproduction, unless the extirpation has been very freely performed. A perfectly pure adenoma is one of the rarest tumors of the breast. Gross could only find accurate records of a very few, and had only seen one himself.

Adeno-fibroma.—This, on the other hand, is the commonest of all the non-malignant tumors of the breast. It is the old chronic mammary tumor of Sir Astley Cooper, which by many recent authors is called adenoma, although it is not made of pseudo-glandular tissue entirely; and by others fibroma, although it is not pure fibrous tissue. Under the classification here adopted it is to be considered an adenoma in which the periacinous connective tissue has become greatly hypertrophied, while the pseudo-glandular or adenomatous material has diminished. It is most commonly found in healthy young women, and is of very slow growth, often remaining stationary and showing no tendency to degeneration. It is a movable, floating tumor; hard and ovoid as a rule, and generally slightly nodulated. It is completely encapsuled, and shells out easily. It does not retract the nipple, nor tuck in the skin, nor affect the glands. It is painless, except in the case of a few anæmic and neurotic women in whom pain of a neuralgic character is an accompaniment. When small it is apt to be confounded with a very tense solitary cyst, and sometimes the likeness is so great that an exploring needle can alone make the diagnosis certain. From carcinoma it is distinguished by the youthful age of the patient and by its well-defined and circumscribed outline, and this latter character also enables us to diagnose it from a mass of chronic lobular inflammation.

Adeno-cystoma (cysto-sarcoma, sero-cystic sarcoma, or glandular proliferating cysts).—Seeing that adenomatous tissue practically consists of a collection of closed cavities with epithelial linings, which secrete a small amount of fluid,

we have precisely the conditions which naturally lead to the formation of cysts. One is therefore prepared to find that cystic change is one of the commonest occurrences in adenomata, and accounts for the cysts which are occasionally to be found even in such hard and solid growths as the adeno-fibromata. There are certain tumors, therefore, in which there is at first no excessive hyperplasia of the periacinous connective tissue, while, on the other hand, the acini and imperfect ducts become dilated into cysts to such an extent that the growth becomes an adeno-cystoma. A most noteworthy feature is the fact that the cysts do not necessarily remain as walled cavities, growing larger and larger under the pressure of contained fluid. On the contrary, the periacinous tissue at some point pushes its way into the cyst, with the result of forming intracystic growths of every kind, varying from solid masses with broad pedicles to vegetations and dendritic growths of the most delicate description. It should be carefully remembered that none of these arise inside the cysts, but are really projections inward of the surrounding tissue, exactly as the lung may be regarded as projecting into the pleural cavity. To such an extent may the intracystic growths proceed that they sometimes completely fill up the cavities, although they never, even under the greatest pressure, obliterate their epithelium-lined walls. A section shows a dense white or cream-colored lobulated mass, studded with cysts. Some are most minute, others as big as a crab-apple. They contain a clear brownish-colored fluid, and the layers are usually more or less filled with intracystic growths. When these growths have filled up the cavities completely, the tumor appears practically solid, but if it be hardened in spirit, these outlines reappear, and the section looks like that of a cabbage. The growth is always completely encapsuled, and has no tendency to infiltrate the breast tissue.

The tumor is most frequently met with at a more advanced period of life than the adeno-fibroma, usually occurring between thirty and thirty-five years of age. It is hard, heavy, movable, and slightly nodulated, while, if large cysts be present, they are distinguished by their prominence and elasticity. In its other features it closely resembles the adeno-fibroma. It

is of slow growth, but sometimes, after existing for many years it suddenly increases and attains a great size in a very short time. Under such circumstances it so presses upon the skin that this gives way before it, and then the tumor, relieved from tension, protrudes in the form of a true sprouting fungus. Covered with granulation tissue, it appears as a bleeding mass, secreting a watery discharge and presenting to the eye a most malignant appearance. It may even endanger the strength and life of the patient. Nevertheless, it cannot be said to present any of the true characters of malignancy, inasmuch as it does not affect the glands or distant organs, and does not recur if thoroughly removed.

Adeno-sarcoma.—Here the periacinous tissue, in place of assuming the character of fully formed fibrous tissue, assumes that of the embryonic connective tissue type, and may be composed of small spindle cells, with numerous fibers between them, of imperfectly developed fibrous tissue infiltrated with small round cells, of large spindle cells, of delicate fibers with stellate cells and mucous intercellular substance, or of various combinations of these structures. Cysts are often scattered through it. When commencing early in life, it may remain for long periods without making much advance, and then suddenly burst into activity. But when it arises in middle life, it usually grows quickly from the first. In general feeling it is barely to be distinguished from the adeno-cystoma, except by its more pronounced elasticity. Its section is lobulated, and has been well compared to a mass of rice or sago jelly. Its position in point of malignancy can only be determined by a careful microscopic examination. The more fibrous in character the more innocent are the tumors, while those which are juicy and rich in round-cell infiltration are practically on a par with pure sarcomata, from which they are not to be diagnosed before removal.

Sarcoma.—Pure sarcomata occur in the breast just as they do in any other soft tissue. It is thought that the large spindle-cell variety is the commonest, while the small round-cell variety is fortunately not so common. Its malignancy entirely depends upon its structure, the round-cell form with but little intercellular substance being, as it is elsewhere, the most deadly of cancers.

It usually occurs tolerably early in life, between the twentieth and thirty-fifth years. I have seen one at eighteen years of age. It is chiefly distinguished by its smooth surface, more or less elastic feel, isolated position and mobility, and unusually rapid growth. The cutaneous veins are early enlarged, and the skin may give way so that a genuine fungation of the tumor results. It never, however, becomes incorporated with the tumor, which always has a distinct capsule. The axillary glands are long in being infected, but the more malignant kinds are prone to return again and again in and around the cicatrix after removal, and to be reproduced in distant organs, probably by way of the veins.

Prognosis and treatment of adenoma and sarcoma.—The only satisfactory proceeding is removal. As regards pure adenomata we do not know enough about them to say much. The probability is that if thoroughly removed they do not return. Adeno-fibromata should be removed alone, leaving the breast untouched; and their recurrence need not be anticipated. If an adeno-cystoma be of any size the whole breast should be taken away. I have twice had recurrences of such tumors in pieces of breast left at the time of the first operation, but in both cases permanent cure resulted after every particle of breast was swept away. As to adeno-sarcomata and sarcomata, the whole breast should invariably be removed in such cases, and any skin also that may seem to be too near the tumor. When removing a breast tumor the simple rule is to remember that if it is hard, lobulated, and slow of growth, it is probably innocent; while if it is smooth, elastic, succulent, and of rapid growth, it is certainly more or less malignant.

Carcinoma.—It is to this form of malignant disease alone that many writers restrict the term cancer. The word, however, has no anatomical significance. It is strictly clinical in all its bearings, and, moreover, is not a mere surgical term, but is, and always will be, a term understood by the people at large, as having exactly the significance which a surgeon gives to the word malignant. It seems, therefore, most reasonable to consider carcinoma not as *the* cancer, but simply as a variety of cancerous or malignant disease.

Predisposing and exciting causes of

mammary carcinoma.—As regards the influence of *heredity* and *locality*, these are discussed under the general heading of cancer. But it may be said that at present decidedly less importance is attached to the question of heredity than was previously the case. On the other hand, *traumatism*, formerly much scouted, has been shown to be not unfrequently a distinctly exciting cause. The testimony of patients as to blows or injuries being the starting-point of their disease is, of course, very unsatisfactory, inasmuch that no statistics upon the subject are of much value, but there is nevertheless a strong belief that they are often right. Although less clear of proof, there is good reason for believing that chronic induration, left after acute mastitis or abscess, may play a part in producing carcinoma, while chronic eczema of the nipple has been indubitably shown to be a precursor of it in many instances. In short, as in other parts of the body, prolonged irritation of any kind in or about the breast of a woman between thirty-five and fifty years of age is a distinct source of danger.

General microscopic appearances of carcinoma.—Carcinoma is anatomically an atypical, epithelial neoplasm, so that it belongs to the great group of the epitheliomata, as opposed to the sarcomata. It possesses a fibrous framework or stroma, the alveoli of which are occupied by cells. The fibrous stroma is probably formed in part from the pre-existing breast connective tissue, and is partly of new origin. The cells, as a whole, bear the features of spheroidal or glandular epithelial cells, but they are of every size and shape (polymorphous). At one time it was believed that they were characteristic, but this is quite wrong. There is no characteristic "cancer cell"; whence it follows that no mere scraping from the surface of a supposed carcinoma will suffice absolutely to determine it. Nothing short of a properly stained section from a properly hardened piece of the tumor will do this; unless, indeed, the examiner be a man of much experience in surgical pathology. We must not merely examine the cells, but the cells and the stroma, and their exact relations to each other as well. The cells have a certain amount of serous fluid around them, but no genuine cement material. They assume in sections the form of circular groups or cylinders or irregular masses, according

to the shape of the alveoli and the way in which they happen to have been cut. As carcinoma is a growth which does not retain the type of the original gland structure (atypical), an important means of distinguishing it from adenoma, which does retain the gland type, is that in the former the cell-plugs are solid and there is no *membrana propria*, so that the cells freely infiltrate the general connective tissue, whereas in the latter the cell-plugs very generally have a central lumen, and rest upon a distinct *membrana propria*, which limits them.

Varieties of Carcinoma.—From the fact that carcinoma is partly fibrous and partly cellular in its construction, it comes about that there are two main divisions of the growth, according as one or other of its constituent elements happens to predominate. When the fibrous element predominates it is excessively dense and hard. Hence it is termed *fibrous carcinoma*, very commonly called *hard carcinoma* or *scirrhus*. When the cellular element predominates, it is succulent and elastic, whence it receives the name *cellular carcinoma*, or *soft carcinoma*, or, from the appearance of its section, *cerebriform*, *medullary*, or *encephaloid carcinoma*. It would be well if the terms fibrous and cellular carcinoma alone were employed, as they would at once indicate both the clinical and the anatomical features of the two varieties. They gradually run into each other without any definite limitation, so that artificially to make varieties of them can serve no good purpose.

Microscopic appearances of fibrous and cellular carcinoma on section.—A mass of fibrous carcinoma (scirrhus) cuts under the knife like a piece of cartilage, almost with a creaking sound. The cut surface feels tough and impenetrable to the finger, and at once becomes somewhat concave. A creamy turbid juice can be scraped from it. Its color is of a grayish white with a certain glistening aspect, and dispersed throughout it are small yellow dots and streaks. It is exactly like a slice of the thick end of an unripe winter pear. These dots and streaks represent cell columns in process of fatty degeneration. Sometimes there are little collections of a thick, white, milky fluid, which is clearly mammary secretion pent up in partially obliterated ducts. There is no definite limit whatever to the morbid structure, but it shoots

into all the nearest tissues and infiltrates them, so that at its margin may be found fragments of muscle or little islands of fat surrounded by the disease.

A cellular carcinoma (encephaloid) varies in appearance according to the amount of cells in it. If these are not very excessive, the knife cuts it more easily than the fibrous form, while its surface does not become concave, and the exuding juice is more abundant. It is not gray, but white in color, while scattered about are patches where softening or blood infiltration is going on. When the cells are in great abundance and the fibrous tissue reduced to a minimum, then the section has the brain-like appearance from which the name cerebri-form or encephaloid was obtained. Its surface is somewhat of a pinkish hue, with areas of broken-down material, and often large blood effusions and coagula.

General characters of fibrous or hard carcinoma (scirrhus).—A fibrous carcinoma is of an irregularly rounded shape, somewhat nodular, and intensely hard to the touch. It has a stony hardness and weight, which is not possessed by any other mammary tumor, and which is eminently characteristic. It has no definite circumscribed outline, but merges into the healthy gland tissue. At first it is quite movable, but, as it grows, it adheres to the skin, and afterward to the great pectoral muscle, so that it becomes immovably fixed to the chest wall. Its early growth is slow, and speaking generally it does not attain a great size as compared with most other mammary tumors. There are instances, fortunately not very numerous, where the disease does not commence, as just described, in the form of an isolated movable lump, but as a general infiltration of the whole gland.

The most frequent *site* of fibrous carcinoma is without doubt the upper and outer quadrant of the gland toward the axilla, and after that immediately beneath or close to the nipple. Very rarely indeed does it commence low down on the inner side of the gland.

Adhesion of the skin is most characteristic of fibrous carcinoma. Doubtless the skin also adheres to inflammatory growths and even to simple tumors, but then it is always of a glazed appearance, thinned, and stretched before an ever increasing and advancing subjacent mass;

whereas in fibrous carcinoma the growth lays hold of the skin from below and pulls it down to itself. It tucks in the hair follicles and the fibrous bands which pass from the under surface of the skin to the mammary fascia, and thus produces a delicately pitted appearance, which exactly resembles the pigskin of which a saddle is made.

Retraction of the nipple and discharge therefrom.—Even simple tumors may push the nipple on one side or almost bury it, but by the retraction caused by fibrous carcinoma is meant a distinct pulling in of the nipple so that it looks like a depressed umbilicus. Naturally this can only occur when the disease is situated just below the nipple, so that while its presence is strongly indicative of fibrous carcinoma, its absence is of no moment if the tumor be situated at any distance from the nipple. Grave errors have been committed by assuming nipple retraction to be an essential feature of carcinoma. Its value simply depends upon the site of the disease. In some instances (but not many), where the disease is close to the nipple, there exudes from the latter a thin discharge. It is generally, however, light in color and very small in quantity, which distinguishes it from the copious, colored discharge which sometimes occurs in certain forms of cystic disease.

As regards *pain*, there is none in the commencement of the carcinoma. When the tumor has attained such a size as to be distinctly perceptible, the patient's attention is generally attracted to it by slight pricking or shooting sensations, but often the first discovery is purely accidental, made perhaps in the act of washing. For the most part the growth itself is not painful to the touch, and can be gently handled without giving distress. From the absence of pain patients often comfort themselves with the idea that their disease cannot be cancer, but, in making his diagnosis, the surgeon must be upon his guard never to be led away by this fallacy. On the other hand, in the latter stages of the disease, and particularly when the enlarged glands have grasped the brachial plexus, the pain is agonizing and almost without cessation. It is one of the chief agents in literally wearing the life out of the unhappy victim of cancer.

Very erroneous notions are prevalent

as to a general *cachectic condition* of the patient being an essential accompaniment of cancer. Of course, when months of mental anxiety, physical agony, and perhaps exhausting discharge, have done their work, the patients are cachectic enough, but it can hardly be too strongly impressed upon the student that the subjects of mammary cancer are, for the most part, healthy persons, and are often never in better condition than when the disease first makes its appearance. I think I have noticed that robust, squarely-built women, with dark hair, slightly sallow aspect, and thick skin, are among the most common subjects.

A most important guide in the diagnosis of fibrous carcinoma is the *age of the patient*. The following table of 642 cases given by Gross shows this at a glance :

18 first appeared between 20 and 30 years of age.					
128	"	"	30	"	40
245	"	"	40	"	50
165	"	"	50	"	60
78	"	"	60	"	70
8	"	"	70	"	80

Henry records a case of fibrous carcinoma at 21 years of age, and Sibley one at 26. I have myself operated upon one case at 26, commencing toward the end of pregnancy. It was diagnosed mainly by the pigskin appearance of the integument over the tumor. Agnew has seen fibrous carcinoma at 100 and 107; but the most dangerous time is certainly from 45 to 50, while up to 30 years of age fibrous carcinoma may almost be put out of the question in a matter of diagnosis. Statistics are not very clear as yet as to the relative frequency with which the disease affects married or unmarried women, or as to the relations between those who have and those who have not borne children.

Mode of extension, ulceration, axillary and other secondary deposits.—A fibrous carcinoma or scirrhus, if left untouched, gradually but steadily increases, invading the skin and the mammary tissue until the gland almost disappears, and becomes converted into a stony nodular mass with depressed nipple, which in time adheres immovably to the pectoral muscle. After a while the morbid elements find their way along the perivascular sheaths of the vessels of the skin, and are deposited at intervals, where they grow and form *shot-like bodies* which

develop into larger tubera. Sometimes the disease spreads very extensively through the skin after this fashion, invading the whole chest-wall, and, by its contraction, so tightening it and rendering it rigid, that the greatest difficulty in breathing is experienced. This the French call cancer *en cuirasse*. Often when this occurs a red blush, like that produced by a mustard-leaf, spreads over the affected area.

Sometimes *ulceration* takes place, occasionally superficial, but at other times forming deep, excavated cavities, with hard, irregular, and everted edges. There is never, however, any fungation. From the ulcerated surface exudes a thin, foul, ichorous discharge, often bloody. At times vessels in it give way, and hemorrhages occur which may even endanger life, from their suddenness and severity. They are easily stopped, however, by the least pressure, if well directed.

Very early in the course of the disease the *axillary glands* are infected, long before any enlargement in them can be made out by the finger, unless the patient be extremely thin. The pathological changes which occur in the glands are exactly similar to those in the parent mischief in the mamma. As they enlarge, the glands lay hold of the axillary vein and the brachial nerves, compressing them and stopping the circulation in the vein, so that the arm becomes intensely swollen. It feels like lead, utterly helpless, and with exquisite shoots of pain thrilling along it. From the armpit the disease creeps along the lymphatic vessels (which can be seen like thrombosed white threads when the axilla is opened) to the glands of the neck.

In time *secondary deposits* take place in other organs, most frequently in the liver, next in frequency in the lungs and pleuræ, and next in the bones. The femur and ribs are often infected, and very often, too, the vertebræ, in which, when it occurs, the disease produces all the phenomena of acute angular curvature with paraplegia.

Cellular, soft, or encephaloid carcinoma.—As has been stated, the essential feature in this form of carcinoma consists in the excess of the cellular over the fibrous element. This implies active growth, and, as a consequence, we find the disease occurring earlier in life than the fibrous or scirrhus form, and run-

ning its course with much greater rapidity. Its malignant or infective characters are also much more pronounced. It commences as a round, movable tumor, usually more deeply seated than a fibrous carcinoma. Growing often with frightful rapidity, it may reach the size of a fist or of a child's head in a month or two, attaining much larger dimensions than the fibrous variety ever does. It has a knobby feeling, but not the stony hardness of scirrhus. Indeed, it is more usually slightly elastic, and at points presents a most deceptive feeling of fluctuation. At first it merely pushes the skin before it, but soon it adheres to it. Often the integument over it becomes red and œdematous, producing a most deceptive resemblance to abscess. After a time it thins and gives way, and ulceration sets in. Pieces of the disease may become detached, but there is no true fungation. For a long time the pain is very slight, but the general cachexy makes its appearance much sooner than in fibrous carcinoma. The glands and the distant organs in due course become infected, and the patient dies worn out. As Agnew puts it, "The great size, rapid growth, and comparative softness of the tumor, the absence for a long time of severe pain, and the early constitutional involvement, will always serve to distinguish it from other carcinomatous diseases of the breast." But its resemblance, in bad cases, to malignant, round-celled sarcoma is very great, and doubtless until very recently the two have been much mixed up. The grand distinction is that the cellular carcinoma is an infiltrating growth without definite limits, whereas the sarcoma is a distinctly circumscribed and encapsuled tumor.

Minor varieties of carcinoma.—In fibrous carcinoma the epithelial elements, in a few instances, becoming fatty and granular, undergo absorption, while the fibrous elements increase greatly in bulk, and become sclerosed and almost tendinous in consistence. As a result, the growth becomes contracted into an indurated mass of hard fibrous tissue, from which this variety receives the name of atrophying or withering scirrhus. This form often remains quiescent for long periods, and patients may live for many years with it. Nevertheless, although the original portions of the disease may undergo a sort of spontaneous cure, it still

spreads and infects the glands and distant organs in the same way as the more acute forms, and ultimately is always fatal.

Combined both with fibrous and cellular carcinoma are found various forms of cysts, very often of the simple retention variety produced by obstruction of the terminal acini and ducts. Moreover, some rapidly growing carcinomata, particularly those occurring during pregnancy, undergo inflammatory changes in their connective tissue elements leading to the formation of distinct, although comparatively small abscesses. The presence of cysts or abscess is very apt to add difficulty to the diagnosis. Again, colloid changes take place in carcinomatous tumors, but this is so rare an occurrence as almost to constitute a surgical curiosity. Diagnosis before removal is practically impossible. One feature is that colloid carcinoma grows very slowly indeed, and seems to take a long time to infect the glands, so that removal is hopeful.

Treatment.—It may at once briefly be stated that all the internal remedies and local applications which have hitherto been tried for the cure of carcinoma (and their name is legion) have been, to all intents and purposes, practically useless. There are only two plans of procedure: either to leave the disease entirely alone and employ palliative and soothing measures, or promptly to extirpate it with the greatest thoroughness.

Palliative treatment.—The patient should cease to employ the arm on the affected side, and should wear it in a sling. Every movement of the arm involves movement of the great pectoral muscle upon which the tumor rests. Stays or other portions of dress which in any way irritate the disease should be left off, and the breast itself carefully supported. Belladonna and other sedatives applied locally give a little relief, but in the end the surgeon has to fall back upon opium in one form or another; and, if there exist cases in the whole category of disease in which it is allowable to give sedatives in a lavish way, cases of cancer are they. When the disease is allowed to run its course unchecked, it is reckoned that the average duration of life in fibrous carcinoma (scirrhus) is about two and a half years. Of course there are cases where death occurs much sooner, but

there are probably more which exceed that limit, and in which the malady may take several years to prove fatal, remaining at intervals quiescent for long periods. In cellular carcinoma (encephaloid) the progress is much more rapid, and the patient seldom lives more than from six to twelve months from the commencement of the growth. Without doubt the younger and more vigorous the patient, the more rapid is the course of the disease; while the slowest progress is to be looked for in very old, thin subjects. Of all conditions, pregnancy exercises the most stimulating effect upon carcinoma, and those terrible cases which sometimes run their course in a few weeks usually commence at this time.

The general question of operation.—Operative measures should never be undertaken when they manifestly involve excessive risk to the patient's life, or when the surgeon cannot see his way to a complete and thorough removal of all diseased parts visible to the naked eye. He must remember that he has not merely to consider the patient immediately under his care, but that he must on no account do anything which shall prejudice the operation of removal in the eyes of the public. The unsatisfactory result of a single case may turn many women against having their breasts removed, whose cases might have been eminently suitable for operation, and who might have thereby saved their lives.

Long experience alone can produce reliable judgment on the matter of when to operate and when not, but certain broad principles can be laid down. Extensive infiltration of the skin with small shot-like bodies or tubera is a serious obstacle. It is the condition of all others from which local recurrence is most to be dreaded, and, unless it is possible to leave a wide margin of skin beyond the smallest and extremest of these bodies, it is no use operating. It cannot be too often repeated that the smallest particle of disease left behind is as deadly as a large mass. Extensive affection of the axillary glands is a strong deterrent, while invasion of the cervical glands by the mischief is an absolute bar to the use of the knife. The liver, lungs, bones, and uterus, should be examined, if possible, before operating, as nothing can be done if disease is found in them. Again, in persons who have nearly attained the

end of a long life, say approaching seventy, it is to be expected that the growth of the disease will be slow, while a severe operation necessarily involves the utmost risk. Many old women live for a considerable time after the discovery of breast cancer, have very little suffering from it, and die apparently from some other malady. Unless earnestly requested by the patient, the surgeon will do well to refrain from operation where the sands of life have already pretty nearly run out.

On the other hand, given a healthy, middle-aged subject, with a movable tumor of no great size, and but little affection of the glands and skin, then a sweeping removal will in a large number of such cases be found to be permanently curative. It is pretty generally admitted, that while certain persons have a distinct cancerous tendency or diathesis, most cancers are local, and kill by being allowed to infect neighboring parts too freely before removal, so that if the very first germs of the disease could be made out and freely removed, immunity from return would nearly always result. The view that partial operations prolong life and give relief is perfectly erroneous. The local excitement and irritation which ensue after operation and during the healing of the wound, have always appeared to me only to stimulate the remaining disease to more rapid growth. The worst arms I have ever seen have been those where the breast was removed and the axillary glands left behind to grow.

Removal of the breast and axillary glands.—In order to avoid a cutting operation, the breast has been removed by the écraseur, by the thermo-cautery, and by caustics of various kinds, such as Vienna paste, chloride of zinc arrows, and sulphuric acid with lampblack. There is no possible advantage in these plans for any ordinary case, and the pain produced is worse than that caused by the knife. Furthermore the dread of the latter (which is the only real excuse for resorting to other methods) is rapidly dying out, now that anæsthetics are universally used.

There are no special rules for removing the breast by dissection. The one thing to be aimed at by the surgeon is thoroughly to uproot every particle of disease, cutting always well into sound tissues. Selecting the central part of the growth, he should plant his incisions around it

according to circumstances, so that all suspicious skin may be removed without any heed being taken for the manufacture of flaps to close in the wound. If the skin remaining after the operation will close in the gap, so much the better. If it will not do so, then tension-button stitches may be used to pull everything together as far as possible, while the rest must be left to granulate over like any open wound. The fascia over the great pectoral muscle should always be carefully removed along with the breast and any pieces of muscle to which the tumor may have become adherent.

Having quite cleared away the diseased breast, I make a point of at once bringing together the wound so made, as far as possible, and protecting it with gauze, being satisfied that many cases of pleurisy and pneumonia are caused by the prolonged exposure to cold of the lung, for the time covered only by ribs, intercostals, and pleura.

After this an incision should be carried into the axilla about one and a half to two inches below the edge of the great pectoral. The axillary fascia being opened, the knife should at once be laid aside, and the armpit cleared out with the aid of two pairs of very strong broad-pointed forceps and a dissecting tool. The first thing to do is to lay bare the axillary vein, after which there is no risk in removing the glands. Should these be adherent it is better not to run the risk of tearing the vein, but to tie it above and below the disease and remove the affected part. I have twice removed portions of the axillary vein, and have on another occasion tied it in two places, and have not found the least mischief arise from doing so, not even œdema. It is this fact which has often made me doubt whether the swelling of the arm from enlarged axillary glands is entirely due to mechanical pressure on the vein or not. When it can be done I bring together the whole operation wound, inserting a large drainage-tube at the highest point in the axilla. Then I make an artificial drainage aperture at the lowest point of the cavity, about half-way down the axillary region, and insert another large tube. For some days after the operation I employ new sponges wrung out of an antiseptic lotion as a dressing, finding that they provide excellent compression for the wound cavity,

while rapidly and effectually sucking up all discharges.

Cysts.—Mere cysts of the breast are carefully to be distinguished from cystic tumors, by which are meant tumors primarily solid in which cysts are subsequently developed. All breast tumors may have cysts form in them; but those in which they most frequently occur are the adenomata or adeno-fibromata and the sarcomata. Very rarely do they arise in carcinomata. These cystic tumors have been referred to more fully under the head of Adeno-cystomata.

Retention cysts.—1. *Milk cysts*, or *galactoceles*, are by no means common. Nearly always they are found close to the nipple, and arise from dilatations of the large milk ducts in that region, produced by obstructions in some part of their course. They are almost invariably single, usually appearing during the period of lactation, and increasing rapidly in size. They are painless, soft, fluctuating swellings, having the cutaneous veins over them generally much dilated. Sometimes their contents become semi-solid, or cheesy.

2. *Glandular cysts.*—These seldom arise in the large milk tubes, but take origin in the smaller ducts or in the acini. They may be single, or there may be several in connection with a lobule of mammary tissue, which has its main efferent duct partially or wholly occluded. Sometimes, indeed, the whole gland is full of them. When the occlusion is not quite complete, the contents of the cyst or cysts escape at the nipple, usually in the form of a copious sero-sanguineous discharge. They are of every size, from that of a mere millet seed up to such as will contain a pint of fluid; but they usually come under observation when about the size of a walnut. The contained fluid is very commonly straw-colored, but may be brown and turbid or even bloody. The cysts are lined by a distinct epithelium, which frequently serves as a starting-point for proliferating intracystic growths of a papillomatous character. They are almost painless, slow of growth, and never form adhesions, while the age of the patient is usually between thirty-five and fifty. They are smooth in outline, and with a certain elasticity, but distinct fluctuation is seldom to be made out, and, when very tense, they have so solid a feeling that

they are often mistaken for early carcinoma, if deeply buried in the gland tissue. In fact, the diagnosis of not a few cases can only be made certain by the use of an exploring needle, so that if, in the mind of the operator, there should be any doubt at all as to the nature of a tumor presumed to be carcinoma, he should cut into it before sweeping away the whole breast, lest it should turn out to be merely a cyst.

3. "*Involution cysts*," as they are termed, occur in the mammae of females past middle life, as a result of degenerative changes. For the most part they are small and numerous, and give rise to hardly any discomfort, so that they are often never discovered during life. Occasionally, when one or two of them attain some little size, they are most difficult to diagnose from cancer.

Connective tissue or lymph space cysts.—These cysts, which only differ in some minor points from the ordinary glandular cysts just described, are believed not to arise in glandular tissue as the result of retention, but to take origin in the inter-fibrillar lymphatic spaces of the connective tissue. They are, therefore, not "serous" cysts, but "lymphatic" cysts in point of origin (Butlin).

Treatment of cysts.—Small thin-walled cysts may sometimes be cured by mere tapping, or they may be laid open and packed so as to make them granulate up. But if large, or if there are two or three together, excision is undoubtedly the best plan; and if, in the process of so doing, it should be found that the breast is studded with others evidently in process of growth the whole gland had better be removed. This is recommended, not so much from fear of any tendency to malignant degeneration but from the dread which recurrent tumors excite in the minds of patients. The so-called "involution cysts" of old persons need not be interfered with, unless causing decided annoyance.

PROF. W. MITCHELL BANKS.

Symptomatic Indications.—*Aconite* is usually the only remedy required in simple mastitis, particularly when the disease is the result of a chill or exposure to dry cold air. Inflammation with shining, red swelling, or with red streaks running like radii from a central point, usually yields to *belladonna*. The breast feels heavy, with burning pains. *Belladonna* is also indicated for tumors with much inflamma-

tion; painful even to light touch. *Bryonia* will resolve inflammation, when the breasts are stony, hard and heavy, hot and painful but not very red. It is also indicated in the early stage of mammary abscesses when the breasts are gorged with milk, also in indolent tumors of slow growth, and is specific for mastitis neonatorum, produced by efforts to squeeze milk from the breast. *Phytolacca* is specific in mammary engorgements, abscesses, and will often cure after *bryonia* and *phosphorus* have failed. *Phosphorus* is valuable in phlegmonous inflammation, when the breasts are swollen, with hard knots and fistulous openings with blue margins, or show spots of red or streaks; with cutting, stitching pain. *Phosphorus* is also useful in various disorders of the breast attended with hectic fever and night sweats. *Silicea* is indicated in long continued unhealthy discharges, and chronic abscesses, or following abscesses when a fistulous ulcer remains, discharging a thin, watery, offensive pus. The whole breast sometimes seems to be discharging away in pus, one lobe after another opening into one common ulcer; or there may be several orifices. The best remedy for abscesses, tumors, or mastitis resulting from mechanical injury is *arnica*, but in some cases it is necessary to resort to *conium*, particularly when the disease is accompanied with stitching pain as from needles. *Conium* is specific for scirrhus tumors, coming on after contusion, with stony hardness of the breast and feeling of weight. *Calcium sulphide* is indicated for threatened abscess, when suppuration appears inevitable, with throbbing pain. It promotes and controls suppuration.

BRIGHT'S DISEASE.—The term includes several different organic affections of the kidneys, which are classified thus:

Acute	{ Acute parenchymatous nephritis.
	{ Chronic parenchymatous nephritis.
Chronic	{ Granular contraction of the kidneys.
	{ Albuminoid degeneration of the kidneys.

Acute Bright's disease (acute parenchymatous nephritis).—**Symptoms.**—The affection generally begins suddenly with

chilliness or rigors, vomiting, headache, and pain in the back; soon the temperature rises slightly, and œdema appears in the face and other parts of the body. When occurring as a sequel of scarlet fever, the symptoms are more insidious in their onset, and the first sign of the renal affection may be swelling of the face coming on about the third week after the commencement of the primary fever.

When the symptoms of the nephritis are fully developed, the *skin* is dry and pale, the subcutaneous tissues are swollen and œdematous in all parts of the body, but the change is most apparent in the face. A characteristic appearance is produced by the pale and swollen eyelids and cheeks. The *pulse* is increased in frequency, and is of markedly high tension.

The *urine* is voided frequently, but is scanty in quantity, and may, indeed, be for a time entirely suppressed. It is of a dark smoky hue, and gives a copious brownish deposit on standing. Its specific gravity is increased in inverse proportion to the quantity passed. The reaction is usually acid. The urine invariably contains a large amount of albumen. Blood can in almost all cases be detected by the guaiacum-ether test. In nearly all cases red corpuscles may also be found when the urine is examined under the microscope. A condition has, however, been observed in which only the blood-coloring matter was present (hemoglobi-nuria); this replaces for a time a true hematuria. The urinary deposit consists of casts of the renal tubes; epithelium from the kidney, renal pelvis, and the bladder, with the free nuclei of the epithelial cells. Blood corpuscles of both varieties, and a granular organic *débris* mixed with a quantity of amorphous urates are also present. The tube-casts vary in size, and consist usually of the hyaline, epithelial, and blood varieties. Occasionally granular casts may also be seen. The epithelial cells and blood-corpuscles undergo considerable alterations from their prolonged soaking in the urine, becoming at last broken up and disintegrated. The quantity of urea excreted daily is always diminished, and the total amount of the natural solid constituents of the urine is generally lessened. The patient complains of heaviness and an aching pain in the loins, and tenderness is experienced when pressure

is applied over the lumbar region either in front or behind. Sometimes also a fullness can be felt here due to enlargement of the kidney.

The *heart* may, at an early period, show some enlargement from dilatation of its cavities, and, even before the acute symptoms have entirely passed away, may, in rare cases, give some signs of true hypertrophy. A blowing systolic murmur at the apex of the heart may accompany dilatation of the ventricles. As the disease progresses, the *blood* becomes poorer in quality and loaded with matters which ought to be eliminated by the kidneys. The mucous membranes, as well as the general surface of the body, therefore become anæmic. Respiration is hurried, and, at the bases of the lungs, some impairment of percussion resonance, with bubbling and crackling râles, indicate congestion and œdema of these organs. The pleuræ and peritoneum may give signs of a moderate amount of serous effusion. The temperature is somewhat raised, but presents no typical curve. The tongue is dry and coated, the bowels confined, the appetite is lost, and there is great thirst.

Such are the ordinary symptoms of the disorder. They are prone to present themselves in diverse combinations, now one symptom, and now another, being the most prominent. The anasarca especially varies in its situation and amount from time to time. The predominance of the dropsy in certain parts occasionally gives rise to alarming symptoms. The lungs may be waterlogged by œdema; the pleuræ and peritoneum may be so filled with serous fluid that dangerous pressure is exerted upon the surrounding organs; the legs may be excessively swollen, may inflame, and even become gangrenous; the loose tissue about the glottis may swell from œdema and threaten asphyxia. Further dangers impend from the gradual accumulation of excrementitious matters in the blood by reason of the inaction of the kidneys. Convulsions, coma, severe headache, and vomiting may be thus produced, and constitute very serious complications. (See URÆMIA.) Inflammation of the lungs and of the pleuræ, pericardium, and peritoneum is prone to arise. Certain eye phenomena are met with. Frequently the retina is hazy, apparently from œdema; flame-shaped hemorrhages are not un-

common, and occasionally signs of inflammation of the optic papilla are apparent.

That form of the disorder in which the glomeruli of the kidney are specially affected (glomerulo-nephritis: *see below*) is characterized by the presence of excessive dropsy and by the early occurrence of uræmic phenomena.

Course.—The disease may end in recovery or in death, or may lapse into chronic Bright's disease.

The course toward recovery is inaugurated by a decline of the pyrexia, a much freer discharge of urine and a diminution of the amount of blood therein contained. The urine becomes of lower specific gravity; the albumen and tube-casts diminish in amount and finally disappear, the small hyaline casts being the most persistent. The œdema of various parts is gradually removed, the dryness of skin becomes less apparent, the pulse resumes its normal tension, and, after a period of more or less protracted convalescence, not infrequently interrupted by one or more recrudescences of the disorder, the normal state is attained.

Death may be caused by any of the untoward conditions mentioned above. Further, cardiac failure is frequent, for the heart may not have sufficient reserve power to overcome the increased arterial tension. In such a case the pulse assumes the characters of "virtual tension" (*see PULSE*), and the feeble heart dilates to a dangerous extent. Finally the albumen may never entirely disappear from the urine, the dropsy of the integuments and internal parts may remain in diminished amount, the pulse may retain its character of high tension, and gradually the case assumes the appearance of one or other of the forms of chronic Bright's disease.

Diagnosis.—The recognition of the disease is nearly always easy; it may, however, be difficult to determine whether an acute attack is merely a complication of the chronic disease, as is very often the case, or whether it has been primary in its onset. The absence of similar symptoms at any preceding time, of any hypertrophy of the heart at an early stage of the affection, of fatty elements in the urinary deposit, and of the white patches in the retina, generally called albuminuric retinitis, are all in favor of the disease being primarily acute. If, in addition to the

above negative signs, the affection occur in a young person, or after a drinking bout, or as a sequel to one of the specific fevers, the probability that the attack is primary is much increased.

Morbid anatomy and pathology.—The organic lesion in this disorder is always an acute inflammation of the kidneys. The kidneys are enlarged, and, on section, the cortex is seen to be disproportionately increased in extent. The medullary portion is of a bright red color, showing a longitudinal striation of deep red lines, some of which are prolonged into the cortex from the bases of the pyramids. The cortex is either red or yellowish-white in color, or shows a mottling of the two colors. On the cut surface of the red kidney the Malpighian bodies are seen as red spots, and spots of hemorrhage are here and there apparent, while a bloody fluid exudes abundantly. In the pale kidney the glomeruli are not so easily seen, and may be entirely invisible to the naked eye. In the cases to be described below of glomerulo-nephritis, the glomeruli often appear as white glistening points on the generally pale surface. In all cases the capsule of the kidney peels off easily, and leaves on removal a smooth surface on which the congested stellate veins are more than usually prominent.

On *microscopic examination* the changes are chiefly found in the cortical portion of the kidney, and especially in the convoluted tubes, although all parts of the organ are more or less affected. The convoluted tubes are greatly increased in diameter, their cells are swollen, and so amalgamated as to present an almost continuous mass of protoplasm, not easily separated into its cellular elements even at the free margin. The bodies of the cells are no longer striated, but are very granular, and contain large hyaline globules, and sometimes droplets of fat.

The color of the kidney depends upon the relative preponderance of the congestion or of the epithelial change, the enlarged blood vessels giving the red color, which is afterward hidden by the proliferated and swollen epithelial cells. Between the tubules, and especially around the glomeruli, numbers of leucocytes may be seen, but this interstitial infiltration is rarely a marked feature of the disorder. The glomeruli show ex-

treme congestion, and there is often a hemorrhagic exudation into the interior of Bowman's capsule, while the small afferent and efferent arteries are occasionally seen to have undergone hyaline degeneration.

In certain cases the glomeruli are the seat of more pronounced changes, to which condition the term "*glomerulonephritis*" has been given. The changes observed are various, and may briefly be described as follows: There may be proliferation of the cells lining Bowman's capsule (capsular epithelium), or of the cells covering the glomerular tuft (glomerular epithelium), or of the few connective tissue cells which bind the glomerular loops together. Also there have been observed proliferation of the nuclei of the small capillary vessels of the tuft, and thrombosis of these vessels; while, again, leucocytes, which had clearly exuded from the vessels, have been found between the loops and in the cavity of the capsule. The result of these changes is that the circulation of blood through the glomerulus is greatly interfered with, and consequently its functional activity hindered. Probably the glomerular inflammation is never found without changes in the renal tubes.

Ætiology.—Acute Bright's disease is most frequently caused by exposure to cold. It is a common complication of some of the specific fevers, especially scarlet fever, and more rarely of measles, erysipelas, and smallpox. It may also be produced by an overdose of turpentine or cantharides. An alcoholic debauch is not infrequently followed by an attack of acute nephritis. The existence of chronic Bright's disease, or of puerperal albuminuria, or of so-called functional albuminuria, acts as a predisposing cause for an attack of the acute disorder. In such conditions any of the causes above named, but especially exposure to cold, is the more liable to produce an attack of acute nephritis.

Prognosis.—The prognosis is not so favorable in the young as in those advanced in life. The symptoms of evil augury have been mostly detailed above in describing the complications. The presence of any of these greatly increases the danger of the patient. The condition of the circulatory system is of great importance. The presence of a considerable degree of dilatation of the heart,

indicating failure of the heart-muscle to overcome the increased arterial tension, is a most serious condition. On the other hand, an even more unfavorable sign is the entire absence of an increased tension in the pulse throughout the attack, a condition which sometimes occurs in weakly subjects. The persistence of albuminuria or of anasarca when the other acute symptoms have disappeared, is indicative of a probable lapse into the chronic condition. Nevertheless, a patient may entirely recover after a long convalescence, and when repeated recrudescences of the disease have occurred.

Treatment.—Dr. Mahomed showed that an attack of acute nephritis during the course of recovery from scarlet fever may be averted by proper treatment. High arterial tension and the presence of a small amount of blood-coloring matter in the urine precede the appearance of albumen, and are in turn caused by constipation. A free purgation will remove both these conditions and prevent the onset of renal changes.

At the commencement of an attack of acute Bright's disease the patient should be placed in bed and wrapped in blankets. A hot poultice should be applied to the loins, and renewed as often as it becomes cooled. Dry cupping to the loins is also of value, but it is not advisable to apply the scarificator unless the patient be of a robust frame. The food must be entirely fluid, and contain as little nitrogenous matter as possible. Milk, beef-tea, chicken-broth, barley-water, arrowroot, and such-like articles, should form the staple of the dietary. Diluents, such as lemonade, should be given freely, and distilled water (best in the effervescent form, as Salutaris water) should be taken in large quantities in order to wash out the accumulated epithelial *débris* from the kidneys.

As internal remedies the citrate and acetate of potassium in dilute solution and the liquor ammonii acetatis, with a little tinct. hyoscyam., are of great use in allaying the febrile symptoms and promoting the action of the skin. For the same purpose the tartrate of antimony may be given in the form of the wine or the powder, but the alkaline remedies are preferable in all but very robust patients. A hot-air or vapor bath, or the "blanket bath," should be employed every evening. The bowels must be kept freely open by

a purge every day or other day. For this purpose the saline purges and the compound jalap powder are the most advisable.

It is considered dangerous to use mercurial purges on account of the ease with which such patients are salivated. Nevertheless, no drug is so efficacious as calomel in reducing high arterial tension, and the writer does not fear to use it even in acute Bright's disease when the pulse indicates the existence of an excessively high tension. At the commencement of the case 2 grains of calomel with 2 grains of extract of colocynth may be prescribed, followed in a few hours by a saline purge. The further purgation should then be kept up by other remedies, using the calomel again only when the arterial tension becomes excessively high.

Vomiting is best relieved by the sucking of ice, by effervescent drinks, or, if severe, by creosote or carbolic acid internally. Blood-letting is of value when uræmic symptoms present themselves (*see URÆMIA*).

As the more acute symptoms subside, iron preparations should be cautiously given. The tinct. ferri acetatis combined with pot. acetatis is a preparation easily borne, and the alkalies can be stopped as the renewal secretion becomes again established and no ill effects are observed from the use of the iron. Dropsy may be combated by (in addition to the remedies already mentioned) digitalis and scopolium. Secondary inflammation of the lungs or of the serous membranes should be treated by mustard poultices and other hot applications, but turpentine and cantharides are to be avoided on account of their irritant action on the kidneys when absorbed. Cardiac dilatation calls for cardiac tonics, such as digitalis, strophanthus, and strychnine; and the dangerous condition mentioned above, where the pulse tension is throughout low, is best combated by the free use of dilute nitro-hydrochloric acid and strychnine and the early administration of iron.

Chronic Bright's Disease.—Under this heading are commonly grouped three chronic diseases of the kidneys—chronic parenchymatous nephritis, granular contraction of the kidneys, and albuminoid degeneration of the kidneys.

Chronic parenchymatous nephritis is also known as chronic tubal and chronic desquamative nephritis, and the kidney

resulting from the disease is often called the large white kidney.

Granular contraction of the kidneys is also known as chronic interstitial nephritis and its result spoken of variously as the small red granular kidney, the red contracted kidney, and sometimes as the gouty kidney or the arterio-sclerotic kidney.

Albuminoid degeneration of the kidneys is also known as the amyloid, waxy, or lardaceous kidney.

Although the division of chronic Bright's disease into three varieties is convenient for purposes of description, yet it must be mentioned that rarely is a case met with in which the changes peculiar to one variety are present alone. Mixed forms are common, and even the rule. In the large white kidney the interstitial tissue is very frequently thickened, in the small red kidney the cells are often in a state resembling that found in parenchymatous nephritis, whilst in amyloid degeneration the kidney is often puckered by the excess of contracting fibrous tissue.

The symptoms and diagnosis of the various forms will be described together, and the morbid anatomy and pathology of each variety will then be treated separately.

Symptoms.—Chronic Bright's disease is sometimes the consequence of an attack of acute nephritis, and the mode of progression from the acute to the chronic condition has already been described. In the majority of cases, however, the onset of the disease is gradual and insidious, and it is not detected until it has been in existence for some time. Sometimes attention is called to the state of the patient by the supervention of symptoms of acute Bright's disease, when it is discovered that the chronic disorder has been previously in existence. Often a little puffiness of the eyelids or of the ankles, breathlessness, dull throbbing, and persistent headache, disorders of vision, or hebetude and disinclination for customary mental exercises are the first symptoms which cause a suspicion in the mind of the physician that the kidneys are at fault.

The symptoms vary greatly in their grouping and individual intensity according to the form of the disease from which the patient suffers. They may thus be summarized in a general form: Albu-

minous urine, depositing tube-casts and renal *débris*; a pulse of high arterial tension, and hypertrophy of the heart most marked in the left ventricle; frequent micturition, especially at night; dropsy in various parts of the body; progressive anæmia; dryness of skin; derangements of digestion, and a tendency to the occurrence of uræmic phenomena and of secondary inflammations of the lungs and serous membranes. Some of these symptoms require more detailed description.

Urine.--With the large white kidney, when uncomplicated, the urine is always scanty; with the small red granular kidney it is abundant, except in the later stages, when it becomes diminished in quantity; with the amyloid kidney also it is abundant, and this is often the first sign of the supervention of the kidney mischief upon the chronic wasting or suppurative disease which gives rise to it. Partial suppression of urine for a short time is in any of these forms followed by a discharge more copious even than was the previous habit.

The specific gravity of the urine varies inversely as its quantity. It is therefore low in urine from the granular and amyloid kidneys, high in that from the large white kidney. Nevertheless, it may happen that a urine of low specific gravity is small in quantity; this is, naturally, a condition of ill omen. The color of the urine is generally somewhat lighter than normal. It may be quite clear, or may deposit on standing a cloud composed of crystals, casts, and renal *débris*. Occasionally it may contain blood, usually only in very small quantity.

The urine always contains albumen at some period of the disease. In the large white and amyloid kidneys the amount of albumen passed is very large. The urine from the granular kidney, until the very late stages, rarely contains a large quantity of albumen. It may, indeed, for long periods not contain albumen in quantity sufficient to be detected by the ordinary methods. It is to be noted that the albuminuria is influenced by the normal physiological processes, is more pronounced after meals and after exercise, and, moreover, is prone to be more marked in the forenoon than at other times. In doubtful cases, therefore, it is desirable to examine the urine passed shortly after breakfast and exercise, and

not to pronounce upon the absence of albumen until several consecutive specimens have been tested.

In the granular kidney a temporary failure of the heart power, which is not an unusual phenomenon, will cause a considerable increase of the albuminuria, lasting only until the heart again recovers strength. In the latter stages the albumen is, even in the case of the granular kidney, abundant, from a combination of weak circulatory power and degenerative changes in the epithelial structures of the kidney.

The reaction of the urine is generally acid, but it may vary. In the deposit from the urine are found casts of the renal tubes, renal epithelium, granular and fatty matter, and occasionally crystals of uric acid and oxalate of lime. The tube casts are most plentiful in the large white kidney, but are never so numerous as in the acute forms of nephritis. Epithelial and blood casts are rarely met with in chronic Bright's disease. The prevailing casts are the granular, fatty, and hyaline, the last form being often the only one met with in the urine from the albuminoid kidney. The renal epithelium found in the urine may show extreme degenerative changes.

The excretion of the solids of the urine is diminished. The urea, it is to be specially noted, is excreted in greatly diminished quantity.

Intercurrent pyrexia impresses its own peculiar characters upon the urine. Whatever may have been its previous condition, during the pyrexia the urine becomes scanty, of high color, and more albuminous; it deposits urates on standing, and the excretion of urea is increased.

Circulatory system.--The characteristic pulse of chronic Bright's disease is one of high arterial tension (*see* PULSE). The tension is highest in cases of the granular kidney, is well marked in cases of large white kidney, but when there is pure albuminoid degeneration of the kidney the arterial tension is low. The latter condition is, however, rarely met with. The albuminoid kidney is most frequently combined with the granular degeneration, and this combination affects the character of the pulse, which is rendered of higher tension than it would otherwise be. In the course of chronic Bright's disease the heart is prone to become weak, sometimes for a short period

only, sometimes as the precursor of the end. Under such conditions the pulse becomes one of "virtual tension," indicating peripheral resistance in the circulation, not overcome by the cardiac systole.

In chronic Bright's disease *the heart* is enlarged proportionately to the increase of the arterial tension. Thus the enlargement is greatest, and present with the greatest frequency, in the granular kidney; is least, and is often absent, in the albuminoid kidney. Primarily, at least, this enlargement takes the form of hypertrophy, affecting more especially the left ventricle. The special signs in this condition are, displacement of the cardiac apex downward and to the left, extension of the deep cardiac dullness in the same direction, a heaving impulse, and a loud, prolonged, and booming first sound. At the same time the coincident high arterial tension causes a reduplication of the first sound at the apex, and an accentuation of the second sound at the aortic cartilage. In the later stages, and more frequently in association with the large white kidney than with other forms, the hypertrophy of the heart becomes combined with dilatation of its cavities, the heart muscle becoming weakened, and giving way before the peripheric resistance. The apex impulse is then found to be more diffused and less forcible, the first sound short and sharp, and not infrequently accompanied or followed by a blowing systolic murmur. The existence of chronic Bright's disease furthers the production of atheroma in the arteries and of analogous changes in the valves of the heart. This may give rise to valvular incompetence varying in its symptoms and signs with the valve affected. There is another association of kidney mischief with heart disease, which must not be overlooked, although it does not properly belong to this section—viz., the hardening of the kidney from chronic congestion, secondary to a lesion of the heart. The signs of the kidney mischief in such a case are generally but slight, and occur some time after the cardiac phenomena have been evident.

In the course of chronic Bright's disease the *blood* undergoes progressive changes. The clinical evidences of these are anæmia of the skin and mucous membranes, dropsical effusions in different parts, and various symptoms which may

arise from the action of the impure blood on the nervous system. The actual changes in the blood consist of a diminution in number of the red corpuscles, and an increase of the water, together with a decrease of the amount of albumen, and the accumulation in the blood of urea, uric acid, and extractive matters.

The exact *relation between hypertrophy of the heart and kidney disease* has been greatly discussed, and diverse views are still held. They can only be briefly summarized here. Bright believed that the blood, altered in quality by reason of the disease of the kidneys, acted as an irritant to the muscular tissue of the heart, stimulating it to increased work and consequent hypertrophy. But he also suggested that the impure blood did not circulate easily through the capillaries, and that the resistance to its passage called forth the exercise of greater force on the part of the heart, requiring in turn an increase in the amount of muscular fiber. The view that a resistance to the circulation is situated in the capillaries, and that this causes increased arterial tension and so gives rise to hypertrophy of the heart, has been advanced in recent years. This explanation is most in accordance with the clinical and pathological facts. It has been mentioned above that the blood-flow through the granular kidney is obstructed. The obstruction causes a diminished quantity of blood to flow through the kidneys in a given time, and consequently the remainder of the arterial system is distended. Moreover, a less quantity of fluid is withdrawn from the blood in the form of the watery constituents of the urine. Both these factors combine to increase the general arterial tension, and so cause hypertrophy of the heart. Dr. Johnson showed that the muscular coat of the arteries throughout the body was hypertrophied. This, he believes, is due to a resistance offered by them to the passage of impure blood to the tissues—a "stop-cock action." The resistance increases the arterial tension, which in turn calls forth the cardiac hypertrophy. Sir Wm. Gull described a further change widely spread throughout the arterial system. This is a deposit of a "hyalin-fibroid" material in the adventitia of the vessels which he believes to be a primary lesion. It may begin in the kidneys, when it produces the lesions of the so-called "granu-

lar kidney," but it may also commence in other parts. The presence of the hyalin-fibroid material in the vessel hinders the flow of blood, increases the arterial tension, and so causes the hypertrophy of the heart.

Cutaneous system.—The skin is dry and harsh, and rarely perspires. It is pale in cases of the large white and amyloid kidneys, sallow in those of the granular kidney. Dropsy of the integuments is very variable in its appearance. In the granular kidney it is the least marked, and may be entirely absent from first to last. In the large white kidney it is most constant, and is often extreme in amount. It is variable also in its duration and seat. It may be widely diffused over the whole body, or limited to the eyelids, the front of the tibiæ, and the ankles, or to the genitals. A most characteristic localization of renal dropsy is in the loose tissues immediately below the eyelids, and yet œdema is just as commonly found near the ankles, or on the dorsum of the foot, the seats of election for early cardiac dropsy. Many such cases are really of cardiac origin, and due to the failure of nutrition of the heart fibers.

Eruptions may be met with on the skin. The chief of these are eczematous and erysipelatous inflammations, purpuric spots, and pemphigus.

The *digestive organs* are prone to be disordered. The appetite is poor, and various dyspeptic troubles are complained of. The bowels are, as a rule, constipated, the liver may be somewhat enlarged, and, when dropsy is well marked in other parts of the body, ascites is also present.

Cough and bronchitis are of common occurrence.

The *retina* shows a variety of changes. The most marked lesions are flame-shaped hemorrhages, and white glistening spots, most numerous near the macula lutea, frequently arranged in lines like the radiations from a star. The latter constitute a most characteristic appearance, from which alone the nature of the disease may be diagnosed. The following changes are also met with: optic papillitis, general diffused retinitis, œdema of the retina, and atrophic spots, the remains of old hemorrhages.

The *nervous symptoms* of Bright's disease are mostly of uræmic nature. It may be mentioned here that, of late, at-

tention has been called to numbness and pallor of the fingers (*doigt mort*), as an early sign of Bright's disease. The writer doubts if this sign is of any value. Pains of different kinds are frequently complained of. Pain in the lumbar region is clearly associated with the more deeply situated disease of the kidneys, and tenderness on pressure in the same part is often observed. But neuralgic pains also, affecting the region of distribution of the sciatic nerve as well as other parts, are sometimes obstinately persistent.

Complications.—Inflammations of the serous membranes—pleurisy, pericarditis, peritonitis—and pneumonia are among the most formidable of the complications of chronic Bright's disease. The arteries, strained by the high tension, not infrequently rupture and give rise to hemorrhages. The bleeding may take place from the nose, or from the lungs, causing hemoptysis, or even from the kidneys themselves, the blood appearing in the urine. In these situations the bleeding is rarely dangerous, albeit, occasionally, the pulmonary hemorrhage may be so profuse as to disable the lungs, and a patient may in rare instances die from excessive hematuria. But the most dangerous hemorrhages are those from the cerebral arteries. Indeed, granular kidney, with its associated cardio-vascular changes, is the most frequent cause of cerebral hemorrhage.

Cardiac failure with dilatation is one of the most common complications of Bright's disease. It is accompanied by a diminution in the quantity of urine and an increase in the amount of its contained albumen. The œdema of the tissues increases, or, if not previously present, now appears. In addition, œdema of the lungs, as shown by the presence of crepitation at the pulmonary bases, and dropsy of the pleural sacs, result from the cardiac weakness, and their occurrence interferes greatly with the respiratory functions.

œdema of the larynx in some cases causes dangerous and even fatal asphyxia. Severe vomiting and diarrhea occur occasionally, not rarely as the result of the impurity of the blood, but they may also arise from ulcerative lesions of the gastrointestinal tract.

The deficient action of the kidneys causes an accumulation in the blood of

excrementitious matters ordinarily eliminated. This condition is known as *uræmia* (*see* URÆMIA), and is the cause of a great number of symptoms. For convenience they will be here enumerated. In the nervous system we notice headache, muscular twitchings and convulsions, coma, and sometimes a hemiplegia independent of a gross cerebral lesion. Sudden blindness or deafness may come on, and mental derangements may occur, generally assuming the form of melancholia, but sometimes of mania. Vomiting, nausea, and diarrhea of an uncontrollable character are not unusual. Paroxysms of dyspnœa simulating asthma are among the rarer phenomena, but the breathing in uræmic attacks is very prone to assume the Cheyne-Stokes' character.

Diagnosis.—The question of the diagnosis of chronic Bright's disease arises chiefly under the following circumstances:

(1) When albuminuria occurs persistently without any other serious derangement of health. For the points to be relied upon in determining whether in such a case organic disease of the kidneys is present, *see* ALBUMINURIA.

(2) When cardiac disease and albuminuria coexist. The albuminuria may in this instance be due to venous engorgement of the kidneys, secondary to the cardiac trouble, or it may be the result of chronic Bright's disease, to which the heart's affection is secondary. Venous congestion of the kidneys, however, may generally be detected by observing that the urine is scanty, of high specific gravity, and yet contains, as a rule, only a small quantity of albumen, deposits urates, but very few casts, on standing, and contains very frequently a quantity of bile pigment. Moreover, there may be a history of valvular disease of the heart or of some affection likely to have produced it—*e. g.*, an attack of acute rheumatism—and it may appear that the symptoms of cardiac distress, with cyanosis and enlargement of the liver, were present prior to the occurrence of the albuminuria.

(3) When headache, digestive disturbance, or puffiness of the features, or a copious discharge of urine, create a suspicion of chronic Bright's disease, and yet the urine contains no albumen, either the granular or the amyloid kid-

ney may be present. The urine of the granular kidney is frequently, and often for considerable periods at a time, free from albumen, but it is persistently of low specific gravity, while the pulse is of high arterial tension, the heart is hypertrophied, and urinary tube casts are occasionally detected, although they may easily be overlooked. Further, the excretion of urea is deficient. If, however, the retinal changes be found, the diagnosis is rendered certain.

Although the urine of the albuminoid kidney ordinarily contains a large amount of albumen, cases at times occur in which it is entirely absent. Indeed, the passage of a large quantity of limpid urine of low specific gravity is an earlier sign than albuminuria of amyloid degeneration in the kidneys. Such a symptom occurring after long-continued suppuration, or in the presence of a wasting disease or a cachectic state, should excite suspicion that this change is in progress. If the liver and spleen be coincidentally enlarged, no difficulty would be experienced in coming to a correct diagnosis.

(4) When an outbreak of apparently uræmic symptoms occurs (*see* URÆMIA).

(5) When the signs of acute Bright's disease are present, or when an attack of pneumonia, pleurisy, etc., is accompanied by albuminuria, and it is desired to ascertain whether chronic Bright's disease preceded.

Here the condition of the heart is all important. Cardiac hypertrophy or considerable dilatation, in the absence of valvular disease, would indicate that high arterial tension had preceded the acute attack. The white spots of retinal degeneration would be positive evidence of chronic Bright's disease. Great anæmia in a middle-aged person, and the occurrence of pneumonia or pleurisy on both sides of the body, are also probable indications that the affection is only a complication of chronic kidney mischief.

The diagnosis of the several varieties of chronic Bright's disease from one another is to be found above in the discussion of the symptoms. They may be, however, summarized here.

(a) In the granular kidney the urine is copious, of low specific gravity, and contains but little albumen. The pulse is of very high tension, and the heart is greatly hypertrophied. There is little dropsy. In the retina there are hemorrhages and

degenerative patches, and there is a tendency to hemorrhage from various organs. The skin is sallow, and there is some anæmia, but it is not extreme in degree.

(b) In the large white kidney the urine is scanty, of high specific gravity, and contains a large amount of albumen. The pulse is of high tension, and there is hypertrophy of the heart, which very often subsequently undergoes dilatation. There is much dropsy. In the retina there are hemorrhages, but rarely degenerated patches. There is less tendency to hemorrhage from other organs, but more to internal inflammation than in the granular kidney. The skin is pale, and there is great anæmia.

(c) In the albuminoid kidney the urine is copious, of low specific gravity, and contains a variable amount of albumen, rarely none, usually a considerable quantity. The pulse is of low tension, there is no tendency to cardiac enlargement. There may or may not be dropsy. There are no retinal changes, and there is no tendency to hemorrhage, or to internal inflammation. The skin is pale, there is great anæmia, and one of the causes of albuminoid disease enumerated below is to be found.

It must again be mentioned, however, that mixed forms, and therefore mixed symptoms, are the rule.

Morbid anatomy and pathology of chronic parenchymatous nephritis.

Morbid anatomy.—The kidney is large and pale, or its surface may show a mottling of red and yellow patches. The *venæ stellatæ* of the surface vary as regards their prominence. On section the cortical portion is increased in extent and is very pale in color, the medullary portion may appear to be normal or is congested and streaked with deep red lines. The capsule peels off easily, and leaves a smooth or very slightly granular surface, upon which, as a rule, no cysts are seen.

On microscopic examination the changes which are observed are most marked in the convoluted tubes. The tubules are enlarged and distended with the proliferated and swollen epithelial cells. The lumen of the tubule is sometimes almost invisible, so great is the mass of protoplasm bounding it; or, again, it may be blocked by a fibrinous cast. The protoplasm of the cells is very

opaque and granular, and often studded with fat globules, while the outlines of the individual cells cannot be easily distinguished. The nuclei of the cells are often invisible on account of the swelling of the protoplasm. On the other hand, the nuclei are sometimes very evident and much increased in number. The hyaline globules described in acute nephritis are also found in the protoplasm of the cells in chronic nephritis. The basement-membrane of the tubules is thickened.

The glomeruli often show changes consisting of one or other of the conditions described under the head of glomerulonephritis, but proliferation of the capsular epithelium and thickening of the capsule itself by successive concentric layers of fibrous tissue are the changes most commonly met with.

The interstitial tissue is rarely normal. It is usually somewhat thickened, especially between the convoluted tubes, and is sometimes infiltrated with leucocytes. The vessels are at times engorged, and not unfrequently hemorrhages are seen in and between the tubules.

Such is the typical condition of the large white kidney. But it is prone to undergo other degenerative changes. The protoplasm of the cells in the tubules becomes still more granular or fatty, and occasionally pigmented, and finally breaks down into an amorphous *débris*, which is carried away in the urine. The tubules then collapse, and, as the tubules affected are almost entirely those of the cortical portion of the kidney, the thickness of the cortex becomes greatly diminished. At the same time the interstitial tissue becomes increased in amount, especially between the tubules, but also round the blood vessels, and the glomeruli become diminished in size.

These appearances characterize what is known as the *small white kidney*. It is a late condition, but not a necessary sequence, of the large white kidney, and transition stages between the two are occasionally met with.

Pathology.—The large white kidney is most frequently the result of an attack of acute nephritis which has lapsed into the chronic condition. It may arise also as a consequence of pregnancy (*see* PUERPERAL ALBUMINURIA), and is common amongst beer-drinkers. The average age

of its victims has been found to be 28.2 years.

Morbid anatomy and pathology of granular contraction of the kidneys.—

The kidney is almost always much diminished in size and weight. Nevertheless, cases are occasionally met with in which the normal size of the organs is retained or even exceeded. The capsule is greatly thickened, and adherent to the underlying gland tissue. It is sometimes impossible to remove it without tearing away the kidney substance. In other cases, again, the capsule peels off with some little difficulty, and leaves, on removal, a surface the appearance of which gives its name to this form of Bright's disease. The surface is of a general reddish color, on which are seen numerous small yellowish elevations or granules of a rounded outline. Frequently, and, indeed, in most cases, numbers of cysts appear between the granulations, varying in size from that of a pin's head to that of a walnut; some are filled with limpid, others with turbid fluid; and others, again, contain a dark glutinous substance.

The kidney is firm on section, and its cut surface reveals considerable atrophy of the cortical portion of the organ, and more cysts are seen in the renal substance.

When a section of the kidney is examined *microscopically*, the interstitial tissue is found to have undergone very great increase in amount, mostly round the blood vessels and glomeruli, but also in all other parts. In most cases the fibrous tissue is fully formed, yet occasionally its cellular elements are found in excess.

The tubules of the kidney are greatly reduced in caliber; their cellular elements are more or less atrophied, sometimes being entirely absent, at other times fatty and granular. The irregular bulky epithelium of the convoluted tubes is often represented by a layer of cubical cells much smaller than those from which they originated.

The glomeruli suffer equally with the tubules. They are much smaller than normal by reason of the pressure exerted upon them by the growth of fibrous tissue around, and, to a less extent, on account of the atrophy of the glomerular tuft itself from increase of the interstitial tissue between its capillaries. Often the whole glomerulus is transformed into a

fibrous, hyaline, or colloid mass of absolutely no functional utility.

The arteries show a considerable thickening of their walls which may affect all three coats. The adventitia is thickened by a great increase of its fibrous tissue, the middle coat shows a much greater amount of muscular fiber than is normal, and the intima, between the elastic layer and the internal endothelium, is occupied by a fibrous or amorphous material which projects into and occasionally blocks the lumen of the vessel.

In the granular kidney of gouty origin streaks of a yellowish white color are often seen in the pyramidal portion of the gland, and these, on microscopic examination, are found to be either amorphous, consisting of urate of soda, or they may exceptionally be crystalline, and composed of uric acid.

Pathology.—It has been thought that an inflammation starts in the epithelial elements, and that from the atrophy of these the tubes containing them collapse, the fibrous tissue being the altered remains of the collapsed tubes. Again, the process has been looked upon as from the first interstitial and yet inflammatory—a chronic interstitial nephritis. Finally, the fibrous tissue has been thought to be the result of a degenerative overgrowth, believed by some to be confined to the kidney, by others to be part of a widely spread fibrous overgrowth in all parts of the body, but specially connected with the arteries.

The granular contracted kidney may result from an attack of acute nephritis, but not so frequently as does the last form described. It is specially related to the gouty and syphilitic diatheses. Chronic lead poisoning is a frequent cause, and experimentally the disease has been produced by dosing animals for a considerable time with lead or cantharides. Alcoholic excess, and especially spirit drinking, is believed by most observers to be productive of this form of kidney disease.

The average age of patients suffering from the affection is 50.2 years. It is more common in the male sex, and a hereditary transmission has been occasionally noted. Like the large white kidney, it is sometimes the final stage of the renal disease of pregnancy.

Morbid anatomy and pathology of albuminoid degeneration of the kid-

neys.—The kidney in its typical form is enlarged, and much paler than normal, though mottled on its surface by the red *venæ stellatæ*. It cuts firmly, and the pale, bloodless section shows an increase of the cortex in depth, and has a peculiar, glistening, bacon-like appearance. The glomeruli stand out upon the cut surface as bright, pale points. The medullary portion appears by contrast to be of a brighter red than is usual. The capsule peels off easily, and leaves on removal a smooth surface. The change becomes more evident, and can easily be seen when only slight in amount, if coloring agents are used for which the albuminoid parts have a special affinity. For naked-eye purposes a cut surface of the kidney may be treated with liquor iodi, which tinges the affected parts of a mahogany-brown color, the remainder of the kidney taking a yellow tinge. For microscopic examination a solution of methyl-violet is preferable. This colors the albuminoid parts a reddish purple, the others blue. By these reagents the smallest amount of the change can be easily detected.

Such is the typical condition of the albuminoid kidney, but very frequently it is combined with an overgrowth of interstitial fibrous tissue, which causes its surface to be rough and coarsely granular, resembling that of the red contracted kidney, while its volume, too, may then be diminished instead of increased.

Pathology.—This change in the kidneys, as in other parts, is caused by prolonged suppuration, by disease of bones and joints, by tuberculosis, and by the syphilitic, mercurial, or malarial cachexiæ. It is associated sometimes with lead poisoning, gout, rickets, leucocythæmia, Hodgkin's disease, and slowly growing tumors.

Prognosis of chronic Bright's disease.—It has been recorded that albuminoid disease of the kidney, if only slight in degree, has been recovered from when the original suppurative affection has been removed. With this exception, cases of chronic Bright's disease must be looked upon as incurable, and as tending to a fatal issue. Yet the duration of the disease is subject to wide variations, and may be surprisingly prolonged when proper care and treatment are adopted. Comparing the several varieties of the disorder, we find that the

large white and the albuminoid kidneys kill their subjects in a much shorter time than does the small red kidney. The ultimate cause of death to which the kidney changes tend is uræmia, from deficient elimination of excrementitious matter. This perhaps most frequently results with the large white kidney, but in all varieties the complications which may occur are so numerous that the patient usually dies of one of them before a fatal uræmic state can appear, although minor degrees of uræmia are common. Among the signs which render the prognosis very unfavorable are : (1) A diminution in the amount of urine, which previously was copious, while at the same time its specific gravity is not higher than before ; (2) a very low daily excretion of urea ; (3) the occurrence of severe uræmic symptoms, or (4) of pneumonia, pleurisy, or pericarditis. Excessive dropsy, cardiac failure, and œdema of the lungs are dangerous symptoms ; nevertheless, they are more amenable to treatment than those just mentioned. The white degenerative patches in the retina may appear when the patient is apparently in otherwise good health, yet they always indicate a severe degree of kidney affection, and the disease rarely lasts more than two years after their occurrence, unless it be the result of pregnancy. The longer the duration of the disease, the shorter, naturally, must be the expectation of life.

Treatment of chronic Bright's disease.—The aims of treatment must be (1) to relieve the kidneys of any undue irritation, and to assist them in their eliminatory functions by promoting the action of other organs ; (2) to enable the circulatory system to adapt itself to the altered conditions of peripheral resistance ; and (3) to combat the distress and danger to which the patient is subjected by the occurrence of complications.

The skin must be maintained in a state of activity as nearly healthy as possible. Flannel must be worn, and warm baths and friction occasionally employed to stimulate the cutaneous circulation. The Turkish bath is sometimes of value, but it should only be used when the heart is powerful, and always with caution. Moderate exercise is to be taken, and the bowels should be induced to act at least once in the day—if necessary, a morning dose of purgative water being used for this end. The diet should be light, and

contain but little nitrogenous matter. Milk and milk puddings are well borne as a rule. When the arterial tension is high, as is usually the case in granular kidney, it is best to order fish or meat only once in the day, the other meals being of lighter character. In other cases, however, and especially in those of albuminoid kidney, nutrition must be maintained by a more liberal dietary. A moderate amount of light wine, or a glass of bitter ale daily, may be permitted when the patient has been accustomed to a stimulant. Spirits and the stronger wines are generally harmful. All conditions which give rise to irritation of the kidneys, such as exposure to lead poisoning, alcoholic excess, and the gouty state, should be removed by suitable means. Any source of prolonged and exhausting suppuration should be treated by the surgeon so as to prevent any increase of albuminoid change where such exists.

All forms of Bright's disease tend to the production of anæmia, and therefore it is desirable in nearly all cases to administer iron in some form. The citrate of ammonia and iron may be given in 10 to 15-grain doses thrice daily, or the tincture of the perchloride in 15-minim doses. Rarely will any difficulty be experienced in the assimilation of the drug if care be taken to keep the digestive organs in healthy activity. Thus, the use of iron must be suspended if the tongue be dry and coated, and the gastric condition must then be remedied by suitable treatment. The bowels, too, must not be allowed to become constipated, and therefore the astringent perchloride of iron is well combined with 20-grain doses of sulphate of magnesium. When the heart is greatly hypertrophied and the arteries are tense, it is dangerous to give iron, unless, at the same time, the circulatory condition be treated in the way to be presently described.

In cases of granular kidney the loss of albumen by the urine is generally very slight, and needs no special attention. In other forms of the disease, however, the loss is so great as to invite the physician to inquire whether measures might not be taken to control it. So far, however, no reliable remedies with such an action have been discovered.

From the account which has been given of the circulatory changes in Bright's disease it is evident that a cer-

tain degree of increased arterial tension is unavoidable, and it must be the object of the physician to prevent the tension increasing beyond a limit which may be considered normal for the disease, and at the same time to insure that the heart shall put forth such an extra amount of force as shall suffice to overcome the peripheral resistance. Too great tension is to be avoided, because of the increased strain upon the heart and the risk of rupture of an artery in a dangerous situation; too great depression of the circulation causes danger from the liability to œdema of the lungs, dropsy of the serous sacs, and deficient excretion of urine from defective circulation through the kidney. It is a mean between these two conditions which it is desirable to maintain in Bright's disease. When the pulse is of only slightly increased tension, the heart is beating regularly, the heart sounds are normal, and the assimilative functions are in good order, it is unwise to interfere with the existing condition. All that is necessary is for the patient to follow general hygienic rules.

It is rare, however, for this condition to be spontaneously maintained for a lengthened period. The patient may perhaps present himself with signs of cardiac dilatation, slight anasarca, and œdema of the lungs, a pulse of "virtual tension," and a deficient excretion of urine. In such a condition treatment must mainly be directed to sustaining the heart. Acid nitric. dil. or acid nitro-mur. dil. m. x-xv, with liq. strychniæ m. v and tinct. digitalis m. v-x, should be given three times a day, or even every four hours. Tincture of strophanthus and citrate of caffeine may sometimes be substituted for the digitalis with advantage. A small dose of pil. hydrarg. is occasionally advisable to relieve the peripheral tension before which the heart is failing, but in severe cardiac failure it is best omitted. Or, again, the patient may complain of throbbing headache, drowsiness, and yet insomnia; the pulse is of high tension, the heart beats forcibly, and on stethoscopic examination, the first sound of the heart is found to be prolonged or reduplicated, and the second sound greatly accentuated at the aorta cartilage. In this condition 5 grains of calomel should be prescribed, followed in a few hours by a saline purgative draught. Another, but smaller, dose of calomel should be

given after an interval of two or three days if the symptoms have not entirely subsided, and in the meanwhile saline remedies, such as the tartrate of soda and potash in 1-dram doses, together with the citrate of potash in 20-grain doses, may be given three times a day. Given in this way it is very rare for symptoms of salivation to follow the use of calomel.

By these two methods of treatment it is possible to control to a great extent the variations of the circulatory system beyond that condition which may be considered normal for the disease.

When excessive dropsy exists, the abnormal amount of fluid may be removed in various ways. If anasarca of the legs be specially prominent, it is best treated by the insertion of Southey's drainage-tubes beneath the skin. Large amounts of fluid will drain away in a comparatively short time, and there is but little risk of erysipelas or inflammation of any kind being set up round the puncture. The older treatment by incision or simple puncture of the skin is often followed by severe cellulitis. Southey's tubes also offer a convenient and safe way of removing fluid from the abdominal cavity, though here the use of an ordinary trochar and canula of small size is more advisable. Cathartic purgatives are of great use in removing dropsical effusions. The compound jalap powder in half-dram or larger doses is the most generally efficacious, and may be administered twice or thrice a week. Gamboge, scammony, and colocynth may also be given, but commonly the jalap powder is sufficient to produce the desired effect. If, however, the dropsy should be general, and should threaten the life of the patient by interfering with vital functions, the most powerful drug which can be used is elaterium, in doses of one-fourth of a grain. It is important to watch the patient carefully when such powerful purgatives are being administered, lest the diarrhea induced should become intractable.

If free action of the skin can be procured, material relief is often afforded to dropsical and often to uræmic symptoms. Hot baths are most efficacious in promoting perspiration. They can be applied in the form of a blanket bath, already described, or the ordinary hot-water bath, or the vapor bath. The vapor bath can readily be extemporized without removing

the patient from bed. The patient should be wrapped loosely in blankets, and the bedclothes raised by a bed cradle. The nozzle of a steam kettle is now to be introduced beneath the clothes, due precautions being taken to prevent the skin being scalded by the too direct contact with the steam. The steam is allowed to pass for fifteen or twenty minutes, and at the end of that time the patient is still to remain wrapped in the blankets, and will usually perspire profusely. Other diaphoretics, such as the compound ipecacuanha and compound antimony powders and the liquor ammonii acetatis, are less reliable. The injection of one-third of a grain of pilocarpin subcutaneously causes profuse perspiration, and if the patient be directed to expectorate the saliva, the flow of which is, at the same time, much increased, the tendency to vomit can often be avoided. Nevertheless this drug is is not so serviceable in general dropsical conditions as when used as a rapidly acting remedy in uræmic attacks.

When the urine becomes scanty, diuretics are called for. Of these the most efficacious are the acetate and citrate of potash, nitrous ether, and citrate of caffeine. The scanty secretion of urine can often be best treated by attention to the state of the circulatory system, and the administration of remedies in the manner already directed. Calomel given as directed above often acts as a pronounced diuretic. In Bright's disease even more than in other conditions do diuretics seem to be uncertain in their action.

Dropsy is sometimes persistent in spite of all these remedies, and it is then desirable to administer iron, acids, and general tonics freely. Œdema of the glottis may call for special treatment, either by scarification of the swollen parts or even in extreme cases by tracheotomy.

When inflammations of the internal organs occur as complications, they must be treated on ordinary principles, remembering, however, that lowering remedies are rarely admissible. The subjects of Bright's disease are, as a rule, peculiarly intolerant of opium, and it is recommended by most authorities that this drug, if administered at all, should only be given in minute doses, and its action carefully watched. Some doubt has, however, of late been cast upon this statement, and opium has even been given in uræmic convulsions without obvious bad effects.

Further experience is necessary before such a mode of treatment can be recommended with confidence. Similarly, too, dyspeptic symptoms must be treated as if arising independently of Bright's disease. Arsenic is often of great use in such conditions.

ROBERT MAGUIRE.

Symptomatic Indications.—The leading remedy in the treatment of Bright's disease is *arsenicum*, which acts well in all forms of the disease. The indicating symptoms are debility, ascites, hydrothorax or general anasarca, with albuminuria. When arsenicum is indicated, but has failed to relieve, a cure may sometimes be effected by *aurum mur.*, the indications being similar. *Turpentine* is quite frequently useful, particularly in chronic parenchymatous nephritis, after an acute attack from cold, wet, etc. Congestion of the kidneys; the urine, suppressed or scanty, smoky, thick, fetid, or bloody; œdema all over. Acute attacks from cold are relieved by *aconite*, particularly when marked febrile symptoms are present, with rapid anasarca. *Cantharis* will be found useful when there is much desquamation; threatened uræmia; exceedingly painful micturition, drop by drop; scanty, dark urine, with burning in the bladder and urethra. The urine contains cylindrical casts of fibrinous exudation; epithelial cells and blood. Convulsions and coma. *Apis mel.* is often of service when the disease follows upon scarlatina or diphtheria; sudden swelling of different parts, with stinging pains. *Phosphoric acid* acts well in amyloid degeneration, the urine is like milk, mixed with jelly-like bloody juices, with pain in the kidneys.

BROMIDROSIS.—A condition characterized by the odor of the perspiration.

Symptoms.—This disease may be general or local. The former occurs usually in the course of some constitutional disease, when the smell differs according to the variety. Local bromidrosis is normally present in certain regions of the body, such as the axillæ, perineum and feet, and it can therefore only be considered a disease when the smell is excessive. When the feet are affected the odor is at times so offensive that the person is unable to attend to his duties, though his general health is perfectly good. The perspiration is greatly increased above the normal, and is quickly absorbed by the

socks, from which the smell arises, owing to rapid decomposition.

Treatment.—Local bromidrosis is often very difficult to cure. Thorough cleanliness is essential; the part should be washed at least twice daily with plenty of soap, then dried and powdered with starch or flour. Sea-water baths at night are of value in some cases, and so also is painting the whole part occasionally with iodine. In severe cases, when other measures fail, Hebra recommends the following plan, which he says "will invariably be attended with success":

"A certain quantity of the simple diachylon plaster (emp. plumbi, emp. lithargyri) is to be melted over a gentle fire, and an equal weight of linseed oil is then incorporated with it, the product being stirred till a homogeneous mass is produced, sufficiently adhesive not to crumble readily to pieces. This is then to be spread over a piece of linen measuring about a foot square. The foot of the patient, having been first well washed and thoroughly dried, is now to be wrapped in the dressing thus prepared. Pledgets of lint on which the same ointment has been spread are also to be introduced into the space between each pair of toes to prevent their touching one another: and care must be taken that the foot is completely covered, and that the dressing is accurately in contact with the skin. When this has been done an ordinary sock or stocking may be put on the foot, and outside of this a new shoe, which must be light and should not cover the dorsum of the foot. After twelve hours the dressing is to be removed; the foot is not then to be washed, but must be rubbed with a dry cloth. The dressing is then to be renewed in the same way as before, and its application is afterward to be repeated twice a day. This procedure must be continued for eight to twelve days, according to the severity of the case. In the course of a few days it will be found that a brownish-yellow cuticle, about half an inch thick, is beginning to peel off from all those parts of the skin which were before affected with the disease, and that a healthy, clean, white surface of epidermis is exposed as this substance separates.

Symptomatic Indications.—The remedies called for on this condition are: *Baryta carb.*—one-sided sweats, with fetid smell; *belladonna*—empyreumatic

smell; fetid sweats; *carbo veg.*—perspiration easily excited; sour or putrid; *graphites*—sour perspiration; unhealthy skin; *lycopodium*—perspiration having the odor of onions, or blood. Fetid or sour sweats; *petroleum*—fetid sweat in the axilla; *rhhus tox.*—sweat having an acrid smell; *silicea*—excessive sweating of the feet or the axilla, with fetid odor; *veratrum album*—perspiration having a bitter odor.

BROMIDE RASH.—See MEDICINAL RASHES.

BROMISM.—When the salts of bromine are given in excessive doses, certain phenomena are wont to appear which are known by the above name. Bromide of potassium, being the salt in the most common use, is generally the cause. The prominent symptoms are headache, apathy, somnolence, impaired muscular power, dryness of the mouth, and anæsthesia of the soft palate and pharynx. The skin is pale, the heart's action is feeble, and the extremities cold; nausea and flatulence are also complained of, and sometimes there is diarrhea. Catarrh of the bronchial tubes is common, as also the loss of sexual power and appetite, with atrophy of the mammæ and testicles. In advanced cases the patient becomes much emaciated, and falls into a state bordering on imbecility. A characteristic acneform eruption on the skin is one of the earliest and most constant phenomena. (See MEDICINAL RASHES.)

Treatment.—The dose of the drug should be diminished, or its use given up altogether. The addition of from 3 to 5 minims of liquor arsenicalis to the mixture containing the bromide sometimes prevents the appearance of the eruption.

BRONCHIAL BREATHING.—See AUSCULTATION OF LUNGS.

BRONCHIAL CATARRH.—The simplest form of acute inflammation of the bronchi resembles closely simple nasal catarrh, with which it is very frequently associated. A "cold in the head" is said to have "settled on the chest."

Symptoms.—A slight sense of tightness or uneasiness across the front of the chest; a short, dry, irritative cough, which seems to aggravate this uneasy

feeling; very slight expectoration of thin, sticky mucus, and a sensation of chilliness, especially about the neck and shoulders, with a feeling of depression and lassitude. There is generally some sore throat and hoarseness, and occasionally a slight rise of temperature and increase of pulse rate. It attacks persons of all ages and both sexes, but in very unequal degree. Some individuals display a marked susceptibility to bronchial catarrh, and this persists throughout life, generally resulting, before middle life, in chronic bronchitis. In children, the simple catarrh is very prone to spread to the smaller bronchi, or even to the vesicular tissue, and set up bronchial pneumonia. Cold and damp weather at any season of the year is the most common exciting cause; but almost any sort of chill may be held responsible. In the large majority of cases the physical signs of this condition are the occasional presence of a few rhonchi in the larger tubes.

The *pathological changes* in bronchial catarrh are hyperæmia with slight swelling of the mucous membrane of the larger bronchi.

The *treatment* consists in preventing, as far as possible, the aggravation of the disease by outside influences, such as the inhalation of cold damp air and exposure to sudden changes of temperature. The patient should be kept indoors and in one room, and protected from draughts. A mustard and linseed poultice should be applied to the throat and upper part of the chest, and steam, medicated with compound tincture of benzoin (one teaspoonful to a pint of water at 140°) inhaled for about ten minutes at a time, three or four times a day. These measures, followed by a dose of Dover's powder (grs. v-x) at night, and a gentle saline purge (Hunyadi Janos water) the next morning, will often suffice to cut short an attack. A draught containing vin. ipecac. m. v and liq. ammonii acetatis $\frac{3}{4}$ ss may be given every four hours if the case be severe. In some patients an attack may be cut short by 5-minim doses of liq. morphinæ hydrochlor., repeated every hour until five or six have been taken, or by quinine in larger doses (grs. v-x). The diet should be somewhat reduced, and stimulants avoided until the febrile symptoms have subsided. The symptoms of acute catarrh usually pass off quickly, or the disease spreads

further into the lung. A condition of non-febrile or passive catarrh is, however, very apt to linger after the active form has subsided. This is generally best treated by a change of air. Active exercise is beneficial, but it should be short, sharp, and vigorous, and not protracted so long as to cause fatigue. Cold sponge baths at a temperature not lower than 65° should be taken each morning on rising, the feet being at the same time immersed in hot water. The diet should be somewhat more nourishing than that to which the patient is accustomed, and stimulants in the form of full-bodied wines, such as port, sherry, and Madeira, are to be recommended. Tonics, especially preparations of iron and quinine, are always useful in such cases.

Attention to the regular action of the bowels is an important detail in the treatment of bronchial catarrh. The use of the time-honored blue pill or of the more modern hepatic purgatives—podo-phyllin (gr. $\frac{1}{4}$ -j), euonymin (grs. j-iiij), and cascara sagrada (m. x-xx of the liq. extr.)—should not be neglected.

E. CLIFFORD BEALE.

Symptomatic Indications.—Taken in the first stages of the disease, *aconite* is the most frequently indicated remedy, and often the only one required, the especial indications being: febrile symptoms, short, dry cough from tickling in the larynx, soreness and stitches in the chest when coughing and breathing, scanty expectoration of whitish or bloody mucus. *Aconite* is especially useful when the disease results from exposure to dry, cold west winds. Following *aconite* *bryonia* is often serviceable, as a loosening remedy, when the cough is dry and hard, shaking the whole body. There are stitches through the chest, and inclination to keep still, as the least motion aggravates. The trachea and the large bronchi are the seat of the disease. For children *ippecacuanha* is the most useful remedy, particularly when there is dry cough, with much rattling of phlegm on the chest and oppressed breathing, as if asthma. Nausea and vomiting are frequently present; and fluent coryza, with stoppage of the nose and loss of smell. Loose cough, with rattling of mucus in the chest, generally yields to *antimonium tartaricum*, which is also indicated in loose cough, with profuse, easy expectoration, also with nausea and vomiting.

Antimonium tart. is most frequently indicated for old persons or children. Dry cough, particularly when the lungs are involved, calls for *phosphorus*, the especial symptoms being hoarseness with cough; fever and apprehension of death; roughness or complete extinction of voice; dry cough from tickling in the throat, with stitches in the larynx and soreness in the chest. The cough is excited by laughing, talking, or draft of air. A loose cough by day, becoming dry in the evening, with aggravation on lying down, is relieved by *pulsatilla*. Expectoration of salt, bitter, greenish-yellow or whitish mucus, with chilliness, absence of thirst, and desire for fresh air, are strong indications for the remedy. *Rumex crispus* has a specific affinity for the laryngeal and bronchial mucous membrane. It is indicated when the cough is frequent and continuous, dry, occurring in long paroxysms; greatly aggravated by any irregularity of breathing, as a deeper inspiration, talking, inhaling cold air. The cough is worse in the evening, after retiring, when the least air provokes incessant coughing, rawness and soreness in the trachea, extending to the bronchi. *Gelsemium* is useful for liability to take cold from any change in the weather. The conditions in which this remedy is indicated are characterized by sore throat, with pain on swallowing, shooting up into the ear; fever without thirst; wants to lie still and rest. Deep asthmatic or dry, hoarse, rough cough, with nausea or pain in the larynx, with sneezing, crying or sobbing after attacks, indicates *calcium sulphide*.

BRONCHIAL GLANDS, DISEASES

OF.—The chain of glands running beside the bronchi, and particularly those situated in the angle between the right and left bronchus at the bifurcation of the trachea, are subject to enlargement from many causes, especially in children and young persons. From their anatomical position any marked degree of enlargement is very likely to affect the important structures which lie in close relation with them, and the presence of a group of *symptoms*, including cough of an irritative kind, not attended with much expectoration, pain, generally referred to the upper dorsal vertebræ and between the scapulæ, spasmodic dyspnœa, dysphagia, and an alteration of the voice, is gener-

ally considered evidence of enlargement of these glands. These symptoms, however, may be brought about by other means. And the positive diagnosis of the condition is a matter of great difficulty. The physical signs are scarcely more trustworthy than the symptoms.

Pathology.—All impurities passing through the lymphatics into the bronchial glands are liable to be arrested there, the glands acting as filters. Organic impurities, such as carbonaceous particles, are stored up in the meshes of the glands, without giving rise to any inflammatory action; specific poisons, such as syphilis and tubercle, cause an appreciable degree of irritation and consequent swelling. Among other causes of enlargement are: Simple hypertrophy, usually associated with passive enlargement of other glands of the body or with the general symptoms of Hodgkin's disease; bronchitis, or any other non-specific affection of the lower respiratory passages, especially asthma and whooping cough, and malignant growths. Of these, tubercle is by far the most common, but the actual enlargement to which it gives rise is not usually very great. Syphilis is more rarely met with, but it may set up much greater interstitial changes in the gland. Morbid growths—*e. g.*, lympho-sarcoma about the root of the lung—generally begin in the bronchial glands or the peribronchial tissue. Acute inflammation, even going on to suppuration, has in rare instances been observed, and may set up general pyæmia. Chronic inflammation, leading at times to caseation or calcareous changes, is more frequently met with, sometimes as an apparently independent affection, and at others as a part of general scrofulous degeneration of the lymphatic glands. Caseating glands not infrequently give rise, by pressure and irritation, to ulceration and even perforation of a blood vessel, usually with a fatal result. They may also invade the pericardium, and constitute one cause of purulent pericarditis.

Other pathological conditions clearly attributable to the pressure of bronchial glands are bronchiectasis and diffuse gangrene of the lungs. In such cases an enlarged gland has been found to have perforated the bronchial wall and discharged its contents into the air passages; occasionally, also, a communication has been, at or about the

same time, established between the gland and the esophagus, thus throwing the esophagus and trachea into communication through the medium of the gland.

Treatment.—The diagnosis of this condition being almost impossible, very little need be said about its treatment, which must depend upon the nature of the enlargement. Large doses of iodide of potassium (grs. v-xxx) in the early stage, and of calcium sulphide (gr. $\frac{1}{5}$ -j) in the later stages, have been recommended as of service.

E. CLIFFORD BEALE.

Symptomatic Indications.—*Calcareo carb., mercurius.*

BRONCHIECTASIS.—Dilatation of the bronchi is a lesion often found in association with chronic pulmonary disease, but of rare occurrence as a primary affection. It may be met with in (1) chronic bronchitis and emphysema; (2) chronic phthisis; (3) hypostatic pneumonia, with collapse; (4) cirrhosis of the lung (fibrosis); (5) collapse secondary to pleural effusion; (6) pressure on, or obstruction of, a bronchus by growths, or enlarged and infiltrated mediastinal glands; (7) chronic pneumonia; (8) catarrhal pneumonia, especially in children; (9) pulmonary gangrene; (10) as the result of the presence of a foreign body in the air passages, and in some other conditions.

Owing to the frequent occurrence of the condition of chronic phthisis the apex of the lung is its most frequent site, but that disease apart, the bronchi at the base are most commonly affected. A tube may be more or less uniformly dilated for the whole or only a limited extent of its course, the *cylindrical form*; or it may be dilated in isolated places, forming saccules or pockets, the *sacculated form*. A single tube may be thus affected, or the change may be present throughout a whole lung, the so-called *turtle lung*. The dilated tube is seldom of uniform diameter throughout; more often at short intervals the lumen is narrowed by the projection of fibrous septa. The wall is generally smooth and glistening, but may become ulcerated if any septic or infective (tubercular) complication arise; it may be of less than normal density or considerably thickened, the result of inflammatory changes in the mucous membrane, the latter often pre-

senting a velvety appearance. The tubes may be filled with pale, viscid mucus or with pus, or be quite empty; at times the contents are purulent and fetid.

The pulmonary tissue surrounding a dilated bronchus may be unchanged, but, if many neighboring tubes be affected, the intervening tissue is almost invariably condensed from the presence of fibrous changes (*see* LUNGS, CIRRHOSIS OF).

The *symptoms* present much variety, and depend greatly upon the nature of the primary disease. If the dilated tubes be shut off from communication with the other bronchi, or if their contents remain unchanged and aseptic, no symptoms proper to the condition will arise. Paroxysmal cough, with the expectoration of a considerable quantity of muco-purulent material at intervals, followed by a period of almost complete freedom from cough, is the most characteristic symptom of the existence of bronchial dilatation.

Should the sputum become fetid, it may be found, on microscopical examination, to contain soft, friable, yellow masses, vegetable organisms, and needle-shaped crystals; to these latter the peculiar odor is believed to be due (*see* EXPECTORATION).

The only *physical sign* on which reliance can be placed is the appearance of well-marked cavernous breathing (especially if at the base of the lung), following the expectoration of a large quantity of muco-pus and the gradual disappearance of the sign as the secretion re-accumulates. If this sequence of events be clearly and repeatedly observed, it is highly suggestive of bronchiectasis; it may, however, occur when an empyema has opened into the lung, and is altogether absent in many cases. A peculiar wavy and hollow character of the respiratory sounds is also at times present in bronchiectasis.

The *prognosis* will greatly depend upon the nature of the primary disease. If the condition follows collapse of the lung, the result of pleural effusion, or arises from the lodgment in one of the bronchi of a foreign body which is subsequently expelled, recovery may occur and fairly good health be enjoyed. If, however, bronchiectasis occur as a complication of any of the other affections mentioned at the beginning of the article, the condition will probably be permanent.

If the expectoration lose its fetid odor

and gradually diminish in quantity, it is probable that the dilated tubes are either becoming obliterated or shut off from communication with the air.

Treatment.—The results of operative treatment for the relief of this condition are extremely unsatisfactory and disappointing. Some successful cases of opening and draining bronchiectasia have been reported, but they are not free from the suspicion that the condition was really one of localized empyema in communication with a bronchus. So far as surgical treatment is concerned, these cases are best left alone. The establishment of an opening in the chest renders the cough less effective, and, should the secretions be retained and septic changes occur, the condition of the patient is worse than before the operation. A more important objection, however, is that the affection is rarely confined to a single bronchus, hence it is likely that many dilated tubes will remain undrained. The inhalation of creosote or a 40 per cent. solution of carbolic acid, pulverized by a spray apparatus, as the geyser vaporizer (*see* PHTHISIS), may be of use in diminishing the fetor of the expectoration.

Change to a dry and bracing air and the administration of cod-liver oil, quinine, and the syrup of the hypophosphites, are useful aids to the improvement of the general health.

E. CLIFFORD BEALE.

Symptomatic Indications. — Bronchiectasis with purulent expectoration is most frequently relieved by *stannum*; when with thick, whitish expectoration *ammonium mur.* is the remedy. For persons of a scrofulous diathesis *calcareo carb.* is useful, particularly when the expectoration is yellow, lumpy and fetid.

BRONCHITIS, ACUTE. — Acute bronchitis differs from simple bronchial catarrh only in the degree of its severity. It becomes more serious in direct proportion to the number of tubes inflamed and to their caliber, inflammation of the finest capillary tubes being one of the most serious conditions to which the lung is liable.

Symptoms.—Those of bronchial catarrh, but in every respect more marked. The feeling of weight or tightness behind the sternum amounts to a sensation of rawness, which is aggravated to actual pain by the irritating cough. The sputum, at

first thin, becomes, later, thicker and muco-purulent and may at times be slightly streaked with blood. There is not much dyspnœa as a rule. The cough is often paroxysmal, coming on in sudden bursts, and giving rise to much distress. The general feeling of illness and chilliness is more marked; with a rise of temperature, loss of appetite, and thirst. Some cyanosis is occasionally present, or the face may be dusky or slightly flushed.

Physical signs.—The movements of the chest vary in proportion to the seat and extent of the disease, the upper part being generally expanded more than usual if both bases be extensively affected. Expiration is labored and prolonged. In severe cases there may be considerable inspiratory recession of the supra-clavicular and epigastric regions. The percussion note is generally normal. On auscultation the signs vary with the stage of the disease. The breath sounds may be diminished in intensity or harsh, and both movements of the chest may be accompanied by adventitious sounds. These vary with the amount of swelling of the lining membrane present in the affected tubes, and may change considerably within a short time. Sibilant and sonorous rhonchi are generally present, or may be elicited by cough, and bubbling râles are frequently heard, especially over the lower lobes. Sometimes, however, even in severe cases, all adventitious sounds may be absent. Neither vocal resonance nor vibration are materially affected, but rhonchal fremitus can often be distinctly felt.

Ætiology.—Acute bronchitis may be the direct consequence of a chill in healthy persons, but is very frequently associated with some other disease, particularly with affections of the heart or kidney, or with emphysema or any condition which interferes with the general circulation. The exanthematous fevers, rickets, alcoholism, phthisis, gout, and rheumatism are frequently attended with more or less bronchitis, and in children the irritation of teething or the presence of intestinal worms may act as exciting causes. An attack leaves the patient with increased susceptibility to a recurrence of the disease.

Post-mortem appearances.—The mucous membrane lining the tubes is red and congested, sometimes almost purple in color, and covered in places with sticky

and adherent muco-pus. The finer tubes appear to be somewhat dilated, although their lining membrane is often rather swollen. On cutting off a small portion of the lung and gently squeezing it, small beads of purulent matter will ooze out of the minute tubes, and this test affords the most trustworthy evidence of inflammation within them. Care is necessary, however, to distinguish between actual pus and the yellowish froth which is found in a large majority of healthy lungs.

Pathological changes.—The ciliated epithelium is detached, the basement membrane thickened and œdematous, and covered with transitional epithelial cells and leucocytes, the lymph spaces beneath it filled with leucocytes, and the mucous glands swollen.

From the outset the patient should be kept in bed, the temperature of the room being maintained at a level of about 65°, and the atmosphere charged with steam. To steam a room effectually and rapidly, a few gallons of nearly boiling water should be poured into a large flat bath placed on the floor. A considerable amount of moisture is then taken up by the air, and can be maintained by the use of the ordinary bronchitis kettle, but this latter apparatus alone is too feeble to make much alteration in the hygrometric state of the air, although it may maintain the moist condition, when once established, for a considerable period. In cases of bronchitis complicated by or accompanying renal disease the use of steam is not advisable, especially if dropsy be present. Care must be taken, if steam be used freely, to prevent the patient being chilled, an event very likely to happen if the temperature of the room be allowed to fall.

Diaphoretic drugs are of great service in the early stages, vinum antimonale m. x-xv, or vinum ipecac. m. x-xv, with liq. ammon. acetat. $\frac{3}{4}$ ss- $\frac{3}{4}$ j and sp. æth. nitrosi 3 ss, given every four hours, being a most useful combination. If there be difficulty in getting the skin to act, hot-air baths may be given as the patient lies in bed by means of a spirit-lamp and a large cradle. A "jacket" poultice of linseed, or mustard and linseed, changed every three hours, is a useful but rather troublesome local application.

If much pain be present in the front of the chest, relief may often be obtained by

friction with a stimulating liniment, such as the lin. terebinth. acetic. A few drops of oil of turpentine sprinkled on a very hot flannel compress will often relieve the pain and soothe the cough at the same time, as the vapor of the turpentine passes upward and is inhaled.

A mercurial purge (pil. coloc. co. et hyoscy. grs. iij with hyd. subchlor. grs. ij), followed on the second day by a saline laxative (mag. sulph. grs. xxx, mag. carb. grs. x, sod. sulph. grs. xv, aq. menth. pip. $\frac{3}{4}$ j), is generally advisable at the beginning of an attack. When expectoration becomes free and the skin is moist, much relief may be afforded by expectorants, such as tinct. scill. m. xx, ammon. carb. grs. v, tinct. nucis vom. m. x, infus. serpentariæ $\frac{3}{4}$ j; or syrup. scill. m. xxx, acid, hydrobrom. dil. m. xx, sp. chloroform m. xv, aq. $\frac{3}{4}$ j. Alcoholic stimulants, and especially brandy, are of great value in cases of cardiac weakness, although they need not be used very freely. Opium, whether to relieve cough or to procure sleep, should be used with the greatest caution, and not employed at all for the very young or the aged. Chloral (grs. ij-v) with vinegar of squill (m. xxx), or syrup of tolu (m. xl-lx) is useful in allaying the spasmodic bursts of coughing. Chloral alone (grs. v-xv), or in combination with ammonium bromide (grs. v-xx), will act efficiently to produce sleep, but it should not be used when the heart's action is feeble, or when any cyanosis is present. In such cases, bromide of ammonium (grs. xxx) with tinct. hyoscyam. (m. xxx) and camphor water is to be preferred. In a few cases there may be a degree of engorgement of the right side of the heart needing relief by venesection.

In children the amount of secretion is often very great, and its evacuation ought to be encouraged at intervals; the patients should even be waked at night for the purpose. In old and young alike an emetic is often the only available means of clearing the tubes for a while of the suffocating quantities of mucus. One or two tablespoonfuls of ipecacuan wine should be employed for children, and sulphate of zinc (grs. xv-xxx) for adults.

The diet must be regulated by the powers of the patient. During the early stages, where appetite is lost, the frequent administration of small quantities of nourishing food in a fluid form is indicated,

but there is no advantage to be gained by restricting the diet when once the appetite has returned.

E. CLIFFORD BEALE.

Symptomatic Indications.—In the beginning *aconite* will frequently abort an attack. It should be given early and frequently. Particularly when the disease sets in after exposure to dry, cold winds or as a result of suppressed perspiration, with chill and synochal fever; dry, hot skin and great restlessness; short, hard, tickling cough. After *aconite* *bryonia* follows well, especially when the disease is located in the trachea and large bronchi. The cough is dry with stitches of pain through the chest; sensation on coughing as if the head and chest would fly to pieces; the patient wants to remain perfectly still, as any motion aggravates all the suffering. *Bryonia* is also useful in violent morning coughs, with expectoration of a quantity of mucus. Violent, suffocative cough, with loose lumpy expectoration and dyspnoea may be relieved by *antimonium tart.* It is particularly adapted to old persons or children. Acute bronchitis with asthmatic symptoms may generally be relieved by *ipecacuanha*. The cough is suffocative, with great difficulty of breathing; the chest seems full of phlegm, but it does not yield to coughing. Much nausea and vomiting of mucus is frequently present. *Ipecac.* is especially useful in the bronchitis of children. Dry, hoarse cough and roughness in the throat, or rattling, choking cough worse after midnight, indicates *calcium sulphide*. The cough is often rattling, choking, aggravating after midnight; the breathing, hoarse, anxious, wheezing, with danger of suffocation when lying down. *Sanguinaria* is frequently useful after the subsidence of the more acute symptoms. When the throat is dry, with swelling of the larynx; severe, dry cough; with circumscribed redness of the cheeks and pain in the breast; extreme dyspnoea, short, quick breathing. When the lungs are involved *phosphorus* is the main remedy. The cough is dry and tight, with tightness across the chest and pain in the larynx and chest when coughing. The cough is worse from talking, laughing, eating, motion or cool air. Affection of the smaller bronchial tubes is relieved by *kali bichrom.* Hacking cough, with expectoration of tenacious, stringy, opaque white phlegm, indicate this remedy.

BRONCHITIS, ACUTE CAPILLARY.—A form of bronchitis in which the smaller capillary tubes are mainly attacked. It may occur as an independent affection, but more often follows inflammation of the larger tubes or complicates some disease of an inflammatory nature in an other organ. It is always a most serious condition, particularly when complicated with emphysema. It is rather more common in children than in adults, but is more fatal to the latter.

Symptoms.—From the very beginning of the attack the disease presents alarming symptoms; a sense of tightness and oppression in the front of the chest comes on quickly, and rapidly increases; this is followed by urgent dyspnœa, either paroxysmal in character or continuous; a short and extremely irritating and persistent cough, at first dry, but shortly afterward attended by viscid or ropy sputa; sweating, restlessness, and extreme anxiety. The pulse is rapid and bounding, the temperature slightly raised, and the heart's action excited and forcible.

Physical signs.—In the early stage there is often but little to be heard in the chest except a slight diminution of the inspiratory sound at the bases, with a few small crackling râles scattered over the same area, the percussion note being unaltered. In a short time, however, these râles become audible over a larger area of the pulmonary surface, and acquire a peculiar hissing character, being accompanied by other adventitious sounds according to the amount of mucus present in the tubes. If, as is frequently the case, collapse of many lobules should occur, the inspiratory sound becomes still feebler, and, if the inflammatory process extend to the alveoli, the signs of broncho-pneumonia will be added to those already present.

Unless the attack can be cut short, the patient rapidly shows symptoms of failing power, sinks down in the bed, and ceases to expectorate. Extreme exhaustion comes on, cyanosis, with engorgement of the venous trunks, sets in, albumen appears in the urine, the temperature falls, the pulse becomes feeble and thready, and delirium follows.

The breathing now is shallow and feeble, the period of anxiety and distress seems to have come to an end, the patient usually loses consciousness, and dies

quite quietly, although slight convulsions may sometimes occur.

Diagnosis.—The affection is not likely to be mistaken for any other condition except that of œdema of the lungs. The rapidity with which the symptoms are developed and their severity form a sufficiently striking contrast with the more insidious progress of pulmonary œdema.

The *prognosis* in this form of bronchitis is always unfavorable, except in those rare instances in which it occurs independently of any other disease.

Post-mortem appearances.—Those of ordinary bronchitis, but intensified. The pulmonary tissue is more acutely inflamed, and exudes much fluid blood on section; the minute tubes are often found full of pus, and frequently dilated. Not unfrequently, however, a certain amount of œdema is present at the same time.

Treatment, if it is to be of any effect, must be applied early and energetically. Counter-irritation over the bases of the lungs, or over any point where the inflammation has set in, should be employed with vigor. Dry cupping is sometimes effective, but in the more severe cases it is wiser to abstract blood freely by cupping, provided it is done before the disease has spread over a wide area. The severity of the general symptoms at the outset must be taken as the guide in deciding to make use of it. Stimulants in the form of carbonate of ammonia (grs. v), ether (m. xx–3 j), and brandy must be used from the beginning of the attack. Digitalis is sometimes called for, but in the majority of cases very little can be done by the use of any special drugs.

Energetic treatment may sometimes check the disease before it is so far advanced, and the case must then be regarded as one of ordinary bronchitis.

E. CLIFFORD BEALE.

Symptomatic Indications.—The principal remedy for capillary bronchitis is *phosphorus*. The cough is dry and tight, with tightness across the chest. Cough with expectoration of frothy, pale red, or rust-colored mucus. Severe and exhausting cough which the patient dreads and puts off as long as possible. Following phosphorus, *ipêcacuanha* is most frequently required. It is indicated by the spasmodic cough and difficulty of breathing. *Antimonium tart.* is also a valuable remedy in this condition. It is indicated by lumpy expectoration, with sound on

coughing as if the chest were full of phlegm; emphysema. It is frequently useful in aged persons and is of especial value in threatened paralysis of the lungs. *Kali bichrom.* is often useful when severe cough, with tenacious stringy phlegm is present. Hoarse, anxious, wheezing breathing, with danger of suffocation when lying down, may be relieved by *calcium sulphide*.

BRONCHITIS, CHRONIC.—Chronic bronchitis may occur as an independent disease or as the result of repeated attacks of acute bronchitis. In either form it is almost always associated with chronic changes in the lungs and other organs which may be more serious in their consequences than the affection of the bronchi. The chronic pulmonary changes are—(1) emphysema, (2) collapse of lung, (3) dilatation of bronchi, (4) chronic phthisis, (5) gangrene of lung, and (6) pleurisy. Certain diathetic conditions, especially gout, have a definite influence in the production and maintenance of a tendency to chronic bronchitis, but they are often difficult to recognize with certainty.

The *symptoms* in the uncomplicated form resemble those of bronchial catarrh, but there is usually much purulent expectoration. A sense of oppression in the front of the chest is frequently complained of, but usually corresponds to some slight exacerbation of the condition. There is always some degree of dyspnoea, varying in amount with the activity of the inflammatory process and with the nature of the secondary changes in the lungs. When complicated with emphysema, dyspnoea is a characteristic symptom of the disease. The dyspnoea often occurs in paroxysms not unlike those of asthma, the so-called "bronchial asthma"; a difference, however, is to be noted in that the expiratory effort is much more laborious and prolonged than in the case of spasmodic asthma. Much distress is generally caused by the cough, which is peculiar in character, and apt to come on suddenly. The patient takes a long breath and coughs a great number of times in succession during the same expiratory movement, until the chest seems to be fairly emptied of air. This necessitates a pause for inspiration; after which a second series of coughs begins as soon as the lungs have been sufficiently inflated to permit of it.

Physical signs.—The chest is rounder and fuller than normal, and does not move much on ordinary quiet respiration. When associated with emphysema, it is hyper-resonant, the normal cardiac and hepatic dullness being often completely masked. On auscultation the inspiratory sound is found to be weaker than normal, and is followed by a long, wheezing, expiratory sound. The breath sounds are often accompanied by rhonchi, some deep toned and snoring, others high pitched and whistling, but almost always audible throughout the whole act of expiration. Crepitation may be present, especially at the bases of the lungs. The vocal resonance and vocal fremitus are not, as a rule, altered. Rhonchal fremitus may be felt when there is much mucus of an adhesive kind retained in the larger bronchi.

Diagnosis.—The main point of importance in this variety of bronchitis is that the physical signs, as a rule, are equally distributed over both lungs. Bronchitis and emphysema are frequently present in association with quiescent or arrested phthisis, notwithstanding a prevalent opinion to the contrary; but the physical signs of those conditions will then usually be limited to a smaller area, and there may be other signs to indicate the real nature of the case, but these are often masked by the emphysema, and the phthisis is apt to be overlooked. The possibility of this complication should always be borne in mind in the case of spare individuals suffering from emphysema and bronchitis. Bronchitis complicated by collapse of lung is indicated by the general symptoms of the simple form of the disease, coupled with a more marked degree of cyanosis indicating the permanent want of a larger oxygenating surface (*see* ATELECTASIS).

Dilation of tubes is present to a greater or less extent in almost every case of chronic bronchitis. Constant dyspnoea of long standing, paroxysmal cough followed by the expectoration of large quantities of thick and often purulent and fetid sputa, are the characteristic symptoms of this condition (*see* BRONCHIECTASIS). The subjects of chronic bronchitis and emphysema almost invariably become liable to attacks of spasmodic dyspnoea (bronchial asthma), which occur most commonly in the early morning, about 4 A. M., or on waking from the first sleep; or may be induced at any time by

some of the various causes which give rise to attacks in cases of asthma. In such cases it is probable that a "nervous" factor has been added to the organic changes already present. During the attack the dyspnœa becomes for the time urgent, and the condition resembles that of asthma. Relief ensues when free expectoration is established.

Excessive secretion of sputa is a feature of some forms of bronchitis, especially in old and infirm subjects. Its character varies in different cases, being sometimes thin and watery, and at others thick and gluey in consistence.

Secondary changes commonly occur in the heart and other organs as the result of emphysema and chronic bronchitis, and are of great importance in determining the treatment and guiding the prognosis of each case.

Hypertrophy, followed by dilatation of the right cavities, tricuspid incompetence, congestion of the liver (nutmeg liver) and kidneys, with albuminuria and dropsy, is a sequence of events frequently observed.

The *post-mortem appearances* in all forms of bronchitis have much in common, especially as regards the condition of the lining membrane of the tubes. This is generally of a purplish-gray color, from the greater prominence of the white elastic fibers of the inner coats of the bronchial wall. When examined microscopically, it is found to have lost almost all its columnar epithelium, a few small, bud-like projections from the basement membrane alone remaining in its place. The cellular tissue beneath the basement membrane is infiltrated to a greater or less degree with inflammatory cells, the muscular and glandular tissue being, in some cases, entirely destroyed. The cellular infiltration is limited by the basement membrane, and hence the muco-purulent contents of the tubes must be derived from the smaller bronchi, which are less seriously altered. The denuded membrane never becomes a granulated surface. Ulceration or even necrosis may occasionally be met with, but it will generally be found limited to small areas, where, from the irritation of retained and perhaps decomposing secretions, a definite local sore has been produced. The smaller tubes are almost invariably somewhat dilated. If emphysema be present, the lungs will in addition present the appearances typical of that disease.

Treatment.—The patient must avoid as much as possible all exposure to chill and draughts, and warm woolen clothing should always be worn. When no special symptoms are present, perchloride of iron with spirits of chloroform is of service in improving the general health and nutrition of the lungs, and cod-liver oil is of almost as much value in chronic bronchitis as in phthisis.

If the cough be of such an irritating kind as to prevent rest, relief may be obtained by the use of soothing balsamic inhalations, or by means of opium or belladonna. A morphine and ipecacuanha lozenge, or one containing extract of licorice grs. iij, oil of aniseed, half a drop, with pulv. acacia and sugar, often gives much relief. Expectorants given by the mouth are, as a rule, of very little use in checking cough, but stimulants, such as ammonium carbonate and ether, are often effective, especially when the attack comes on at night. Sometimes an irritating cough may be coupled with a tickling sensation in the larynx, and is then generally due to hyperæmia or slight inflammation of the vocal cords. Such a condition is best treated by the direct application to the larynx of a solution of sulphate of zinc (20 grains to the ounce) by means of a brush.

Occasionally, where the cough is accompanied by pain or a sense of oppression in the front of the chest, counter-irritation to the sternum or even the interscapular region will often give relief. For this purpose a liniment containing 6 drams of liniment. terebinthinæ with 2 of tincture of iodine may be used night and morning, or a mustard and linseed poultice may be applied.

Of the many expectorant remedies the best are ipecacuan., squill, and senega, the balsamic preparations of benzoin, and syrup of tolu. Small doses of cod-liver oil have also a marked expectorant action. The salts of ammonia are of great service when there is much depression of strength. Local medication by means of simple or medicated steam inhalations is often of more immediate benefit than any general treatment (*see* PHTHISIS). The action of steam alone is occasionally sufficient to loosen the adhesive mucus in the larger tubes and so to aid its expulsion, but the addition of one teaspoonful of tincture of benzoin to a pint of boiling water is usually an advantage. A draught con-

taining sodium bicarb. grs. x, sodium chlor. grs. iij, ammonium carb. and potassium iodid. aa grs. iij, sp. chlorof. m. v, and aq. anisum ad $\frac{3}{4}$ j, given in an equal quantity of warm water before rising in the morning, will often, by assisting expectoration, prevent the vomiting which frequently occurs after long attacks of morning cough. If the amount of mucus in the smaller tubes be excessive, and neither expectorant drugs nor inhalations effect its expulsion, an emetic of sulphate of zinc (grs. xx-xxx) may be tried, but emetics, especially ipecacuan. and apomorphia, must be used with a careful regard to the patient's strength, owing to the depression which they are liable to produce. Turpentine is often of great value in diminishing profuse expectoration. Change of air under like circumstances often succeeds when drugs fail to relieve.

If there be any gouty factor in the case, iodide or bicarbonate of potassium with colchicum should be added to any expectorant mixture which may be prescribed, and a saline purge administered.

In severe cases, and especially such as are subject to attacks of spasmodic dyspnoea, iodide of potassium grs. v-viij with ext. of stramonium gr. $\frac{1}{4}$, ext. of licorice grs. ij, sp. chlorof. m. v, in an ounce of water, is often of great service; the dose of iodide may be gradually increased to 15 or 20 grains. Bronchial asthma requires a treatment very similar to that described under ASTHMA, except that morphine injections are generally inadmissible. The antispasmodic powders containing stramonium often give great relief. Ether and carbonate of ammonia are also very useful, and strychnine is sometimes of considerable service.

With much venous engorgement and orthopnoea no hesitation need be felt in abstracting blood freely from the arm. In such conditions venesection, followed by the administration of digitalis, often gives the greatest relief, and may form the starting-point of a recuperative process by allowing the heart and lungs a period of rest from overstrain.

The great majority of persons suffering from bronchitis are not in a position to select their own place of residence, and their treatment is frequently hampered by adverse climatic conditions. No part of the world is altogether free from cases of inflammation of the air passages, but they are less frequent in those regions

where the range of temperature and the degree of moisture are not subject to any great or sudden diurnal variation, and, provided this condition is observed, the actual degree of heat is of minor importance. Of all atmospheric conditions, that of cold damp is the most trying to sufferers from chronic bronchitis (*see CLIMATE*). The most suitable climates are those of islands and of those of the sea-coasts with a southern aspect.

E. CLIFFORD BEALE.

Symptomatic Indications.—The remedies most frequently indicated in the treatment of chronic bronchitis are *antimonium tart.* and *kali bichrom.*, the choice usually lying between the two. *Antimonium tart.* is generally the first remedy, and is indicated by the lumpy expectoration and large collection of mucus in the bronchial tubes, which is expectorated with difficulty. The expectoration of *kali bichrom.* is tough, stringy, and glutinous, adhering tenaciously to the mouth and fauces. Where these prove inefficient resort may be had to remedies which more closely correspond to the particular condition, as follows: pulmonary catarrh with constant hacking; cough with thick whitish expectoration, sometimes in lumps, calls for *ammonium mur.* Harassing dry cough, particularly in old persons, with thick, tough mucus in the bronchi which causes great, often ineffectual, efforts of coughing and hawking for its expulsion, *senega*. Incessant cough, sensation of wool in the larynx, muco-purulent expectoration, *ammonium carb.* Muco-purulent discharge calls for *silicea* or *stannum.*, preference being given to the latter remedy when the expectoration is excessive with weak feeling in the chest. Dirty yellowish expectoration, with offensive odor, *calcium sulphide*. Chronic bronchitis occurring in overgrown young people, with weak chest and dry cough, and who are subject to pulmonary hemorrhage and cardiac palpitations, enlarged gland, is generally amenable to *iodine*. *Hydrastis* externally and internally is often of extreme service in the treatment of chronic catarrh when other remedies have failed. For similar conditions, with copious secretion of pus, *balsam peruviana* is an excellent remedy.

BRONCHITIS, PLASTIC.—A disease of rare occurrence characterized by

the formation of a fibrinous membrane within the bronchi.

The *symptoms* are usually ill-defined, and a correct diagnosis is rarely possible until portions of the membrane have been expectorated. In its early stage the disease may simulate an ordinary attack of bronchitis; subsequently, there is severe cough and dyspnœa, only relieved by the expectoration of a cast of one of the tubes, and generally occurring during the formation of another. These attacks of dyspnœa most commonly occur at night. The affection may be limited to a single bronchus, as is proved by the exact similarity of successive portions of the expectorated membrane. The casts are hollow, yellowish-white in color, and vary from 1 or 2 to 6 or 7 inches in length. They are formed of fibrin, entangling in its meshes numerous leucocytes, and occasionally also red corpuscles and fat globules.

The *prognosis* is usually favorable, but death may occur from asphyxia either suddenly during an attempt to expectorate a cast, or slowly from wide extension of the morbid process throughout the bronchi.

Pathology.—The epithelial lining of the affected tubes is destroyed, but beyond this the morbid appearances are not characteristic.

Ætiology.—The disease occurs most often in males between the ages of ten and thirty, but has been observed in a child of five years and in a man of seventy. Not infrequently two or more members of the same family have been attacked. It may last a few days or two or three weeks, and in rare cases casts have been expectorated at intervals for years. After apparent recovery the exudation may reappear.

The only *treatment* of much service is the inhalation of a spray of lime-water. Emetics have been useful in some cases; mercury and iodide of potassium are also reported to have given good results.

E. CLIFFORD BEALE.

Symptomatic Indications.—The principal remedy for this condition is *calcium sulphide*. See also ACUTE and CAPILLARY BRONCHITIS for symptoms.

BRONCHO-PNEUMONIA (Catarrhal Pneumonia).—This disease is most common in children, the inflammation of the pulmonary alveoli being as a rule sec-

ondary to that of the bronchial tubes. It is rarely met with in adults, but may occur in extreme old age. Three distinct forms of the affection may be recognized:

(1) Simple acute inflammation, spreading downward, as the result of a severe bronchial catarrh. This form usually runs an acute course, is attended with considerable danger, but in favorable cases is followed by complete recovery of the lung.

(2) Broncho-pneumonia may be secondary to some precedent disease of the lungs, as whooping-cough, or to some general febrile infective disease, such as measles, scarlet fever, smallpox, etc. In this variety the progress of the disease is slower and more insidious, and recovery is often long delayed, some permanent changes being not unfrequently left, such as pleuritic adhesions, or dilatation of bronchial tubes or lobular collapse.

(3) There is also a suppurative form, very rarely met with, which leads to the formation of scattered abscesses throughout the lungs. Cases of this kind are generally traceable to some direct local irritation, as the inhalation of septic material or prolonged immersion in dirty water, etc., and almost invariably have a fatal termination.

Localized inflammation of tracts of lung tissue, generally near the surface, leading rapidly to the formation of abscesses, is not uncommonly present in pyæmia (see PYÆMIA), but it is distinct from the rare condition just referred to, which is due to actual inhalation of septic material.

Symptoms.—The onset of the disease is usually marked by an increase of fever and general illness in a child who has already been suffering for a few days from a simple catarrh or from bronchitis, or it may be more sudden, being preceded only by indefinite *malaise* or loss of appetite. The patient becomes very feverish, the temperature sometimes rising as high as 104°, the pulse is rapid, the breathing is at first somewhat labored, and this increases later on to considerable dyspnœa, which may at intervals be paroxysmal. The *alæ nasi* are generally dilated with each inspiration. The amount of dyspnœa will depend in some measure upon the degree of atelectasis which may have already taken place in the lung.

The range of temperature is very uncertain, and defervescence is usually slow, with irregular intermissions. A sudden

fall of temperature is not uncommonly observed, but may be speedily followed by a rise, indicating either a fresh extension of the inflammation or the onset of acute pleuritis or empyema. There is much restlessness as a rule, and occasionally convulsion, and in some cases marked cerebral symptoms are present, which closely resemble those of tubercular meningitis. The cough is often slight at first, but increases after the more active inflammatory symptoms have passed off. There is in the case of adults rarely much expectoration except in the later stages; in young children it is of course absent. The tongue is generally coated and the bowels irregular, diarrhea often coming on at intervals. The urine is scanty, and sometimes slightly albuminous. As the disease progresses, strength is rapidly undermined, and pallor and often a slight degree of lividity appear; the inspiratory effort becomes feeble, and causes a recession of the intercostal spaces and of the soft tissues above and below the sternum, and a suffocative condition may be set up which may terminate fatally. In the majority of cases, however, the disease is arrested before these graver symptoms appear. Recovery, in the simple form, is then steady and complete. Appetite returns, and all febrile symptoms disappear. Relapses are apt to take place if due caution be not observed, the lungs apparently remaining very susceptible to fresh catarrhal affections for some time after the original attack has passed away. Pleurisy or even empyema may thus occur.

In that form of the disease secondary to whooping-cough or the infective fevers the symptoms resemble the foregoing, but are neither so well marked nor so severe. The onset is slower, the amount of fever is generally less, and the course of the disease much more prolonged; recovery taking place very slowly, and often leaving behind a chronic cough, with indications of the presence of permanent changes in the lungs.

The symptoms attending the rare cases in which a condition of diffuse suppuration is set up are acute at an early stage, and resemble those of capillary bronchitis. There is usually more or less cyanosis, marked anxiety of expression, sweating, and cough, with a varying amount of purulent expectoration. The physical signs are those of diminished

breath sounds over a very large area, if not the whole of both lungs, with small and medium crackling râles equally widely distributed. These cases are of rare occurrence, and are invariably fatal. The history of the attack generally explains the cause. A condition of diffuse general lobular suppuration somewhat resembling cases of this nature is sometimes seen as a result of rapid disintegration of a widespread deposit of tubercle.

In each form of the disease the *physical signs* vary much in different individuals. Lobules or groups of lobules may become inflamed, and the disease may extend in patches scattered over both lungs, and show no tendency to remain limited to definite areas, although beginning, as a rule, about the bases. The inflammatory process is in each case accompanied by a varying degree of congestion, and sometimes of œdema of the surrounding lobules.

The physical signs of the simple form are not always obvious. The whole of both lungs should therefore be carefully searched in any suspected case. At one spot the inspiratory sound may be feeble, with slightly prolonged expiration and increased vocal resonance, whilst at another the breathing will be found harsh and bronchial. These signs are subject to frequent variation, and may occur at any part of either lung.

Small or medium crackling râles, with occasional rhonchi, may be audible, but these latter sounds, being dependent upon the amount of bronchitis present, are by no means constant.

Pleuritic friction sounds may sometimes be detected, and are apt to appear and disappear in any given area with remarkable suddenness.

The *course* of broncho-pneumonia is generally chronic, except in the primary simple cases, and even after recovery is apparently complete a tendency to pulmonary inflammation may remain. This chronic course is especially marked in children of enfeebled constitution, in whom permanent structural changes, such as atelectasis, pleuritic adhesion, dilatation of tubes, or fibrosis, may result, to be followed possibly by pulmonary tuberculosis. When large areas of lung tissue are consolidated in broncho-pneumonia, resolution takes place much less perfectly than in croupous pneumonia;

instead of resolution, softening and disintegration may follow, and lead to the formation of a cavity, but whether such a change ever occurs independently of tubercle may be considered doubtful.

Prognosis.—The prognosis of broncho-pneumonia at all ages must be given with caution. The mortality in infancy is very high, some statistics even showing that two-thirds of the cases end fatally. The younger the patient, and especially if below the age of three years, the greater is the risk. Rickety children, or those who are extremely fat and flabby, are the most liable to succumb. Amongst old persons the chance of recovery is in direct proportion to the general vigor of the patient; the strongest recover, but those in whom the constitution is weak and enfeebled generally succumb.

Pathology and morbid anatomy.—In the majority of cases the inflammation of the bronchial tubes precedes that of the alveoli; the swelling of the lining membrane of the tubules leads to narrowing of their caliber and congestion of the vesicles to which they lead. These in their turn become filled with serum, fibrin, epithelial, and inflammatory cells, a condition followed by active inflammation of their walls, which spreads to surrounding lobules or groups of lobules. The result is that a small patch of consolidation is formed, which appears on section as a slightly raised, reddish-gray mass, with a dull or even granular surface. Such patches vary much in size, and a whole lobe may sometimes be studded with them; the interlobular divisions, however, remain well marked, by which the condition may be distinguished from that of acute (croupous) pneumonia.

The subsequent course of this inflammatory process depends chiefly upon the nature of the disease of which it has become a part. If the inflammation be of a simple character, resolution may take place, and reëxpansion of the collapsed lung is possible. If, on the other hand, any septic or specific element is present, the solid lobules and patches are very likely to become softened and disintegrated, forming larger or smaller cavities in relation with dilated bronchial tubes. Such cavities, however, usually shrink to very small proportions. In some instances neither complete disintegration nor complete absorption takes

place, the consolidated tissue becoming the seat of fibroid changes which may lead to shrinking and obliteration of the affected lobules, with emphysema and bronchiectasis in neighboring areas.

Ætiology.—Simple acute broncho-pneumonia is common during the first four years of life. Rickety children, and those whose general nutrition is, from any cause, imperfect, are particularly liable to it, and this liability is rather increased than diminished by each attack.

Treatment.—Same as indicated for acute bronchitis. The patient should be kept in bed, and disturbed as little as possible; the air of the room should be maintained at an even temperature of about 62°, and kept moist by means of steam. Cold draughts must be carefully guarded against. A warm flannel jacket should be worn, as the restlessness will often lead the patient to throw off the bedclothes. The whole chest should be kept warm and moist by the continued use of poultices or hot flannel or spongipiline. In the case of a child a purge of castor-oil, best administered in the form of castor-oil jelly, may be given at first, and repeated every three or four days if there be need of it. A saline draught of citrate of potash (grs. v–xv), sp. ammon. aromat. (m. iij–x), liq. ammon. acetat. (m. xx–lx), may be given, and Dover's powder, in doses of gr. $\frac{1}{2}$ to grs. iij, according to age, is often useful to obtain quiet sleep and allay pain. When the skin acts freely and the more acute symptoms begin to subside, expectorants, vin. ipecac. m. iij–x, syr. tolu m. xx–xl, sp. ammon. aromat. m. iij–x, or ammon. carb. grs. $\frac{1}{2}$ –ij, may be substituted. In cases of much exhaustion with a rapid pulse, brandy ($\frac{1}{2}$ oz. to 1 oz.) in divided doses in the twenty-four hours is of great service. Cold baths or cold packing for the reduction of temperature are not advisable, as a rule, but in cases of hyperpyrexia a careful sponging of the face, limbs, and body with water of a temperature of 80° may be tried. If much cyanosis be present, a few minutes in a hot bath containing a little mustard, cold water being at the same time poured over the head and upper part of the chest in the case of children, often gives great relief. If there be much venous congestion, a venesection to 3 oz. will often prove beneficial. In the later stages, if the larger tubes become clogged with mucus, urgent dysp-

nœa and cyanosis result. An emetic dose of ipecacuan wine (3 iij to vj) is the simplest remedy for this condition. The diet should be restricted to milk and farinaceous foods, administered in small quantities at short intervals. Thirst may be relieved by sips of water acidulated with a few drops of dilute hydrochloric acid. It may occasionally be necessary to feed by means of small nutrient enemata, and in the most difficult cases it is advisable to resort to those in preference to the nasal tube or other mechanical means of introducing food into the stomach.

In cases of broncho-pneumonia occurring in persons of advanced age the amount of rest that is obtained, and the quantity of food that is taken, are important factors in determining the result. Strict rest in bed must be insisted upon, the patient not being allowed to rise for any purpose whatever. Milk, nutritious jellies, or peptonized foods should be given in small quantities at least every two hours. Stimulants in the form of brandy or whisky are generally called for, and must be used with freedom if necessary. A close watch must be kept upon the heart's action, and any indications of failure combated by digitalis or strophanthus in doses of 5 to 10 minims of the tincture, and by diffusible stimulants, such as carbonate of ammonia (grs. v-x) and spiritus etheris (m. xv-xxx). The bowels in old persons need not be urged unless there be actual discomfort arising from the constipation. A simple enema is then the appropriate means of relief.

Poultices should be kept applied to the affected side or to both sides of the chest, if necessary, and should be changed every four hours, care being taken to disturb the patient as little as possible in the process. Sponging of the hands, arms, and face may be done twice in the day for cleanliness and its refreshing effect.

Great care must be exercised to prevent recurrence during the period of convalescence. It is particularly apt to take place, and with each relapse the inflammation becomes more chronic and intractable. Change of air is generally advisable after the attack has subsided.

E. CLIFFORD BEALE.

Symptomatic Indications.—*Phosphorus* the main reliance. See CAPILLARY BRONCHITIS.

BRONCHOCELE.—Two kinds, ordinary and exophthalmic goiter; the former may be endemic or sporadic, simple or cystic, and it may be acute.

Causes.—Immediate cause unknown, but certainly poverty and an unhealthy mode of living greatly conduce to it.

Character and effects.—Enlargement of the thyroid gland or part of it, fluctuating if cystic; occasionally causes dyspnoea, dysphagia, or loss of voice, or displaces neighboring parts; cysts usually contain serous fluid when single, grumous fluid when multiple.

Exophthalmic goiter.—Pulsation, anæmia, prominence of eyeballs.

Diagnosis may have to be made from carotid aneurism.

Treatment.—General hygiene; high, dry, breezy places; iron, iodide internally and externally; iodide of potassium; lead iodide and mercuric iodide ointments; pressure; tapping cysts and injecting them with iodide or iron tincture (3 j to 3 ij with water); pressure; seton (dangerous); ligature of thyroid arteries; excision when pressure of tumor threatens death; for acute bronchocele, if the pressure gets dangerous, tap any cysts and divide the binding cervical fascia. D'Ancona claims to have cured a case of exophthalmic goiter by galvanization of the cervical sympathetic.

C. B. KEETLEY.

Symptomatic Indications.—The most useful remedy in this condition is *iodine*; inveterate cases, which have defied other remedies, frequently yielding to iodine. The harder the swelling, and the more other symptoms are wanting, the stronger is the indication for iodine. After iodine *spongia* is the most useful medicine, particularly when the patient is easily frightened thinking he is going to suffocate. *Belladonna* is nearly specific, especially in congestive conditions; the gland is painful to the touch; the heart palpitates violently. *Ferrum met.* is valuable in cases occurring in anæmic persons, with ashy pale or greenish color of the face, which becomes fiery red on motions or exertion.

BROW AGUE.—Neuralgia of the first division of the fifth cranial nerve is so called because the affection is common in malarious districts, and then presents an intermittent character, the attacks coming on at regular intervals in a sim-

ilar manner to those of ordinary ague. It may, however, occur independently of any malarious influence, when it is probably dependent upon some diathesis—*e.g.*, gout—the attacks being apparently induced by chill. Or it may be symptomatic of some cancerous or other affection of the bones of the skull in the immediate neighborhood. When not dependent upon malaria, the treatment would be the same as for other forms of neuralgia (*q. v.*).

BRUISES.—*Possible after-consequences.*—Abscess, contraction or shriveling (*e.g.*, of the ear after hematoma), permanent thickening, long-continued pain and tenderness, paralysis of nerve or muscle, necrosis or hypertrophy of bone, a weakness and liability to disease.

Treatment.—Pressure, uniform, equal and tight, especially by cotton-wool and starch bandage; stimulating liniments, ice, cold lotions; or, in severe cases, warmth and exclusion from the air. Rest. When the effusion remains, try friction, kneading, or pressure, or tap antiseptically.

BUBO.—*Causes.*—Syphilis (suppurating bubo caused by the soft chancre), gonorrhea, and any irritation about skin of external genitals. When there has been no visible sore, the bubo is called a "sympathetic" one. "Bubon d'emblée" means a syphilitic bubo from absorption of virus, without intermediate ulceration; scrofulous constitution or severe local disease of genitals aggravates bubo.

Symptoms.—Those of inflammation and sometimes suppuration of and around the inguinal glands; suppuration may greatly undermine and destroy skin; chronic or acute.

Diagnosed from deeper abscesses by its connections, situations, history, and course.

Prognosis.—Proper treatment will often prevent abscess; liability to slough and open arteries.

Treatment.—1. To prevent abscess: rest, counter-irritation, blisters, iodine paint, ex. belladon. and glycerine on cotton-wool, pressure, cold, leeches. General treatment for cause: attend to bowels, quinine, iron. 2. When abscess forms, poultice, foment, then open freely; destroy rotten skin; stimulating ointments, red oxide of mercury powder or

ointment, ung. resinæ, caustics when required; iodoform.

Creeping bubo heals at one side, extends at other; horseshoe shape.

C. B. KEETLEY.

BUBONIC PLAGUE.—Black Death.

—A specific germ disease epidemic in China for centuries, occasionally extending into other countries, as in 1665, when 100,000 died of the disease in England. The name "black death" comes from the dark spots which appear just before dissolution. The bacillus has been discovered by Professor Kita-Sota, a Japanese bacteriologist. See PLAGUE.

BULBAR PARALYSIS (*Labio-glosso-laryngeal paralysis*) is a disease of the motor nuclei in the medulla oblongata.

The disease occurs in acute and also in chronic form. The latter only, the most common form, will be described.

Two other forms of bulbar paralysis—the "apoplectiform," which comes on suddenly, and is due to a lesion in the fibers descending from the cortex to the bulbar nuclei, and the "acute inflammatory," analogous to acute poliomyelitis are of such rare occurrence as only to require mention.

The *symptoms* begin very insidiously, and take the form of a progressive bilateral atrophy of the muscles of the tongue, lips, soft palate, and pharynx, with consequent paralysis of these parts. The tongue is usually the first to be affected, and, before there is any wasting of this organ, the patient has a difficulty in uttering dentals and linguals. The appearance of the tongue is quite characteristic; it is atrophied, the mucous membrane is thrown into folds, like a half-empty bag, while, at the same time, numerous fibrillar twitchings are seen on its surface. The lips become weak from wasting of the orbicularis oris, so that the patient cannot purse up the mouth or pronounce explosive labials. The soft palate becomes paralyzed, usually bilaterally, the patient being unable to close the posterior nares. This is best tested by making the patient blow up his cheeks while the anterior nares are nipped by the fingers; then, on suddenly removing the pressure, the air rushes through the posterior nares from the mouth.

The speech acquires a nasal tone, and the word "rub" becomes "mrum." In

most cases the soft palate loses its reflex action to the stimulus of tickling.

As the case advances the patient gets a characteristic mournful expression—though most patients are really exceptionally cheerful and good-tempered—the lower lip drops, the saliva is not swallowed, but dribbles continually out of the corners of the mouth, or hangs in ropy festoons about the fauces; the tongue cannot be protruded from the mouth, speech is lost, and only a grunting sound can be made. Swallowing is difficult, owing to regurgitation into the nose or the larynx, the muscles of which are now paralyzed. The epiglottis cannot be raised, and the vocal cords cannot be approximated. The wasted muscles of the tongue respond to the faradic current as long as there are any fibers left, but with the constant current they give the reaction of degeneration—*i. e.*, react to the positive better than the negative pole, and give a slower contraction than in health. Bulbar paralysis is frequently associated with progressive muscular atrophy and with amyotrophic lateral sclerosis, and in the latter condition clonus of the lower jaw is frequently obtained.

Course.—The disease runs a slow progressive course, and usually ends fatally in from one to four years, death resulting either from inanition, impaction of food in the glottis, bronchitis or pneumonia set up by particles of food which have got into the lungs, or from direct implication of the respiratory and cardiac centers in the medulla oblongata.

Pathology.—Similar to that of progressive muscular atrophy, and consists of gradual atrophy of the motor nuclei of the medulla, especially the hypoglossal, the spinal accessory (which supplies the levator palati), also less frequently of the nuclei of the vagus, glosso-pharyngeus, the facial and the motor division of the fifth nerve. The cells of these nuclei atrophy, and lose their processes, granule corpuscles appear in the interstitial tissue, and in some cases the anterior pyramids are degenerated. The muscles supplied by the atrophied nuclei waste and undergo fatty and granular changes, while the nerves supplying them are gray, from degeneration of nerve fibers and increased interstitial tissue.

Diagnosis does not, as a rule, present much difficulty, the gradual bilateral

wasting of the muscles being its chief characteristic. It has to be distinguished from acute bulbar paralysis, which has a sudden onset; and from lesions of the cranial nerves outside the medulla, secondary to tumor or syphilitic disease. In the latter cases there is more pain, and the symptoms are not usually bilateral. There are also more distinct changes in the electrical reactions. Intra-medullary tumors often involve other nuclei, as that of the facial or sixth nerve, and other signs characteristic of a tumor will be present.

Ætiology.—Bulbar paralysis is a disease of advanced life, rarely beginning before forty, and occurring in cases with an hereditary neurotic history. *Causes.*—Exposure to damp and cold, mental anxiety, and bad living, but in a certain number of cases no cause can be ascertained; syphilis is not predisposing.

Treatment is very unsatisfactory. The general health may be improved by the administration of nervine tonics, such as arsenic, phosphorus, quinine, and strychnine, and by cod-liver oil. Temporary improvement has been obtained by hypodermic injections of strychnine (gr. 1-60), with small doses of morphine (gr. 1-36 to 1-24). But the improvement has not been permanent (Gowers). With regard to electrical treatment, the writer has never seen any definite good result from its use, but, as he has seen marked improvement in early cases of progressive muscular atrophy, a trial should certainly be given to the constant current, the positive pole being applied to the back of the neck, and the negative pole to the affected muscles, so as to produce a slight contraction.

Great care must be taken in feeding these cases; semi-fluids answer best, but in some cases esophageal tubes or catheters have to be used.

C. E. BEEVOR.

Symptomatic Indications.—See PARALYSIS.

BUNION.—Thickening of bursa over head of metatarsal bone of great toe; occasionally the term is applied to any enlarged bursa on the foot.

Symptoms.—First a tender spot, then swelling, effusion, liability to inflammation; suppuration, sinus, large cavity with narrow orifice, thin discharge; distortion of the toe outward, displacement

of the flexor longus pollicis tendon in the same direction; changes like those of chronic rheumatic arthritis in the subjacent joint, or more serious articular disease which may lead to fatal inflammation of the foot; may be the starting-point of senile gangrene.

Prognosis.—Rarely altogether curable when it has long supplicated.

Treatment.—Rest; remove the pressure of the boot, which is always the cause; restore the toe to natural position by mechanical contrivance; it may be justifiable to divide tendons or ligaments; corn plasters, soap plasters, iodine, or ointment of iodides to produce resolution. When discharging apply stimulating dressing, *e. g.*, ung. resinæ; when inflamed, poultices, fomentations, etc. Nitrate of silver solution will harden tender skin.

BURSÆ.—Situations of chief: Acromion, olecranon, great trochanter, tuberosity of ischium, beneath psoas, lower, superior, and outer parts of patella, condyles of femur, popliteal space, tuberosity of tibia, and the os calcis. They also occur on almost any hard prominence, especially if subject to pressure, and under any tendon which glides over bones.

Diseased conditions of bursæ.—Four, viz., 1, simple enlargement with fluid contents; 2, enlargement and solidification; 3, enlargement and formation of melon-seed bodies; 4, inflammation.

Bursa patellæ.—All the above diseases may occur here, and are the result of undue and repeated pressure. Inflammation may follow a blow only, but especially a blow on bursa already enlarged. 1. Simple enlargement.—A globular swelling, obviously in front of patella or lig. patellæ, and therefore not in the joint. Fluctuation sometimes, or even transparency. Usually painless. Stiffness. Perhaps no trouble whatever. 2. Solidification.—May be judged by the feel, or detected after incision. 3. Melon-seed bodies may cause a crackling feel. 4. Inflammation causes heat, redness, etc., and leads almost always to abscess.

Treatment.—For 1. Remove cause, iodine or blistering externally, tapping simply, or with injection of tincture of iodine (3j); seton; free incision with gentle but firm compression. 2. Excise the solid bursa. In dissecting it out, remember the absolutely close proximity

of the joint. 3. Melon-seed bodies are to be let out by incision if the bursa is troublesome. 4. For inflammation: leeches, fomentations, poultices, rest, elevation, back-splint. When abscess forms incise freely. Suppuration may cause cellulitis all about the knee, bursting of pus into neighboring tissues or joint, or disease of patella. Enlarged bursa over olecranon often causes diffuse cellulitis of forearm. Bursa in popliteal space, and beneath semi-membranosus, very liable to communicate with knee-joint. Hence caution in tapping; antiseptic. Enlarged bursa with liquid contents can be easily reduced by elastic pressure. But this elastic pressure requires experience and care to be used with perfect safety.

C. B. KEETLEY.

Symptomatic Indications.—*Arnica*, the main remedy for bunions or bursitis, when, from friction or bruises, inflamed. *Belladonna*, when attended with heat, redness, and swelling; throbbing pain. *Bryonia*, when with pale swelling with stitching pain from motion. *Rhus tox.*, after a twist, sprain, or strain; pain better from motion. *Silicea*, violent lancinating pains; tendency to suppuration; bursitis of knee-joint.

BURNS AND SCALDS.—These painful and often fatal injuries are the result of the application of a degree of heat to the surface which occasions either inflammation or complete disorganization of the textures.

Local effects.—The severity of burns and scalds depends on the intensity of the heat and the duration of its application; these are necessarily closely connected with the mode of causation. Thus, an explosion of gas or of gunpowder will produce a superficial scorch, while the catching fire of clothes, from the longer continuance of the heat, causes a more severe burn. Scalds by hot water generally are less destructive to the tissues than burns, owing to the heat being limited to the temperature of boiling water, and to the duration of its action being shorter. But some of the most severe injuries by heat are occasioned by scalds with fluids, especially oleaginous fluids, which have a higher boiling point than water, and by burns from molten metals.

Classification.—Dupuytren's classification divides them into six degrees, cor-

responding to the depth to which the effect of the application of heat extends. An appreciation of these degrees is chiefly necessary in estimating the after result of burns in regard to readiness of healing and liability to contraction of cicatrices.

In burns of the *first degree* the skin is merely scorched by the momentary application of heat, and the only result is a reactive hyperæmia and slight swelling of the skin, with some tingling pain. Desquamation of the cuticle usually follows.

The *second degree* is characterized by the formation, immediately or a few hours after the accident, of bullæ or vesicles. A serous fluid exudes from the dilated vessels of the corium, and separates the corneous from the Malpighian layer of the epidermis; but at various points the two layers remain connected by bands of epithelium. If the serum be evacuated without destruction of the detached layer, the epidermis is quickly restored beneath it; or a crust forms and healing takes place by scabbing; otherwise a raw surface is exposed, from which a sero-purulent or purulent discharge issues. After healing some discoloration of the surface, but no cicatrix, remains.

In burns of the *third degree*, the cuticle and part, but not the entire thickness, of the papillary layer or corium are destroyed; while the *fourth degree* differs from the third in that the whole thickness of the corium and the subcutaneous tissue are involved. In both the affected skin is tough and parchment-like, and its separation takes place by sloughing and suppuration; so that until this is accomplished it is rarely practicable to distinguish between them. The escape from destruction of some part of the thickness of the corium is, as regards the ultimate effect of the injury, of the greatest importance. For the corium contains important elements of the skin which cannot be reproduced, *i. e.*, hair follicles, sudoriparous glands, and elastic tissue. These, in burns of the third degree, are restored in the cicatrix; the new formation of connective tissue being limited, its contraction is slight, and the healing process is much accelerated from the fact that islands of epithelium appear, and extend over the surface of the granulations wherever traces of the rete Malpighii, hair follicles, or sudoriparous glands remain. But sometimes, owing to the points of the papillæ being exposed,

burns of the third degree are excessively painful.

Contrasted with those of the third, burns of the fourth degree are more tardy in healing, for they are covered with epithelium only by extension from their margins; the cicatricial tissue is abundant, devoid of the elements peculiar to skin, and contraction is extreme, producing often horrible distortions.

In the *fifth degree* the whole thickness of the skin and some portion of the muscle are destroyed. In the *sixth* the whole thickness of a member is carbonized. Such severe injuries are rarely seen, and then, as a rule, only affecting a portion of a limb.

It is scarcely necessary to add that the different degrees combine and pass the one into the other in the same case; in fact, that in severe burns the first three or four degrees are nearly always combined.

Symptoms.—The severity of the constitutional effects of burns depends on their extent rather than their depth, and is also profoundly modified by their situation and the age of the patient. An extensive burn, even of the first and second degrees, is more serious in its immediate results than a smaller although deeper burn. Burns of the chest, abdomen, head, and face, are followed by much more severe symptoms than more extensive burns of the extremities; and the effects of burns of the chest are disproportionately exaggerated in young children and old people, who, as might be expected, are much the worst subjects of burns.

The constitutional effects of burns, under the influence of these chief modifying causes, range from slight passing fever to shock and collapse terminating in death within a few hours; the fatal result may be deferred for some days, being ushered in by symptoms resembling those of sepsis, or, after a long course of suffering and suppuration, may supervene with exhaustion. Again, both the course and mode of termination may be varied by complications affecting the brain, the thoracic or the abdominal viscera. The constitutional disturbance following burns has been conveniently divided into three stages: (1) Depression and congestion of internal organs. (2) Reaction and inflammation. (3) Suppuration and exhaustion.

1. The earliest symptoms are synonymous with those of shock; the skin is cold, the patient is repeatedly attacked with shivering, the pulse is rapid and feeble, sometimes thready, and the temperature is subnormal. The mind remains clear. Pain is severe and of greater intensity in slighter (especially burns of the third degree) than in deeper burns; but it is nearly or quite absent in the worst cases. In children, vomiting comes on early, the vomit being sometimes bloody; in adults it is longer delayed.

There is thirst and dysphagia when the mouth and pharynx have been scorched by the flames. The urine is scanty, often albuminous, and sometimes contains blood. In many cases the patient lapses into a drowsy condition, which is followed by coma and death; in others there are restlessness, delirium, and clonic spasms, generally affecting the muscles of the back. The temperature continues subnormal to the end. Children not infrequently die within the first few hours with convulsions.

2. If life be prolonged, reaction sets in after twenty-four or forty-eight hours. The appearance of a widespread blush of redness, heat, and swelling (the general evidence of inflammation) of the parts around the destroyed area of skin are accompanied by a rise of temperature, and general febrile symptoms resembling those of severe traumatic fever. These symptoms are kept up by the absorption of inflammatory products during the process of separation of the sloughs, and, if decomposition be permitted to occur, may culminate in those of septic poisoning. Constipation, usually existing at the earlier part of this stage, often gives place to diarrhea, which is sometimes profuse and exhausting. Vomiting is not uncommon, and when associated with diarrhea and melena, such a combination of symptoms suggests, but by no means indicates, the existence of a duodenal ulcer. An ulcer may, however, suddenly cause death, with hemorrhage or perforation of the peritoneum, without having given rise to any symptoms by which its presence might be suspected. Pulmonary complications more often occur in this stage; but unless pleurisy is manifested by acute pain, the symptoms are not generally well marked, although the lungs be extensively hepatized.

3. The process of separation of the

sloughs is usually completed by the end of the second week, and with it the third stage of suppuration begins; it continues until the termination of the case. The wound now becomes covered with granulations, and there is a profuse secretion of pus, which, if allowed to decompose, collects and becomes absorbed, renews the fever, and exposes the patient to the danger of pyæmia.

Thoracic and abdominal complications, although less to be apprehended, are not uncommon; and attacks of diarrhea are of frequent occurrence. Weakness is often extreme; hectic may result from the continued drain on the system, and, after a longer or shorter period, may terminate in death with exhaustion.

As convalescence advances the constitutional symptoms disappear, and the local ailment becomes that to which attention is directed.

In addition to the visceral disorders already mentioned, it must not be forgotten that burns are liable to the complications of ordinary wounds, *i. e.*, tetanus, erysipelas, septicæmia, and pyæmia. Rarely, hemorrhage occurs during the separation of the sloughs.

Prognosis.—The relative importance of the extent and intensity of burns, their situation, and the age of the patient, as regards the severity of the constitutional symptoms, have already been commented on; from these remarks the influence of these conditions on the prognosis of the case may be gathered. It is generally considered that recovery is impossible if one-third of the surface of the skin be involved. Next to shock, congestion and inflammation of internal organs are the commonest causes of death after burns, hence the onset of symptoms of these complications renders the prognosis exceedingly grave. Burns of the chest are liable to be followed by inflammation of its contents; of the abdomen by peritonitis, and of the scalp and face by diffuse inflammation. The longer life is prolonged the greater the chance of recovery; especially is this the case after the eighth day, before which by far the larger number of fatal cases occur.

Pathology.—The pathological changes after death from burns vary with the stage at which death has taken place.

In the *first stage*, congestion of the brain and its membranes, and of the thoracic and abdominal viscera (the first-

named almost invariably), are found ; occasionally there is serous effusion into the brain. The congestion may be the result of reflex paralysis of the vessels from shock, which is an exceedingly common cause of death in this stage. But death in many cases cannot be attributed to shock, as it occurs often after reaction has set in. Many hypotheses have been brought forward, and many experiments made, with a view to explain the rapidly fatal issue of extensive burns. Some attribute it to the immediate effect on the heart and blood vessels, others to changes in the blood itself. The former suppose (and the supposition is supported by experiment) that when death occurs immediately after a burn, the heart is paralyzed from overheating of the blood ; or, if death be somewhat delayed, that it is brought about by a reflex paralysis of the blood vessels and lowering of the blood pressure.

In the *second* stage, that of reaction and inflammation, the pathological appearances generally correspond to those observed after death from septic poisoning. There is congestion of the brain, of the lungs, and intestines ; in a considerable proportion of cases pneumonia, pleurisy, or both, are found. It is in this stage that ulceration of the duodenum is most frequent. The ulcer is, as a rule, situated immediately below the pylorus ; it is indolent, with clearly cut edges ; it may extend deeply into the substance of the pancreas, and perforate the peritoneum, or a large vessel, usually the pancreatico-duodenal artery or one of its branches. More than one ulcer may be present.

In the *third* stage, inflammation of the lungs and pleura are relatively much more frequent than lesions of the intestine or brain. The first mentioned, according to Mr. Holmes, are found chiefly when the thorax is the seat of the burn.

Treatment.—*Constitutional* should be based on general principles, and especially according to such symptoms as may be most prominent in the various stages succeeding the infliction of a burn. A stimulating plan of treatment is almost invariably necessary ; and depletion is rarely advisable even in the presence of inflammation of internal organs, for such complications are usually of a low and congestive character.

In the first stage the chief aim is to

establish reaction and relieve pain. The former indication may be met by stimulants and warmth, the latter by a full dose of opium, which should not be withheld even in children. After extensive burns much relief is afforded and the depression is diminished by placing the patient at once in a hot bath. In the second and third stages complications must be met by appropriate remedies, and the strength may be maintained by a nutritious diet and stimulants, with ammonia and bark. Diarrhea may be arrested by astringents and opium. Quinine may be given with advantage if the temperature be high.

Local.—Protection of, and exclusion of air from the burnt surface, and the prevention of decomposition, are the indications which should guide us in the selection of dressings. During the dressings, especially the first, the body should be exposed as little as possible, one portion being uncovered and dressed before the clothes or dressings are removed from another portion. The necessity of frequent change may be avoided by using antiseptic and absorbent materials, which seldom need renewal ; and in severe cases the pain and exposure attending redressing may be much mitigated by allowing the dressings to soak off in a bath.

A convenient and soothing mode of treatment of burns of the first degree consists in dredging over the surface a thick layer of flour or starch, and, if the burn be extensive, enveloping the part in cotton-wool. Lint soaked in Goulard water, or Carron oil (equal parts of linseed oil and lime-water) may be used with advantage if the heat and burning pain are severe.

The blisters formed in burns of the second degree should be punctured (the fluid being allowed to drain away) and the epidermis carefully preserved. Flour or Carron oil may then be applied and the part enveloped in cotton-wool, and bandaged. Later, oxide of zinc ointment may, if necessary, be applied.

After burns of the third and higher grades, which are followed by the separation of a slough and suppuration, a non-irritating antiseptic dressing is, in order to prevent decomposition, the chief requisite. If the burn be extensive, carbolic acid and iodoform, owing to the serious effects produced by their absorp-

tion, are unsuitable; and the harmless but efficacious antiseptics, boracic acid, salicylic acid, and eucalyptus, must be resorted to. Lint which has been soaked in a saturated solution of boracic acid, surrounded by "salicylic wool," is, perhaps, the most convenient dressing; boracic ointment, or eucalyptus oil in olive oil, may also be used. The direct application to the burnt surface of cotton-wool or of gauze soaked in some antiseptic cannot be recommended, owing to the difficulty and pain attending their removal. Iodoform may be sprinkled over the surface if signs of decomposition appear. Bilroth speaks in terms of high praise of the method of treating extensive burns by the continuous immersion of the patient in a warm bath until the sloughs have separated. This may be accomplished by means of a bed slung in a bath designed by Hebra.

After the separation of the sloughs and the formation of granulations the treatment resolves itself into that of an ordinary ulcer of the integuments, but due precautions against decomposition of the profuse discharge must still be maintained. An ointment of boracic acid or oxide of zinc will now promote healing. Exuberant granulations should be checked by the application of a lotion of sulphate of zinc or the solid nitrate of silver. Contraction of the wound and the repression of exuberant granulations are materially assisted by strapping judiciously applied. When the granulations are in a healthy condition, skin grafts, or larger patches of skin, should be applied, and the wound covered with oiled silk or "protective." Sponge grafting, which consists in laying an exceedingly thin slice of sponge over the wound, was introduced and advocated by Professor Hamilton, as a means of promoting healing and preventing contraction after deep and extensive burns.

In the healing of burns of the fourth and of higher degrees, particularly those affecting certain regions, precautions must be taken against the occurrence of contraction. Among the sad and hideous deformities too frequently seen as the result of contraction may be mentioned the drawing of the head down upon the chest or shoulder, eversion of the lids and lower lip, binding of the arm to the side, flexion of the elbow and knee, deformities of the hands and feet with webbing,

or distortion of the digits. Hence it is in deep burns of these localities that special precautions are necessary both during and after healing, for contraction continues at least a year after cicatrization is completed. In the case of burns involving the flexures of joints, the limb may be kept straight by splints. Tension may be kept up by strapping, elastic bands, or other mechanical contrivances; and the same means are applicable after contraction has commenced. Adhesion of scars to deeper structures may be prevented by daily friction with oil, and massage is also of use in arresting the further progress of contraction.

The scar tissue sometimes becomes overgrown and forms firm, raised, pinkish nodules, with claw-like processes projecting from their sides, a condition known as false keloid.

The plastic operations appropriate to the various deformities arising from contraction will be detailed in another place.

Amputation of limbs or parts of limbs may, under certain circumstances, be necessary. It may be advisable, if the patient be sinking from the exhausting discharge from an extensive burn of an extremity, or if, in the progress of the case, it becomes evident that the destruction is so extensive as to render the limb useless. It may be unavoidable at first, owing to the depth to which the parts have been destroyed, or may subsequently be called for by the opening of a large joint for sloughing.

FREDERICK S. EVE.

Symptomatic Indications.—The constitutional symptoms from burns or scalds will require: *Aconite*—Chills, high fever, dry, hot skin and much thirst. Great fear and anxiety of mind, with much nervous excitability, are present. *Arsenicum*—Dark, watery, offensive diarrhea. Rapid and great prostration, with sinking of the vital forces. Extreme thirst, drinking often, but little at a time. Great anguish, restlessness, and fear of death. *Cantharis*—In superficial burns or scalds for external use. Put twenty drops of the tincture in a gill of water and keep the injured parts constantly covered with rags or lint saturated with the solution. *Chamomilla*—In convulsions arising from severe burns. Becomes almost furious about the pains. Very impatient, can hardly answer one civilly.

Warm sweat about the head and face. *Cinchona*—Extensive suppuration, producing much debility. Painless diarrhea, of dark, watery stools, particularly at night. *Silicea*—When the ulcer heals slowly or proud flesh forms. *Sulphur*—When there is a strong tendency to the production of proud flesh and there is no appearance of granulations. Much itching, burning and inflammation around the ulcers. *Urtica urens*—Externally; for all classes of burns. Apply same as cantharis.

CACHEXIA is the name given to the state resulting from the prolonged duration of certain diseases, and especially to those associated with impoverishment of the blood. The principal signs are an earthy, muddy, sallow, or pallid complexion, according to the disease which has induced it, and some degree of emaciation. Syphilis, malaria, cancer, tubercle, disease of the spleen, chronic diarrhea, and rickets are the most common causes of cachexia. Some writers speak of a cancerous cachexia or a tubercular cachexia; used in this sense, the word cachexia would be synonymous with diathesis.

CACOTROPHIA FOLLICULORUM.—A disease having a close resemblance to severe lichen pilaris; with palish or reddish pimples seated at the

hair follicles; but is a more severe affection of the follicles. It is peculiar in its general distribution in severe cases over the major part of the body, in the fact of its being congenital, and in its obstinacy to treatment. The disease commonly makes its appearance upon the arms above the elbow, usually upon the outer side, giving the skin of the affected part a rough appearance which has been likened to a nutmeg grater. It may also affect the thighs, the trunk, and the sides of the face and forehead. The follicles are plugged by scales or exudations which adhere strongly; the hairs are lost or of the feeblest growth, but the interfollicular spaces are not affected. It is said that the disease is apt to occur in families where ichthyosis is common. According to Dr. Fox the disease may be regarded as a xeroderma of the follicles.

Treatment consists of alkaline baths and rubbing the skin with simple oils or fats and the internal administration of tonics.

CALCIS, EXCISION OF.—See EXCISION OF JOINTS.

CALCULI, BILIARY.—See GALL BLADDER, DISEASES OF.

CALCULUS.—Urinary deposits.—Table of two classes, organic and inorganic:

TABLE OF URINARY DEPOSITS.

NAME.	CHARACTERS.	CAUSES.	SYMPTOMS.	TREATMENT.
Urates or Lithates of Ammonia and Soda.	Pinkish yellow, red or lateritious (brick-dust) sediment; urine scanty, acid, and high-colored. The precipitate, before subsiding, forms a cloud in the urine, which clears off when heated. Crystalline form—uric acid, mostly rhombic prisms and plates. "Gravel."	1. Rapid waste of tissues, <i>e. g.</i> , as in fevers; 2, excess in nitrogenous food; 3, dyspepsia; 4, obstructed perspiration; 5, congestion of the kidneys (Golding Bird). Also imperfect respiration. Cold weather will precipitate urates sometimes from healthy urine.	Those of the causes. Sometimes also a slight burning feeling in passing water.	Treat the causes. Moderate animal food, plenty of exercise, fresh air, particular attention to the digestion, etc. Fredrickshall and Vichy waters.
	Urates.—Minute spheres with acicular spiculæ of uric acid projecting from them.			

NAME.	CHARACTERS.	CAUSES.	SYMPTOMS.	TREATMENT.
Oxalate of Lime.	Crystalline forms: 1, quadratic octahedra; 2, dumb-bell crystals.	"Nervous exhaustion;" dyspepsia, overwork; mental distress; excess of saccharine food or alcoholic liquors.	Those of the causes. Occasionally, loss of sexual vigor, or disorder of the sexual functions.	Treat the causes. Regular diet, exercises, etc. Mineral acids.
Phosphates.	1. <i>Phosphate of Lime</i> .—White, cloudy mass. Crystals: spherules, dumb-bells, rosettes, oblique hexagonal prisms. 2. <i>Phosphate of Ammonia and Magnesia (triple phosphate)</i> .—Crystals (large); triangular, truncated prisms, four-sided prisms, irregular six-sided plates; stellate crystals when ammonia has been added.	Alkaline urine is the immediate cause. It is caused by injuries and diseases of the bladder, especially paralysis and catarrhal inflammations; renal inflammation; spinal injury or disease. Nervous exhaustion; excessive use of alkalies; the alkalinity of the urine is said to result from the metamorphosis of urea into carbonate of ammonia.	Urine is offensive, and often contains muco-pus. Signs of causative disease.	Treat the causes. See DISEASES OF BLADDER, etc.
Carbonate.	Small and delicate crystalline spherules. Drumsticks.	The causes which determine the change of urea into carbonate of ammonia.	No special symptoms known. Deposit rare.	Treat the conditions which accompany it.
Blood.	Urine a dirty-red color; after standing, a slightly flocculent, brownish sediment. Heat coagulates the albumen. There may be blood enough to form a clot; then the urine is dark brownish-red. Or the blood may be quite unmixed with the urine.	1. Kidney disease. Calculi, congestion, inflammation, injury, scurvy, the Bilharzia capensis. Malaria may cause intermittent hematuria. Blood from the kidney is generally mixed uniformly with the urine, and forms blood-casts. 2. Bladder affections; injuries, stone, tumors. Blood from bladder often flows pure <i>after</i> the urine. 3. Urethra: blood pure and comes before or with urine, or without urine at all.	Those of cause. (Use Heller's test for blood.) Heat urine, then add KHO and heat again. The phosphates then fall down with the coloring matter of the blood. The sediment has a dirty-red color by reflected, and a splendid blood-red color by transmitted light.	Rest and internal styptics, <i>e. g.</i> , gallic and sulphuric acids, acetate of lead with opium. Dry cupping the loins also in renal hemorrhage. For vesicle hemorrhage use similar treatment and local remedies; ice to perineum and epigastrium and in rectum. Do not catheterize unless there is retention of urine. If the clots will not come away without interference, use, cautiously, Clover's exhausting apparatus for lithotomy, or a syringe, and full-sized catheter. Ruspini's styptic.
Pus.	Pus-corpuscles, under the microscope, are spheroidal and granular. The pus generally subsides as a dense layer of a "pale greenish-cream color," which can be mixed thoroughly with the urine by shaking. Not affected by acetic acid. Forms a translucent jelly when liquor potassæ is added. The urine is albuminous.	Abscess, ulceration, or merely catarrh of any part of the urinary passages. 1. Pus from the kidneys is usually diffused throughout urine passed. 2. Pus from bladder is mostly mixed with mucus. 3. Pus from an abscess is usually variable in quantity, and not equally diffused.	Those of the cause.	Treat the cause.
Epithelium.	Epithelial cells lining urinary passages. See works on general <i>Anatomy</i> . Often in form of casts.	Kidney disease. Ulceration or catarrh of bladder.	Those of cause.	Treat cause.

Fibrine is sometimes present in the form of flocculi. Or it may form fibrinous casts of the tubuli uriniferi. Echinococci cysts are sometimes found in the urine. Give turpentine in large doses. In cancer of the bladder cancer cells and *débris* are sometimes found in the urine.

Calculi.—There are seven mineral substances of which urinary calculi may be formed. A calculus may consist of several of these materials in layers or of one only. 1. Lithate of ammonia; 2, lithic or uric acid; 3, oxalate of lime; 4, xanthic or uric oxide; 5, cystic oxide; 6, phosphate of lime; 7, triple phosphate. The nucleus or center of each calculus may be formed first in the kidney or in the bladder, or it may be a foreign body. Poverty, certain localities, and the male sex are great predisposing *causes* of stone in the bladder. Negro race remarkably exempt.

Phosphate of lime and triple phosphate very rarely occur separately.

Fibrinous calculi smell of burnt feathers when burnt, and are stained bright yellow by nitric acid.

Uric acid forms the nucleus of most “alternating” calculi.

The nature of the stone, while still in the bladder, may be guessed at by considering the urine and any deposit from it. The urates are formed from acid, the phosphates from alkaline urine.

Symptoms of calculus in the bladder.—(Often so trifling as to attract no attention for a long time). 1. Pain radiating from bladder to perineum and in glans penis, especially after micturition; 2, riding or jolting may aggravate the pain by shaking stone about; less pain when prostate is much enlarged; 3, urine sometimes stops flowing suddenly; 4, frequent micturition; 5, in children, incontinence of urine; 6, blood in urine; 7, signs of vesical catarrh; 8, prolapsus ani; 9, priapism. Many of these symptoms are often absent.

TABLE OF CALCULI.

	PHYSICAL CHARACTERS, ETC.	CHEMICAL CHARACTERS.
Lithate of Ammonia.	Occurs rarely except in children. Gray, smooth, dusty, non-laminated appearance.	Soluble in boiling water. Add HCl to solution and you get a precipitate of uric acid. Heat with potassium carbonate; ammonia escapes. Blow-pipe burns it away.
Uric Acid.	Smooth or warty. Yellowish or brownish. Concentric structure.	Gives off no ammonia when heated with KHO. Evaporate to dryness with nitric acid. Cool, and add a little NH ₃ ; the characteristic deep purple-red murexide is then obtained. Blow-pipe burns uric acid away.
Oxalate of Lime.	Rough, warty, “mulberry” appearance. Very hard. Dark “blood stained.”	Easily soluble in nitric acid. Boil long in a solution of potassium bicarbonate, neutralize carefully with nitric acid; then white precipitates can be formed with solutions of lime, lead, or silver. Blow-pipe reduces it, first to calcium carbonate, to quick-lime. Heat on platinum foil and it chars. Then add HNO ₃ , and it effervesces.
Cystic Oxide.	Has a wavy appearance, especially when fractured. Changes color with age from pale yellow to brown, gray, or green. Extremely rare. Contains sulphur.	Dissolves, in great part, in ammonia; its solution then deposits, by spontaneous evaporation, six-sided prismatic and tubular crystals. Dissolve in strong caustic potash. Boil and add a little solution of lead acetate; a black precipitate of sulphide of lead falls.
Xanthic Oxide.	Section, lustrous bright brown. Most extremely rare.	Has a peculiar deep yellow color, when its solution in nitric acid is evaporated to dryness: characteristic.
Mixed Phosphates of Lime.	Chalky, soft, brittle, laminated.	“Fusible calculus,” melts in the blow-pipe flame. Dissolve in nitric acid and add excess of ammonia: white precipitate.

Sounding.—The sound should have a short, sharply curved beak, and is best hollow. Warm, oil, and introduce. Hold lightly and gently. Push backward and forward, and from side to side. Then turn point downward, to examine base of bladder. The finger in the rectum, or suddenly letting the urine flow through the sound, will sometimes assist. Points to be ascertained: 1, presence or absence of stone; 2, size; 3, number; 4, nature; 5, whether the stone is encysted or not; 6, state of bladder as to rugosity. Size and number are best found by seizing and measuring with a lithotrite. Nature best judged by considering the urine and the patient's age and constitution. Fallacies result from mistaking a fasciculated bladder, or the feel of some bony pelvic prominence, for a calculus. The stone should be heard as well as felt. A stone may be hidden away in a sacculus. It there keeps always in one position, and perhaps is only felt occasionally, or not at all. "The surgeon should always remember that when irritation at the neck of the bladder arises from stone, it is referred to the glans penis; when from disease of the bladder, to the organ itself; and when from a disease of the prostate, to the perineum or rectum" (Bryant).

Treatment.—1, Palliative: treat the complications, *e. g.*, vesical catarrh; recumbent position; decoction of triticum repens. 2, Operative: As lithotripsy is not yet of any value, refer to articles LITHOTOMY, LITHOTRITY, and LITHOLOPAXY.

Calculus in the kidney.—**Causes.**—*Vide* Table of Urinary Deposits.—**Position.**—They may occur as small infarctions in the tubules, or as stones of various sizes, single or multiple, in the pelvis or calices, often forming a cast of the pelvis and its offsets.

Symptoms and Course.—Pain in the back; blood, pus, or "gravel" in urine; sometimes intense pain (renal colic), caused by passage of a calculus down the ureter into the bladder; pyelitis.

Treatment.—When an abscess forms it has been found sometimes practicable and justifiable to cut down upon and remove the stone. For the renal colic, use opium boldly, chloroform, and warm baths.

Calculus in the prostate.—Origin: either descends from bladder, or forms first in prostate. Number, 1 to 100; size,

grain of sand to cherry stone; faceted; color various; consistence, various; structure, usually concentric layers; chemistry, phosphate (rarely carbonate) of lime; position, projecting into or near the urethra usually, but sometimes near circumference of gland, and occasionally even partly in bladder and partly in prostate.

Symptoms.—Those of irritation, inflammation, or abscess of the prostate, according to their effect; semi-erection of penis, and difficulty in seminal ejaculation. Calculus can possibly be felt by sound in the urethra or finger in rectum.

Treatment.—Remove, if possible, by urethral forceps, or operate as for median lithotomy; but do not operate when the calculi are small, very numerous, or only to be felt per rectum. When operating, see if there be any calculus in the bladder also.

Calculus in the urethra.—Usually descends from bladder, but may be formed *in situ* (then usually behind a stricture).

Symptoms.—Pain, obstruction, or retention of urine. If not relieved, dilatation of urethra, extravasation, abscess, and urinary fistula, through which stone may pass.

Treatment.—1. Push forward with finger and thumb; 2, extract with urethral forceps, wax bougie, or some specially devised instrument, if necessary slitting up meatus urinarius; or, 3, push back stone to posterior part of urethra, and do median lithotomy. If there is not serious obstruction, a little patience will sometimes allow the urine to wash the stone right to the meatus within twenty-four hours. In other cases delay is highly dangerous.

Calculus in female has, besides many of those of male, these special symptoms, viz., 1, bearing-down pains; 2, incontinence of urine. Diagnose carefully from uterine disease, by sounding and vaginal examination.

Prognosis.—Liability to ulceration into vagina, and consequent vesicovaginal fistula.

Treatment.—Remove calculus. Three classes of methods, viz., 1, urethral dilatation; 2, lithotritry; 3, lithotomy. The dilatation is best done with a screw, three-bladed dilator. *Vide* also articles LITHOTOMY and LITHOTRITY. Danger of incontinence if the urethra is dilated too much. The limits of size for dilatation

should be a diameter of one to one and a half inch for adults and half as much for children. Slow dilatation is almost always followed by incontinence.

C. B. KEETLEY.

Symptomatic Indications.—*Berberis* is useful to relieve the pain, particularly when with blood-red urine, depositing a copious, slimy, red, bran-like sediment. *Calcareo carb.* is also valuable in giving relief to the pain. Often more effective than chloroform. *Gelsemium* for spasm while passing. *Lithium citrate* increases the action of the kidneys and assists in washing out gravel.

CANCER.—The term is commonly used as if synonymous with “malignant,” and therefore including other new growths besides “carcinomata.”

Characters of malignancy.—A cancer tends to 1, infiltrate neighboring tissues; 2, recur; 3, affect lymphatic glands; 4, be followed by secondary deposits; and if the cancer be left long enough, all these four events are pretty sure to take place. Cancers also tend to soften and ulcerate, and “there is scarcely a tissue or an organ which they may not invade.”

Causes.—There can be but little doubt but that hereditary influence has some effect in this as in the liability to most other diseases. Still the cancer at its origin is probably local, and various local irritations, such as blows, smoking clay pipes, decayed and rough teeth, etc., can often be traced as exciting causes. Soft cancer occurs chiefly in youth, hard cancer in middle age. It is certain that affections, at first pure chronic inflammations in their nature, sometimes pass into cancer.

Symptoms.—Those of a new growth differing from an innocent tumor in more or less of the following characters: 1, It tends to infiltrate; 2, to involve neighboring tissues; 3, to attack neighboring lymphatic glands; 4, it grows more rapidly than innocent tumors; 5, it is usually more painful; 6, it tends to soften and ulcerate; 7, it has the peculiar features of one of the varieties of cancer.

Prognosis.—*Vide* CANCER OF BREAST, etc.—Epithelial cancers kill, on the average, in fifty-three months; scirrhus in thirty-two (Sibley). Soft cancer is still more rapid. Cancer kills by, 1, hemorrhage; 2, interference mechanically with

vital organs; 3, general infection of blood and consequent cachexia, etc.

Histology.—Every cancer consists of cells lying in the interstices of a network of fibrous tissue; the network may be close or open, strong or weak; the cells are of two kinds: one, the larger, are of epithelial origin; the other, the “small cell formation,” of connective tissue origin. It may here be mentioned that the cells of a sarcoma are all of connective tissue origin, and primarily directly connected with the meshwork in which they lie. *Vide* special varieties of cancer. Cancer juice is a fluid containing cancer cells and often oil particles and *débris*.

Varieties of cancer.—Some of the sarcomata, and, indeed, exceptionally almost any kind of tumor, may have most of the characters of malignancy. In these cases the characters are usually so modified as to cause a condition spoken of as “semi-malignant.” But most cancers are *carcinomata*. There are five varieties of carcinoma, viz.: 1, hard; 2, soft; 3, colloid; 4, squamous (ordinary) epithelial; 5, cylindrical epithelial cancer; besides villous, melanotic, and osteoid cancers.

Cancer, hard, scirrhus.—The fibrous, part preponderates over the cell elements.

Pathology.—Hard, section concave, white or gray, dotted with yellow points; no defined margin; juice. Either tuberos or infiltrating; “tuberos” means “forming a distinct nodule.” When infiltrating, the neighboring parts are hard, adherent, and often drawn in; infiltration of skin with tubercles a very valuable clinical symptom. Parts of the cancer often atrophy, or even slough. The cancerous ulcer is irregular, fetid, with thick hard edges.

Locality.—Breast, skin, rectum; found also in testicle, tonsil, eye, etc.

Cancer, soft, encephaloid.—Fibrous part small; cells abundant; special characters of other varieties absent; not distinct in nature from scirrhus. If a scirrhus be removed, cancer often recurs as encephaloid. Consistence, often as soft as, or even much softer than, brain; color, white, creamy, or blood-stained. When connected with bone or periosteum, liable to contain bony plates or even a complete bony framework; often contains large blood cysts; may be encapsulated; soft and fluctuating. Puncture

lets out blood and often cancer-juice as well. May ulcerate and fungate as a bleeding mass; grows fast and is covered by large cutaneous veins, owing to its obstructing deeper veins; large vessels and nerves not generally compressed; amount of pain, variable; "cancer of young life."

Locality.—Bones, female breast, eye, testicle; attacks also uterus, bladder, etc.

Cancer, colloid.—**Alveolar cancer.**—Its carcinomatous nature doubtful; consists of a stroma of wide meshes, with rounded or oval nuclei; meshes contain a jelly-like substance, besides cells, some of which have concentric laminæ like an oyster shell; to the naked eye this cancer has a markedly jelly-like appearance.

Locality.—Peritoneum, ovary, breast, limbs, parotid, rectum; in alimentary canal, it is said to arise from Lieberkuhn's follicles.

Cancer, squamous epithelial, or ordinary epithelioma.—Least malignant of the carcinomata; cells flattened like those of epidermis; tendency to arrange themselves in "nests." First appearance, usually a hard lump or wart, which may be dry for a long time, but usually ulcerates sooner or later. Ulcer has hardened, elevated edges, and often an excavated base; occasionally cauliflower-like; glands slow to be affected; infection of the system slower still.

Locality.—Places where skin and mucous membrane meet, *e. g.*, lips, eyelids, anus, etc.; also warts on the skin, back of hand, front of leg, prepuce (from irritation of soot), tongue. Life usually destroyed by local causes. Cancer should be removed, even if glands are somewhat enlarged; for the enlargement may be merely the result of irritation or inflammation. If done early, there is fair hope of non-recurrence.

Cylindrical epithelial cancer occurs in mucous membranes. Both primary and secondary deposits contain cylinders of cylindrical epithelium, like the structure of mucous membrane itself.

Villous cancer.—*Vide* DISEASES OF BLADDER.

Osteoid cancer.—Here not only the primary tumor has a skeleton of bone, but bone also appears in the secondary deposits.

Melanotic cancer is simply cancer with deposits of pigment in the cells. Its primary seat is usually a part origi-

nally highly pigmented, *e. g.*, a dark mole. May be either carcinoma or sarcoma.

Treatment of cancer.—Constitutional.—Tonics, especially iron. Anodynes necessary in latter states. Diet ample and nutritious.

Local treatment.—Support and rest when not actually interfering with it; layer of cotton wool and bandages; iodine, opium, and lead retard growth of tumor; amadou plaster; for sloughing, a bread poultice with powdered charcoal; terebene; wash ulcers with a weak solution of zinc chloride and laudanum; tepid lotion of chlorate of potash to be used frequently; lotion of citric acid said to be sedative to epithelial cancers. For œdema of a limb caused by pressure, soft bandages. For hemorrhage, perchloride of iron, or ligature of any bleeding artery, or bathing with water as hot as it can be borne. For pain, extract of belladonna with glycerine, locally. Apply to a painful cancerous sore, morphia and glycerine on lint, or iodoform; chloral or morphia internally.

Question of operating.—Objects of operation: 1, to prolong life; 2, to give an interval of ease and usefulness. Reasons for not operating: 1, unhealthy condition of patient, *e. g.*, severe kidney or lung disease; 2, diffusion and wide infiltration of a cancer; 3, cancerous cutaneous tubercles; 4, disease of glands which cannot themselves be removed; 5, considerable adhesion of a scirrhus breast to pectoral muscle; 6, more than one tumor (except in rare and chronic cases); 7, cancers beneath scalp. If the conditions are favorable, the sooner the cancer is removed the better. It should be removed freely, the neighboring parts carefully examined, and in many cases treated with caustic, *e. g.*, zinc chloride (gr. xx to i). Suspicious glands should be removed entire. Ecraseur instead of knife in cancer of tongue, neck of uterus, etc.; galvanic cautery to cancers of the skin; caustics; Maisonneuve's caustic arrows; injection of dilute acetic acid (1 to 3), its efficacy doubtful. Injection of bromine in alcohol (m. v to i). Esmarch and Billroth have treated cancer, with some success, by increasing doses of arsenic, long continued.

C. B. KEETLEY.

Symptomatic Indications.—The most useful remedy in the various forms of

cancer, undoubtedly is *arsenicum*. In cancer of the stomach it diminishes the pain and checks the vomiting; perseveringly used it is reported to have arrested the growth and gradually dispersed the tumor. In epithelioma it relieves the pain and retards the growth. Sharp, burning pains; thin, bloody, excoriating discharge, and extreme sensitiveness to cold air, characterize this remedy. Scirrhus indurations; cancerous ulcers, burning when touched, are relieved by *belladonna*, which is very effective in palliating the severe cancer pains. *Conium* is specific for scirrhus indurations of the mammary gland, after injury. Firm, hard tumor in the breast, which is sensitive before the menses, with dull aching pains, which come on at night and are better from warmth and motion, are the indications for conium. Cancer of the breast following mastitis; with burning, stinging pains is relieved by *apis mel.* *Aurum met.* is valuable in cancer of bones, with nightly pains. *Silicea* in scirrhus indurations, bony outgrowths resembling sarcoma. *Hydrastis* acts particularly upon the digestion, improving the general condition. Externally applied it diminishes pain, retards ulceration, and lessens the discharge. *Calcarea silicate* perseveringly used is efficacious in abating the pain and causing the withering of cancerous growths.

CANCNUM ORIS (Gangrenous stomatitis; noma; gangrenous ulceration of the mouth).—*Symptoms*.—As the disease is frequently unattended with pain, it may often have made much progress before it is discovered. Usually, the first thing that is noticed is a brawny swelling in the substance of the cheek; this softens and breaks down, and ulceration occurs on the inner aspect of the cheek; in very exceptional cases it may commence on the outer surface. The breath becomes horribly fetid, there is a sanious discharge, a sloughing ulcer is seen in the cheek, which may even be perforated, and there is enlargement of the lymphatic glands.

In spite of the severity of the local mischief, the child apparently suffers little pain and takes food readily. Symptoms of great prostration soon set in, the pulse becomes very rapid and almost imperceptible, and the patient dies from exhaustion or blood poisoning.

Diagnosis.—The appearances are so characteristic that the diagnosis is readily made.

The *prognosis* is almost absolutely unfavorable.

Pathology.—By Hutchinson the disease is regarded as allied to, or identical with, hospital gangrene and syphilitic phagedena. In severe cases the gangrene, after perforating the cheek, may spread in all directions, involving lips, tongue, alæ nasi, and eyelids, and causing exfoliation of the teeth and portions of the jaw.

Etiology.—Cancnum oris is chiefly met with in children between the ages of one and five, convalescing from the acute specific diseases, especially measles. The surroundings of the patient are almost invariably insanitary.

Treatment.—The only hope of cure lies in the early and free destruction of the gangrenous surface with fuming nitric acid, the patient being anæsthetized. The use of antiseptic lotions for the mouth, and the administration of chlorate of potassium, tonics, and stimulants may subsequently be of service.

F. DE HAVILLAND HALL.

Symptomatic Indications.—The principal, and usually the only remedy required, is *arsenicum*, which covers the extensive disorganization and prostration associated with the disease. Intense burning, great restlessness, constant thirst, characterize this remedy. *Apis mel.* is indicated by the continuous extension of the erysipelatous inflammation, burning, stinging pains. *Belladonna* by bright redness of the inflamed part, with throbbing pains, drowsiness, with inability to sleep. *Hydrastis* will improve the general condition by acting upon the digestive organs.

CANITIES (Poliosis), or grayness of the hair, is an acquired condition caused generally by the gradual cessation of formation of the natural pigment, or, exceptionally, by the sudden disappearance of existing pigment. Senile canities is almost a physiological process; it usually begins in the temporal region or in the beard.

Premature canities is frequently hereditary; it may result from neuralgia, worry, or overwork, may complicate alopecia areata and leucoderma, or may follow acute diseases, especially scarlatina. In summer the follicles may resume their pigment-producing function

to some extent, and complete recovery occasionally takes place. In exceptional cases the hairs are "ringed"—*i. e.*, present alternate colored and colorless zones.

Under the influence of strong emotion, specially fear, sudden whiteness of the hair may show itself within a few hours, due either to great increase of the quantity of hair normally present in the hair-shaft, or to some sudden change in the constitution of the sweat, giving it an extraordinary bleaching power.

The only *treatment* consists in the use of suitable dyes; those containing a solution of nitrate of silver, followed by sulphur, to give a light color, or by pyrogallie acid, to give a darker tint, are probably harmless.

J. J. PRINGLE.

CANTHARIDES, POISONING BY.

—The *symptoms* are those of an active irritant poison; burning in the mouth and a sense of constriction in the throat are noticed at once, followed by pain in the epigastrium, great thirst, difficulty in swallowing, salivation, vomiting, and the passage of blood in the stools. Pain in the loins, frequent calls to micturate, and violent tenesmus of the bladder (*strangury*), are prominent symptoms following upon the absorption of the poison. The urine may contain blood, or the secretion may be suppressed. Swelling of the genitals (priapism) in the male, and in pregnant women a tendency to abort, are symptoms occasionally present. Conjunctivitis, lachrymation, and blisters in the mouth have been noticed in some cases. Death may take place from coma or convulsions.

Post-mortem appearances.—The powder may be found adhering to the mucous membrane of the stomach, and may be recognized by its glistening appearance; there will be intense inflammation throughout the whole or part of the alimentary canal, and the kidneys and bladder will also be inflamed.

Treatment.—The indication is to get the poison out of the body as speedily as possible; the stomach must be washed out thoroughly if an instrument for the purpose be at hand; if not, an emetic of sulphate of zinc (grs. xxx, in water) or mustard (a tablespoonful of the powder in water) should be administered. Barley water, white of egg and water, or lin-

seed tea, may be given freely, but oil should be avoided. Opium or morphine is of great service, and stimulants may be necessary.

CARBOLIC ACID, POISONING BY.

—*Symptoms.*—A burning and disagreeable taste in the mouth, vomiting, cold perspiration, small pulse, and faintness are among the early symptoms. The pupils become contracted and insensible to light, the breathing shallow, and the patient loses consciousness. Convulsive twitchings and a lowering of the temperature are often present. The urine is of a deep olive-green color, turning black on keeping, and having no tendency to decomposition. Death, when it occurs, takes place rapidly, and is due to failure of respiration.

Post-mortem appearances.—The mucous membrane of the mouth, throat, and gullet will be white, sodden, and sometimes eroded; there will be brownish stains about the mouth; the mucous membrane of the stomach, and to a less extent of the small intestine, may be thickened and corrugated; the bronchi will be inflamed, and the lungs somewhat congested. The vessels of the brain, the right side of the heart, the liver, spleen, and kidneys will be congested. All the viscera will smell of the poison, and putrefaction will be delayed.

Treatment.—The stomach should be thoroughly washed out with soda or saccharated lime dissolved in large quantities of tepid water until the fluid returned is free from odor, or nearly so. A solution of Glauber's salts or Epsom salts may then be left in the stomach. Olive oil and white of egg may be given freely; stimulants and warmth externally will probably be required. If there be a marked degree of coma, the treatment should be as in narcotic poisoning.

CARBUNCLE.—An acute localized inflammation of the true skin, differing from that in furunculus by the multiplicity of the cores and by the liability of the intervening skin and the subjacent tissues to slough. The constitutional symptoms are usually severe.

Symptoms.—Carbuncle begins as a flattened, slightly elevated swelling of the true skin, slightly red in color, and attended with severe pain and marked fever. Usually there are several points

of intense inflammation, that lead to necrosis of the tissues and the formation of "cores." Considerable inflammatory infiltration surrounds the little nodule. As in a boil, suppuration soon commences; but, as the cores usually form only the superficial indications of more extensive subcutaneous sloughs, it has to continue a long time before they are separated, during which lymphangitis, cellulitis and septic absorption, giving rise to pyæmia, may occur.

Carbuncles appear most frequently on the nape of the neck, buttocks, and external surfaces of the limbs; they occasionally arise on the face and lips, in which situations the liability to phlebitis and fatal septicæmia is very great. They are usually solitary, but sometimes are multiple, and not infrequently a succession of them appears in different parts of the body. They can only be mistaken for a collection of boils which have become confluent. The more intense pain and constitutional symptoms, the more extensive subcutaneous necrosis, and the greater proneness to sloughing of the skin will serve to distinguish.

Prognosis.—Being an affection of serious import, it is especially grave in those suffering from exhausting diseases or in a cachectic condition, however produced. The intense pain, causing sleeplessness, the nervous exhaustion, severe fever, and prolonged suppuration, with the special liability to septicæmia, in carbuncle of the face and lip, are all elements which intensify the danger in proportion as they are well marked.

Treatment.—An abundant, nutritious, and easily digested diet, with stimulants in proportion as the patient is depressed or debilitated, is essential. Iron and quinine, or ammonia and bark, as for boils should be given. Of local treatment the free crucial incision, the subcutaneous incision of the nodule, and cauterization with potassa fusa are advised. In the early stages the application of cold, by means of ice bladders, will check the extension of inflammation and subsequent suppuration. Poultices and warm poppy fomentations, with some antiseptic, such as carbolic acid or thymol, to lessen the risk of septic absorption and to promote the separation of the sloughs, are undoubtedly useful. These measures are quite as efficacious

as the more active treatment mentioned. MALCOLM MORRIS.

Symptomatic Indications.—*Belladonna* followed by, or alternated with calcium sulphide is the principal remedy in the early stage, relieving the pains and forming a favorable issue. Malignant cases, with fever and prostration, require *arsenicum*. Prostration without nervous or vascular erethism, *lachesis*. *Silicea* checks and controls suppuration; clears wound of dead matter and promotes healthy granulation. *Bryonia* is useful in indolent cases, hastening suppuration. *Cinchona*, for exhaustion from excessive suppuration, or when symptoms of blood poisoning appear.

CARMINATIVES are used to relieve griping pain, the result of flatulent distension of the stomach or intestines, or to prevent the pain which may arise from the administration of certain purgatives. The chief are the essential aromatic oils, ether, camphor, chloroform, ammoniacum, and the aromatic bitters. Such remedies are generally most efficacious when given in moderate doses and at short intervals.

CARPHOLOGY.—A condition characterized by plucking at the bedclothes, and other movements of the hands, occurring in the delirium which often accompanies the later stages of febrile affections. It is generally regarded as an unfavorable symptom. The term "flocitatio" was formerly used to describe the same condition.

CARPO-PEDAL CONTRACTIONS.—A condition met with in young infants. The fists are clenched, the thumbs being bent on the palms and covered by the fingers; the toes are flexed, and the feet arched. There is also flexion of the elbows and knees. This condition may be taken as an indication of a tendency to convulsions, and is not infrequently associated with dentition or the presence of thread worms. Another variety will be found described under the head of TETANY.

CARIES.—See BONES, DISEASE OF.
CARPAL BONES, DISLOCATION OF.—See DISLOCATIONS.

CARTILAGES, LOOSE. — See JOINTS, DISEASES OF.

CASTRATION.—Required for malignant or other hopeless disease of the testicle. Scalpel; forceps; artery forceps; catgut ligatures for scrotal vessels; whipcord ligature for cord; suitable dressings. Hold testicle in left hand so as to tighten the scrotum; incise skin, etc., from external abdominal ring to bottom of scrotum, so as to expose testicle; pull down the cord, and put whipcord ligature tight around it. In cancer cases, dissect upward, and tie cord as high up as is safe. Cut cord a quarter of an inch below ligature; a touch or two of knife then liberates testicle.

Prognosis.—Operation very safe. Peritoneal process has been opened in a child, causing fatal peritonitis.

C. B. KEETLEY.

CASTS, URINARY.—This term is applied to cylindrical bodies having the appearances of molds of the renal tubes. When present in large numbers, they form, on standing, a small deposit visible to the naked eye. To find them, this deposit must be very carefully examined (*vide* URINE, EXAMINATION OF). The addition of a little staining fluid, such as osmic acid or fuchsin, will render the paler varieties more distinct. Oblique illumination should be employed.

Characters.—Casts vary considerably in size, shape, and general appearance. In *length* they range from a mere fragment to 200 μ or more; in *diameter* from 4 μ to 40 μ ($u = \frac{1}{1000}$ millimeter = $\frac{1}{25000}$ inch; diameter of red blood disk = 7.5 μ). The large majority fall into one of two groups: (1) those of 10 to 15 μ diameter, called "small," and (2) those of 25 to 40 μ , called "large." In *shape* they are generally straight or slightly curved cylinders, but sometimes much twisted, convoluted, or fissured. As a rule there is a fractured surface at each end, but occasionally these are round, or, much more rarely, tapering. The outline is for the most part distinct and sharp, but has more of the highly refracting characters of a vegetable fiber.

The more characteristic appearances, and hence the names, vary according to the tissues embedded in the mold or cast, which essentially consists of a homogeneous, almost invisible matrix. Thus there are *epithelial* casts, containing scattered patches of more or less altered renal epithelium; *blood* casts, with red blood

disks in their interior; *pus* casts, studded with degenerate leucocytes; *fatty* casts, with fat globules singly or in groups; *granular* casts, with finely divided granular *débris* either in scattered masses or completely filling the cast; *hyaline* casts, clear and transparent, with a few lateral fissures, but homogeneous in structure. Others are named according to the belief held concerning their origin—*e. g.*, *waxy* casts, which give the albuminoid reaction, and *mucous* casts, probably made up of mucus.

MODE OF FORMATION.—The diameter of a cast depends on that of the tube in which it is formed. Not only does this vary within wide limits in different parts of the cortex and pyramids, but it may be indefinitely increased by loss of the epithelial lining or by dilatation of the tubes themselves. The convoluted tubes are supposed to be the chief sites of cast formation from the shape of the casts, because blood and pus cells would be more readily accessible in the neighborhood of the glomeruli, also from the fact that fatty degeneration of the epithelium has not been observed elsewhere, and, because, after death, casts are found as plentifully in the convoluted as in the collecting tubes.

Significance.—The diagnostic significance of their presence must mainly depend upon clinical experience, which may be summarized: (1) If the prevailing type of cast be of the "blood" or "epithelial" varieties, acute nephritis, either primary or supervening on chronic disease, is the probable condition. (2) Fatty casts occur during convalescence from acute nephritis, or in cases where that condition has become chronic. Their persistence points to the latter alternative. (3) Granular casts are possible in acute disease, but are generally found in large numbers in cases of contracted kidney. (4) Blood and pus casts in cases of pyelitis show that the kidney substance is also involved. (5) Hyaline casts may be found when there is no other evidence of disease. (6) Casts are found in largest number when active inflammatory changes are taking place in the tubules—that is, in cases of acute or sub-acute nephritis.

H. MONTAGUE MURRAY.

CATALEPSY is a morbid state of the central nervous system, characterized

by a condition of muscular contraction known as *flexibilitas cerea*. This is such that there is no voluntary movement and no opposition to passive movement of the limbs or body in any direction; and along with this there is a power of retaining for an indefinite time any position imposed, much longer than is found possible by voluntary effort in health. Such a condition is exceedingly rare unless accompanied by other nervous disturbance, most commonly by more or less complete anæsthesia, loss of memory, and unconsciousness. In primary cases, where catalepsy is the chief symptom of disease, its onset is rapid. It is met with in subjects of from twenty to thirty years of age, both men and women, of nervous temperament, and follows emotional excitement or exhaustion. It may fix its subject motionless or speechless in the midst of action or speech, and release him only after some minutes or hours, without memory of the interval, to finish what he was engaged upon. Of any constant electrical changes in the nerves or muscles during the attack there is no satisfactory evidence, and beyond the abnormality of contraction and anæsthesia there may be little noteworthy in the physical condition during the attack; more probably there will be a weak pulse, slow breathing, and open, staring eyes. Now and then such a state has been known to last several weeks, and artificial feeding has been found possible; the temperature, however, being reduced, the functions somewhat in abeyance, and the patient needing little nourishment. More often there are groups of less severe attacks, each lasting a few minutes, in which some periodicity may develop itself.

The cataleptic state is found, although rarely, as a symptom of importance in many diseases. It has ranked as a twin sister to hysteria, and is frequently intimately associated with its other symptoms; hystero-catalepsy may alternate with hystero-epilepsy, or hysterical chorea (Charcot); it occurs with tetanus and various forms of mania and melancholia (cataleptic torpor), though it ceases when they have degenerated into dementia. It is a grave though very rare symptom in some acute diseases, such as typhoid fever, ague, and pneumonia. It belongs to the symptoms contagious by involuntary imitation, as in the religious epidemics of the Anabaptists in 1686, and

of the Calvinists of St. Médard in 1731. It often forms a part of the hypnotic state (*see* HYPNOTISM), and may then follow on gentle pressure upon the closed eyes of sensitive subjects or on suddenly exposing them to a bright light. In this way, by unilateral action or suggestion, an artificial hemicatalepsy may be induced. By itself it has no serious consequences, but it may be very inconveniently persistent. Primary attacks often terminate in some small crisis, as epistaxis or menstruation. They can rarely be cut short by cold water, faradization, massage, or other treatment, but their recurrence may be gradually prevented by an active life, change of scene, moral stimulus, and encouragement. The pathological condition is as yet unknown.

A. T. MYERS.

Symptomatic Indications.—The remedies which have been successfully used in this condition are: *Artemesia vulgaris*, catalepsy in consequence of fright. *Cannabis indica* presents in its action a perfect picture of catalepsy. *Curare*, catalepsy, with spasm of the lower jaw. *Platina*, catalepsy with full consciousness, in persons who are laboring under violent sexual erethism. *Stramonium*, catalepsy caused by religious excitement or by excesses in venery.

CATARACT is an opacity of the crystalline lens. Various classifications are used. The following is perhaps the best: (1) central; (2) cortical; (3) lamellar; (4) capsular; (5) traumatic; (6) secondary.

1. **Central or nuclear.**—Opacity begins at center and shades off toward circumference. It mostly occurs in old people, when it is hard at the center and of amber color. When occurring before the age of thirty-five it is softer and whiter.

2. **Cortical or radiating.**—Opacity begins at surface of lens as triangular or pyramidal streaks pointing toward center. When advanced they involve whole structure of lens.

3. **Lamellar or zonular.**—Opacity consists of a shell-like layer deposited within the substance of the lens at a variable distance from its surface. It occurs in very young subjects (one to three months), and is sometimes congenital; the subjects of it frequently suffer from infantile convulsions.

4. **Capsular.**—(a) *Pyramidal*; (b) *posterior polar*. (a) *Pyramidal*.—Occurs as a very white, well-defined opacity on front part of lens, just beneath the capsule. It is generally caused by ulcer of cornea following purulent ophthalmia, and, consequently, is generally associated with opacity of cornea. (b) *Posterior polar*.—Begins at posterior part of chief axis of lens, and radiates; generally associated with disease of choroid and vitreous.

5. **Traumatic.**—Follows wound of the lens capsule, by which the aqueous humor is admitted to the lens substance, causing swelling, opacity, and final absorption of this, and leaving only a chalk-like deposit upon the remaining capsule.

6. **Secondary cataract** is so-called when it is the result of some other local disease, as glaucoma, irido-cyclitis, etc., or of some general disease, as diabetes mellitus.

Any combination of the above forms would be called a mixed cataract. The degree of hardness of a cataract depends chiefly upon the age of the patient, all cataracts occurring before the age of thirty-five being "soft."

Diagnosis.—Gradual failure of sight without local inflammatory symptoms is a subjective indication of cataract. A grayish appearance of the pupil is often observed in old people, which is not due to cataract, the lens being transparent. When the presence of cataract is suspected the pupil should be dilated by atropine and examined. (1) By daylight diffused rays condensed upon the pupil with a convex lens. (2) By gaslight in a similar way. These will give a white, amber-like, or brownish appearance of lens. (3) By the ophthalmoscope, when the opacity of lens will appear as dark patches, streaks, or a central nucleus; the red choroidal reflex will only be observed inversely as the amount of opacity. In lamellar cataract, a well-defined shell of opacity appears, surrounded by a clear (cortical) layer of lens substance, through which the bright red choroidal reflex is observed. When any portion of the lens substance remains clear, note should be made as to the state of the vitreous, optic disk, retina, and choroid, with a view to probable fitness for future operation. Opacities of cornea will also appear as dark patches with ophthalmoscope, and may be seen by superficial examination. Opacities of vitreous appear as moving

bodies, and are distinguished by their continuing to move after the patient's eye has suddenly come to rest.

Treatment.—In early stages of nucleus cataract the sight may often be improved by moderate dilatation of the pupil by atropine. Use atropine drops gr. iv ad $\frac{3}{4}$ j once or twice a week. Dark spectacles may be worn to favor dilatation of the pupil. In lamellar cataract patient can often see fairly well. When vision is seriously impaired and the margin of translucency is wide, make an artificial pupil by iridectomy; when the margin is narrow, perform the operation of solution, or of extraction. In forms other than lamellar, sight can be restored only by one of the following methods of operating on the lens: (1) Extraction; (2) needle operation; (3) suction.

1. **Extraction.**—Various methods are in use at the present time, but all have the following common points: (1) An incision in the cornea or at the junction of the cornea and sclerotic, or in the sclerotic just beyond the cornea, sufficiently large to allow exit of lens. The incision is usually made with Von Graefe's straight knife. (2) Iridectomy is very frequently performed, either as a second stage of the operation or two or three weeks previously. This is done to lessen the danger of iritis, which more frequently follows the older operation in which iridectomy was not performed. (3) The capsule is freely ruptured by a sharp-pointed instrument introduced through the corneal wound. (4) The lens is removed through the torn capsule, either by pressure and manipulation outside the eye, or by means of a scoop passed behind the lens. The chief types of operation for extraction are; (1) *Graefe's modified linear* or *peripheral linear*.—Here the incision is made with a long, narrow knife, slightly beyond the sclero-corneal junction, involving conjunctiva and forming a small arc of a circle larger than the cornea; the plane of incision forms a large angle with that of the iris. Iridectomy follows the incision. (2) The incision has nearly the same curve as the above, but is not carried so far toward sclerotic, being mostly in the cornea. Iridectomy is not usually performed here. (3) *Flap operation* (old).—Incision just within margin of cornea, and concentric with it, equal to half its circumference, and parallel to plane of iris. Beer's triangular

knife. No iridectomy. Disadvantages of modified linear operation: frequent hemorrhage into anterior chamber. Greater risk of loss of vitreous. Risk of irritability from prolapse of iris into corners of wounds, and of sympathetic ophthalmitis in the other eye. Disadvantages of the old flap operation: the large flap is liable to gape or fall forward, causing sloughing. Frequent prolapse of iris. Frequent severe iritis. After treatment for either of these methods, keep the patient in bed for a week. Apply a piece of soft linen to the closed eyelids, and a pad of cotton-wool over this to both eyes, and secure by a four-tailed bandage. Keep the room nearly dark. Remove dressing, and gently cleanse the lids with warm water twice daily, just separating their edges to allow escape of tears that may be retained. Use one drop of atropine solution daily after the third day to prevent iritic adhesion. During the first few hours there will be some soreness, and the first dressing a little blood-stained; after this there should be no pain, and only a little mucous discharge. If doing well there will be slight congestion, but no chemosis, edges of wound united, and pupil black. Discontinue bandage after eight or ten days, and order a large shade.

2. *Needle operation for solution.*—(1) Dilate pupil by atropine. (2) Give anæsthetic unless the patient is old enough to control himself well. (3) Hold lids open by stop-speculum, and use fixation forceps to steady globe. (4) Direct a fine cataract needle to a point just within the margin of the cornea, plunge freely and obliquely through into anterior chamber, and carry point to center of pupil. (5) Dip point of needle back through the capsule into superficial layers of lens at center, make a few gentle to-and-fro movements, so as to break up its substance, then steadily withdraw the needle.

After treatment.—Dilate the pupil with atropine (gr. iv ad $\frac{3}{4}$ j) three times daily. Bandage the eye lightly, and employ dark room for several days. In case of iritis apply leeches to region of eye, and ice or evaporating lotions to lids. The result varies with the amount of the opacity of the lens. In cases of complete cataract no change will be observed for some weeks after operation. In partial cataract the ruptured portion of the lens will become opaque and swollen in a few

days, and in seven weeks the lens will be smaller. After six to eight weeks, if the eye be perfectly quiescent, and not otherwise, the operation may be repeated, and the needle used more freely. A third or fourth operation may be required.

3. *Suction operation.*—Only applicable to soft cataract, and requires great skill in its performance, to avoid danger of iritis, or cyclitis. (1) Dilate pupil with atropine. (2) Make oblique opening in cornea with a broad-cutting needle between its center and its margin, and lacerate capsule freely. (3) Withdraw needle and pass nozzle of syringe through wound, and dip into lacerated lens substance. In lamellar cataract, and some other cases, it is necessary to allow an interval of three days between the needle operation and the suction, in order that the lens may be softened by the admission of the aqueous. (4) Use very gentle suction, and remove if possible the whole of lens substance at one sitting.

After treatment is the same as for needle operation (but in the case of waiting, careful watch must be made, and suction performed at once if inflammation be set up by the rapid swelling of the lens).

When to perform extraction.—The more complete the opacity of the lens, the more easily is it shelled out of its capsule; while in immature cataract some of the transparent lens substance is apt to remain, this will become opaque and may interfere with the result of operation. The signs of this "ripe" condition are: (1) No shadow of iris thrown upon lens within the pupillary area. (2) No chloroidal reflex with ophthalmoscope. (3) Patient is able to distinguish light from darkness, but is unable to count fingers when held up before the eyes. When one eye only is affected, or when one is less affected than the other, extraction should be deferred until the better eye is no longer useful, unless for special reasons. When both cataracts are mature, only one should be operated on at a time, with an interval of a few months. When there is no perception of light do not operate, as cataract alone is not sufficient to prevent this.

Occasional results of extraction.—1. Sloughing of cornea, very rare since flap operation was abandoned. 2. Suppurative inflammation extending from wound to the whole cornea, iris, and vitreous,

variable in degree, but, when established, generally going on to suppurative panophthalmitis, or to severe plastic irido-cyclitis with corneal opacity and contraction of eyeball. 3. Iritis of a plastic nature which deposits a membrane in pupillary area. 4. Prolapse of iris into the wound either at the time of operation or afterward.

Conditions of sight after operation.—Results are good when, with the aid of proper spectacles, patient can read any of Snellen's test types from No. 1 to No. 14 at 22 centimeters (8 inches), and from No. 6 to No. 24 at 6 meters (20 feet). The operation renders the eye very hypermetropic for want of the lens. Very strong convex glasses are required to compensate for its absence. Glasses should not be worn for three months after operation, and then not continuously at first. Two pairs of spectacles are needed, one pair making the eye emmetropic and giving clear vision for distant objects (about + 12 diopters), the other pair stronger, to render the eye myopic, so that the patient is able to read, etc., at about 8 or 10 inches (about + 16 diopters).

HENRY JULER.

Symptomatic Indications.—The following remedies will be found useful according to the indications given: Cataract from mechanical injuries, *arnica*; after acute inflammation of the eyes, *belladonna*. Scrofulous individuals, *calcarea carb.* Specks on the cornea, from hard drinking, *cannabis sat.* Constant inclination to touch and rub the eye, which seems to relieve the pressure in it, *causticum*. Traumatic cataract, old persons, *conium*. After inflammation of the eye, preceding ringworms, *silicea*. After cutaneous eruptions, especially suppressed itch, *sulphur*.

CATARRH signifies inflammation of a mucous membrane with increased secretion of fluid from that membrane. The term is generally reserved, when used by itself, for catarrh of the mucous membrane of the nose, throat, and larynx, constituting what is popularly termed "a cold." It usually follows a wetting or exposure to cold of some kind, and may or may not be preceded by chilliness and vague feelings of pain or discomfort in the limbs or joints. In many persons the first symptom is dryness or soreness

of the throat, followed in a few hours by sneezing and a profuse watery discharge from the nostrils. Hoarseness and lachrymation will be present in very varying degree, being always a prominent feature of the attack in some individuals, but wholly absent in others. In the course of the second day the discharge from the nose usually becomes less abundant and more turbid, and from this time the muco-purulent character of the discharge is more marked, while it diminishes in quantity. Smell and taste are diminished or lost during the acute stage. the former, indeed, not being regained until the discharge has nearly ceased. Deafness is by no means uncommon, nor soreness and excoriations about the lips.

Treatment.—An attack may sometimes be cut short if at the very commencement measures be taken to promote copious diaphoresis—*e. g.*, a Turkish bath—while a hot bath before getting into bed, or putting the feet into hot water with a little mustard in it, are well known domestic remedies, which may be aided by drinking some hot wine or hot spirit and water. A full dose of quinine (grs. x) taken upon the approach of the first feelings of discomfort, or small doses of morphine, or 5-minim doses of the tincture of aconite every half-hour for three hours may also have the desired effect. Tincture of belladonna in 20-minim doses, combined with 10-grain doses of bromide of potassium, has been found serviceable, and it has also been recommended to brush the nose and pharynx three or four times with a 6 per cent. solution of cocaine. When the catarrh is established, Ferrier's snuff may be recommended; it contains morph. hydrochl. grs. ij, bism. subnitr. 3 vj, and gum acacia $\frac{3}{4}$ ij. In chronic cases quinine in moderate doses is useful.

Symptomatic Indications.—*Aconite* in the early stage will often prevent or abort an attack. It is especially useful when there is much chilliness, aching of limbs, dry hot skin, and quick pulse. Following aconite *arsenicum* is useful to complete the cure. It is indicated in the second stage of the disease when there is a profuse fluent discharge, stoppage of the nose, frequent sneezing. The discharge is often thin and acrid, excoriating the nose and upper lip. Intense thirst, drinks little but often. Much prostration and nervousness. *Gelsemium* is also useful in

incipient cold, with chills; torpid, heavy condition. Sore throat with pain on swallowing, shooting up into the ears; fever without thirst; wants to lie still and rest. The best remedy for undeveloped or suppressed catarrh. Liability to take cold from any change in the weather. *Camphor* is also useful in incipient colds, with chilliness. When a "cold" has become established *bryonia* is valuable when the coryza is dry, with inflamed and ulcerated nostrils; lips dry, parched, and cracked; aching pains.

CATHODE RAY.—X-Ray.—Roentgen Ray.—The cathode ray derives its name from its occurrence at the negative or cathode pole of the electrical battery. As is well known, a galvanic battery, Holtz machine, or Rhumkorff coil has always two poles, the positive and negative. The wires attached to these two poles for conducting the current are called electrodes. As the electric current proceeds from the positive pole, that pole, together with the wire proceeding from it, is called the anode, from *ana*, up, and *hodos*, way; the negative pole, to which the current returns, together with its electrode, is called the cathode, from *kata*, down.

It is also known as the Roentgen ray, after Professor Roentgen, who was the first to pass these rays through human flesh and to photograph the human bones in a living person; and as X-rays, X being used, as in algebra, to signify unknown or undetermined.

The application of the Roentgen ray in medicine has been in the treatment of tuberculosis, passing the ray directly through the diseased portion of the lung or other tissues; and for the relief of neuralgia, rheumatism, and severe pain, but the results up to this time have not indicated any curative effects in the ray, while on the other hand, serious results from prolonged application of the ray have occurred in several cases, such as severe dermatitis, loss of the hair, and eczematous inflammation. The effect of the ray upon the bacilli of disease appears to be *nil*. The interposition of a card covered with gold-leaf between the pole and the person subjected to the influence of the ray, it is claimed, prevents all injurious effects. In surgery, the Roentgen ray has been of practical benefit, in locating the presence and position of foreign bodies, bullets, needles, etc., for removal,

diagnosing fractures, dislocations, etc. See X-RAY.

CAUSTICS are substances which, when applied locally to organic matter, cause its destruction. The actual cautery (a red-hot iron), Pacquelin's cautery, and the galvano-cautery are the most efficient. As chemical caustics, the hydrated oxides of potash and soda, nitrate of silver, and nitric acid are the most common, but the acid nitrate of mercury, chromic acid, chloride of zinc, chloride of antimony, and glacial acetic acid are also powerful caustics.

CATARRH, EPIDEMIC.—See INFLUENZA.

CATHETERISM.—See URETHRA, STRICTURE OF.

CELLULITIS.—See ERYSIPELAS.

CELLULITIS, PELVIC.—See PELVIC CELLULITIS.

CEPHALALGIA CONTAGIOSA.—See INFLUENZA.

CEPHALÆMATOMA.—A blood-extravasation, caused in child-birth. Two kinds: 1, between aponeurosis and pericranium; 2, between pericranium and skull. Former is diffuse: the latter is circumscribed and small, and never extends across a suture. Treat on general principles.

CEREBRAL HERNIA.—See HEAD, INJURIES OF.

CEREBRAL MENINGEAL HEMORRHAGE.—An extravasation of blood between the surface of the brain and the cranium. This extravasation may be; 1, between the cranium and the dura mater—extra-meningeal hemorrhage; 2, into the cavity of the arachnoid—intra-arachnoidal hemorrhage; 3, into the sub-arachnoidal space between the arachnoid and the pia mater—sub-arachnoidal hemorrhage; 4, into the tissues of the pia mater—pachimeningitis; 5, between the pia mater and the brain—hematoma of the dura mater.

Causes.—The predisposing cause is age, the disease occurring most frequently in infants and old persons. Other causes are, severe muscular efforts, excessive mental labor, injuries to the skull, excessive indulgence in alcoholic liquors, venereal excesses, etc.

Symptoms.—Suddenly appearing coma, or following upon vertigo, pain in the head, impairment of the mental faculties, and in some cases general convulsions. Usually before death, there are vomiting, incontinence of urine and fæces, and convulsions.

Prognosis.—Bad. Nearly always fatal.

Symptomatic Indications.—See APOPLEXY.

CHARBON.—See MALIGNANT PUSTULE.

CHARCOT'S JOINT-DISEASE.—Preceded by the "lightning pains," characteristic of tabes dorsalis or locomotor ataxy. The limb near the affected joint sometimes swells quickly and extensively, after some time returning again to its normal size. Spontaneous dislocations. Fractures caused by gentle movements. Accompanying signs of locomotor ataxy, *e. g.*, more or less inco-ordination of movements and loss of muscular sense. "The very rapid and extreme wearing away of the articular extremities of the bones is the principal character which, from an anatomico-pathological point of view, distinguishes the arthropathies of ataxia from common rheumatic arthritis (arthritis seche)." There is also little or no formation of osteophytes.

C. B. KEETLEY.

CHANCROID.—A chancroid is a contagious, venereal ulcer or sore, which is usually met with upon the genital organs, but which may occur upon any part of the body. It is always the result of contagion or inoculation with the secretion from a similar ulcer, and generally appears within a short time, from three to eight or ten days, after exposure. It is an entirely local disease, and unlike the chancre of syphilis, is never followed by constitutional symptoms. It appears in the beginning as a pustule, surrounded by a pink areola, soon changing to an ulcer, having a soft and pliable base, except when attended with much inflammation, when it may be surrounded by a more or less hardened border, which is not very well defined and fades away into the surrounding tissue. The ulcer is usually deep, with ragged, uneven edges, and secretes an abundant, whitish pus or matter which is virulently contagious, and capable of producing a new ulcer

wherever and whenever it comes in contact with an abrasion or break in the skin, either upon the person having the chancroid or another. The number of chancroids occurring at one time will vary according to the number of abrasions with which the virus comes in contact, and it is not uncommon to find five or more present at the same time, while, from the fact that the secretion is auto-infective, there will not infrequently be several crops, appearing at once, as many as twenty and twenty-five have been reported as occurring upon a single person at one time. In size, the ulcers vary from that of a pea to that of a quarter of a dollar, the intermediate sizes being of most frequent occurrence. As a rule a chancroid, unless attended with considerable inflammation, or when it has become phagedenic, is not very painful.

Prognosis.—Is generally good, chancroids being of all venereal diseases the most amenable to treatment; untreated, they usually continue, under favorable circumstances, for one or two months, before healing. If care, however, is not taken and dissipation is indulged in, or the organs abused, the ulcers are apt to grow larger, becoming more painful and slower in healing. If, at the same time, the general health of the patient is not good they may become phagedenic, that is, the surrounding tissue become mortified, and may slough, resulting in a considerable loss of substance.

Bubo.—Not infrequently, during the course of the second or third week of the existence of a chancroid, or of an attack of gonorrhea, an inflammatory tumor appears in one or both groins. In the simple, or inflammatory form, which results from the irritation induced by the inflammatory process taking place in the parts in anatomical relation with the lymphatic glands attacked, this form of tumor usually affects but one gland, though this is by no means constant, and may last for a few weeks, producing a certain amount of discomfort, and then subsiding, seldom suppurating unless in a person of a scrofulous diathesis, or in a debilitated condition. In the virulent form of the bubo, however, which results from the absorption of the poisonous virus of the primary ulcer by the lymphatic vessels, the tendency is always toward suppuration, with the peculiarity of producing two distinct collections of pus, the first discharge, the

result of simple inflammation, consisting of laudable pus. A day or two later a second discharge occurs, the result of the bursting of the infected gland. This discharge, containing the virus derived from the chancroid, is highly contagious, and converts the simple ulcer into a chancroid, which continues to discharge for weeks or even months. The virulent bubo is especially liable to become phagedenic and cause extensive destruction of tissue.

Prognosis.—The prognosis of simple or inflammatory bubo is favorable, except where the person is greatly debilitated or of a scrofulous diathesis, when it may go on to suppuration. In the virulent form, the prognosis is unfavorable, as suppuration is unavoidable and may result in extensive destruction of tissue, while the great liability of becoming phagedenic must always be considered.

Treatment.—The object of treatment is to destroy the virulent character of the ulcer and convert it into a simple sore, with a tendency toward healing. For this purpose, the application of a powerful caustic or the actual cautery, followed by the use of some simple powder or lotion, is considered by some writers as the best treatment. Treated actively, chancroids not infrequently heal in a couple of weeks or less and the chances of bubo occurring are very much lessened. [Henry G. Piffard.] Many cases, however, require less active treatment, and in the great majority of cases sprinkling the cavity with iodoform will allay the pain and change the morbid action. The iodoform is usually rubbed up with an equal bulk of sugar of milk or of tannic acid and dusted over the ulcer at each dressing until healthy granulations appear, or it may be dissolved in ether in the proportion of one dram of iodoform to the ounce, and painted over the sore. This preparation has the merit of partially destroying the odor of the iodoform. Cleanliness and correct living are of great importance in the treatment, although the chancroid will not require much washing, an occasional washing with castile soap and lukewarm water being all that is necessary, the principal requirement being the absorption of the discharge by pledgets of absorbent cotton. If a bubo appears, rest should be enforced and a simple but nutritious diet ordered. If it is of the simple form, suppuration may be pre-

vented by painting the surface with iodine, with compression to favor absorption. As suppuration cannot be prevented in the virulent form these should be treated in the same manner as the primary ulcer.

Symptomatic Indications.—The most useful remedy is *nitric acid*, particularly in scrofulous and broken down constitutions. The ulcers bleed easily and are painful, as if splinters were sticking into them. Next in value to nitric acid is *mercurius sol.* when the ulcer is painful and itching, sore to the touch and discharging offensive pus; pain in the inguinal region when walking. It is also useful in phagedenic ulcers. *Arsenicum* is an excellent remedy when gangrene threatens. Burning pain, restlessness, and constant thirst characterize this remedy. *Causticum* may be required when the chancroid shows a disposition to fungus growth. The secretion is acrid, corrosive, or watery and greenish. Externally a cerate or a solution of calendula acts favorably.

CHEIRO-POMPHOLYX (dysidrosis, pompholyx) is an ill-defined, inflammatory disorder of the skin of the hands, and often also of the feet, characterized by the development of peculiar vesicles, or blebs, arranged in groups. These are deeply seated, and have the appearance and feel of sago grains; they are distributed chiefly on the soles and palms, and especially along the sides of the fingers. The surrounding skin is at first little, if at all, inflamed. Blebs are usually formed by the fusion of smaller vesicles, but occasionally appear primarily. The vesicles either suppurate and rupture, causing excoriation and maceration of the skin, or more frequently are absorbed, leaving the skin unaffected. Their appearance is preceded and accompanied by violent itching, a feeling of stiffness, and burning pain. The eruption is roughly symmetrical. The disease avoids the extremes of life, and is especially common in women and persons of neurotic disposition, with clammy hands (chronic hyperidrosis). It is almost invariably recurrent, and is rare in winter. After frequent recurrence the nails become stunted and brittle. By some the vesicles are thought to represent dilated sweat ducts containing retained sweat; by others the disease is considered to be of neurotic origin, and allied to herpes. More

probably it is an atypical eczema, as eczema frequently co-exists on the trunk, or is in anatomical continuity with the disease, which sometimes appears to be provoked by external irritants.

The *diagnosis* from scabies may occasionally present some slight difficulty.

Treatment must be mainly constitutional; arsenic and quinine are of special value. Locally, lead lotions, thymol in weak alcoholic solution, or diluted liquor carbonis detergens may be used to allay itching.

J. J. PRINGLE.

CHELOID (Keloid of Albert, Kelis).

—A somewhat rare disease of the skin, characterized by the development of new growth from the connective tissue. The extensive scars resulting from burns, lupus, and syphilis are specially prone to form the starting-point of cheloid, but it may originate in and spread from the minute scars following blisters, variola, varicella, acne, leech-bites, or piercing the ears for earrings. Less frequently the process may start from deep inflammatory changes—*e.g.*, boils. The colored races are more often affected than whites, brunettes more often than blondes. Some families show a marked proclivity to cheloid formation, and in some persons every scratch or scar may become affected, evidencing a peculiar constitutional taint.

The disease is commonest in middle-aged people, but the cicatrices resulting from strumous ulceration in children are often markedly hypertrophic. Cheloid is commonest, and presents its most characteristic form over the sternum; it is also common about the shoulders and neck, but may, as already indicated, occur upon any part of the body.

Symptoms.—The growth first shows itself as a firm, raised, smooth, glossy, cicatriform streak or nodule, which may be whitish, pinkish, or red in color. By its gradual increase a larger, prominent tumor is formed, elastic to the touch, and hairless; sometimes dilated venules course over its surface. From this central tumor irregular raised bands or spurs extend in various directions into the surrounding skin like the claws of a crab—hence the name of the disease. Considerable pain is usually complained of, especially when the part is manipulated, as well as itching, stinging, and burning

sensations. The growth may extend indefinitely, the older portions becoming atrophic and depressed, the more recent, irregular and tuberos; but suppuration and ulceration are of very exceptional occurrence, as is also the development of malignant growths from it. The increase of the tumors is invariably slow, and after a certain time—it may be years—spontaneous arrest usually occurs, followed by gradual diminution in size, but they seldom totally disappear. If removed, either by the knife or by caustics, they almost invariably recur *in loco*.

A rare form of cheloid is described by Mr. Hutchinson in which the new growth is confined to the deeper layers of the corium and to the subcutaneous tissue, the result being extensive flat indurations covered with healthy skin.

Pathology.—The growth originates in the corium, of which the vessels are dilated and the meshes infiltrated with numerous cells, which press upon and destroy the sebaceous glands and hair follicles, obliterate the papillæ, and rapidly form dense fibroid tissue. The fibers lie closely packed together, in bundles, in the long axis of the tumor, with a few spindle cells and nuclei among them, and in the latter stages of the disease are very poorly supplied with blood vessels. The condition is closely allied to granuloma on one hand, to sarcoma on the other. The vessels are dilated for a considerable distance outside the growth. The condition differs clinically from simple hypertrophy of a cicatrix in its aggressive extension beyond the scar tissues; possibly the growths, when multiple, might be mistaken for fibromata or malignant tumors of the skin.

Treatment.—The application of mercurial or lead plaster appears sometimes to check cheloid growth, probably by exerting compression on the vessels. Belladonna plaster is useful in alleviating pain, and occasionally recourse must be had to morphine. Destruction by caustics is unsatisfactory; removal by the knife is only efficacious when the incisions are made very wide of the growth, and is not usually an advisable measure. Linear scarification and electrolytic puncture have been recently warmly advocated. It must be borne in mind that spontaneous arrest and partial recovery usually take place, especially in young persons.

J. J. PRINGLE.

CONTUSIONS OF THE CHEST.**—Contusions of the chest walls only.—**

The simplest cases are those of superficial ecchymosis and bruising; more important are cases in which the muscles are bruised or torn, and their contraction rendered painful; the pain may continue for some time (myalgia), and if the injury to the muscle is severe or extensive, it may seriously embarrass respiration. Desprès records a case in which a contusion of the front of the chest was fatal without any fracture or lesion of the thoracic contents. *Abscess* in the chest wall may follow contusion.

Injury of the pleura and lung.—The pleura may be ecchymosed and subsequently inflamed (*pleurisy*). The lung may be contused without laceration of the pleura; if the injury is slight it causes moderate dyspnoea and slight cough, with expectoration of rusty and sooty sputa in a day or two. When the injury is more extensive it leads to severe spasmodic dyspnoea and cough with hemoptysis, and examination of the chest reveals slight local dullness with moist râles. A subpleural rupture of the lung may lead to an escape of air beneath the serous membrane, which, passing to the root of the lung and mediastinum, may thence spread to the cellular tissue of the root of the neck and back; the position in which this subcutaneous emphysema appears distinguishes it from that due to wound of the lung.

The lung may be ruptured, that is, bruised, with tearing of the pulmonary pleura; this causes an escape of blood and of air into the pleural cavity (hemo-pneumothorax). In some cases the pneumothorax predominates, in others the hemothorax, the difference probably depending upon the position and character of the rupture, and whether large vessels are torn. In the severest cases the lung is extensively torn and contused, and its function wholly interfered with.

The secondary consequences of these injuries of the lung are traumatic pneumonia, pulmonary abscess, and gangrene of the lung.

Injuries of the pericardium and heart are rarer than of the lungs. The pericardium may be torn, the muscular tissue of the heart may be bruised or torn, most often on the right side; the chordæ tendineæ or one of the valves may be torn,

or one of the great vessels may be torn across. Ruptures of the heart and great vessels are quickly fatal from hemorrhage; rupture of the pericardium may be recovered from; lesions of the valves interfering with their competency are sooner or later fatal.

Fractures of the ribs and sternum.—

Ætiology.—In children and young persons the great elasticity of the chest walls protects them from fracture, even under extreme violence; but as age advances, the increasing rigidity of the chest renders fracture more common. In general paralysis of the insane a special fragility of the ribs is sometimes met with. The cause of the fracture may be *direct violence*, such as blows and gunshot injuries; *indirect violence*, the chest being compressed and the ribs snapping across; or *muscular action* in parturition and severe coughing.

Pathology.—The ribs most often affected are the fourth to the eighth; the highest are protected by the clavicle and shoulder, and the lowest by their extreme mobility. The fracture may implicate one or many ribs, may be simple, comminuted, or compound either externally or into the lung. When the result of indirect violence, the ribs are most often broken near their angle, and the broken ends are displaced outward; when direct violence is the cause, the fracture may be in any part of the rib, but is most common in the anterior third, and there is a danger of the broken ends being displaced inward and injuring the pleura, lung, diaphragm, liver, or stomach.

Union is generally firm in three or four weeks; the callus thrown out is often abundant, ensheathing the fragments, or even uniting adjacent ribs across the intercostal space. "False joint" and "fibrous union" have been very rarely observed.

Symptoms.—The patient sometimes feels distinctly the snap of the fracture. The most constant symptom is a sharp cutting pain at the seat of fracture, intensified by respiration, cough, or compression of the chest. Crepitus can sometimes be elicited either by pressure immediately over the fracture, by deep inspiration or cough, or by firm pressure upon the rib at a distance. Acute tenderness immediately over the fracture is always a marked sign; displacement may be detected, especially if several ribs are

broken; emphysema from wound of lung is so frequent as to be a useful sign.

Complications.—External wound, laceration of intercostal artery, wound of pleura, pleurisy, wound of lung, emphysema, pneumothorax, hemoptysis, hemothorax, pneumonia, wound of diaphragm, hiccough, wound of liver, hemorrhage, peritonitis. The embarrassment of respiration from fractured ribs becomes of serious moment in those in whom it is already impeded by pulmonary emphysema and bronchitis.

Treatment.—The usual plan is to fix the injured region of the chest more or less securely, by strapping the side, or by a broad roller applied round the chest. Where this increases the pain and dyspnoea it should be removed, and when the ends of the broken bone are driven inward, pressure should not be employed. In patients with advanced pulmonary emphysema, fixation of the chest dangerously adds to the respiratory difficulty. Unless complicated with a wound, no attempt should be made to elevate depressed fragments.

Fracture of costal cartilages is occasionally met with as a result of direct violence. The line of fracture is clean and vertical; it may separate the cartilage from the rib. If there is much displacement, the sternal fragment is in front of the spinal. These fractures can be readily recognized by pain, mobility, and more or less displacement. Union is by bone. The treatment is the same as that of broken ribs.

Dislocation of a costal cartilage on to the sternum is a very rare accident.

Fracture of the sternum may be caused by severe *direct violence*; by *indirect violence*, such as falls on the back, buttocks, or feet, by which the trunk is violently bent back or forwards; or by *muscular action* in parturition or coughing. The fracture is usually transverse, but may be oblique. The injury may separate the manubrium from the gladiolus, but the most frequent site of the fracture is in the latter part of the bone. If there is displacement, the lower fragment generally rides forward over the upper; the reverse is rare. The fracture is usually easily recognized by displacement and crepitus; emphysema from wound of the lung may complicate it, and suppuration in the anterior mediastinum is a more serious sequela. The

treatment consists in rest in bed, and circular compression of the chest, as for broken ribs; when caused by over-bending of the body, fracture of the spine is associated with that of the sternum.

Wounds of the Thorax.—These are produced by stabs and gun-shots of various kinds. They derive their importance from the injury inflicted upon the thoracic viscera, and hence are classified into *non-penetrating* and *penetrating*, the former being of no special gravity, the latter always being very grave. To determine whether a given wound penetrates the chest walls may be very easy or very difficult; the nature of the injury and the position of the wound should be carefully studied, and signs of wound of the thoracic viscera, especially the lungs, should be sought. No examination with a probe is permissible, but the finger may be carefully used to explore a wound, and if the surgeon is still in doubt he must wait and watch for the inflammatory sequelæ of perforating wounds.

The *treatment* of non-penetrating wounds presents no special peculiarities; the constant respiratory movements delay healing in many cases. Where there is penetration, the treatment of the injured thoracic viscera becomes the main indication.

Wound of the pleura without injury to the lung is a rare accident. It may be caused by a blunt weapon pushing the soft and yielding lung before it, or by the pleural sac being opened beyond the edge of the lung. The pleura extends down in the back as low as the twelfth rib, or even lower than this, while the lung does not reach lower than the tenth rib, and perforating wounds in the tenth and eleventh intercostal spaces open the serious cavity without injury to the lung. As the diaphragm is in contact with the chest walls below the lungs, any injury here is liable to wound this muscle and the liver or spleen beneath it. The signs of a wound of the pleura are, in some cases, protrusion of the lung, in others, moderate emphysema, pneumothorax, or traumatopnoea without hemoptysis or hemothorax; as well as the subsequent occurrence of pleurisy.

If uncomplicated, the treatment consists in closure of the wound after careful antiseptic cleansing.

Wound of the lung may be caused by the sharp fragments of a broken rib, as

well as by stabs or gun-shots. The symptoms are due to escape of blood and air from the severed pulmonary tissue. The blood is partly coughed up (*hemoptysis*) and partly escapes externally, or accumulates in the pleural cavity (*hemothorax*). The hemorrhage varies greatly in amount; in some cases it is slight, in others, when the wound involves the large vessels near the root of the lung, death is almost instantaneous, the rush of blood into the bronchi suffocating the patient. The air escaping from the lung may accumulate in the pleura (*pneumothorax*), or may infiltrate the subcutaneous cellular tissue (*emphysema*); when it passes freely in and out of a wound in the chest, the phenomenon is known as *traumatopnœa*; this is accompanied with a peculiar sucking, hissing, or bubbling sound. Incised wounds in the lungs are quickly sealed by blood clot, which is then infiltrated with lymph, and forms a cicatrix which after a short time becomes recognizable only with difficulty. The contused lacerated wounds produced by bullets, and which are often complicated by the lodgment of foreign bodies, are much more grave, as healing cannot take place so readily, and is liable to be attended with suppuration and septic pneumonia. The *treatment* of the injury to the lung, apart from the complications associated with it, consists in observing the utmost possible rest until the wound is healed.

Wounds of the pericardium may be inflicted without injury to the contained viscus; they are followed by pericarditis.

Wounds of the heart are much less frequent than those of the lung; they are generally immediately fatal from shock and hemorrhage. But many instances are recorded of patients who have survived some days or weeks after wounds of the heart or the lodgment of foreign bodies in it. The right ventricle is the part most often injured, and transverse wounds are more fatal than those in the axis of the organ; wounds of the auricle are speedily fatal. The symptoms in these cases are profound shock, with a very feeble, irregular pulse. The heart sounds are weak and altered, and there is great dyspnœa. If the patient survives, signs of pericarditis or endocarditis supervene.

Wounds of the great vessels are, al-

most without exception, immediately fatal from hemorrhage.

Wounds of the esophagus in the chest are rare, and generally complicated with injury to other viscera; they are recognized by the escape from the wound of fluids swallowed. The patient should be fed by the rectum until the wound is healed.

Wounds of the thoracic duct are followed by the escape of lymph and chyle from the wound; unless fatal from other injuries, death results from inanition.

Wounds and ruptures of the diaphragm are produced by stabs, gunshot wounds, and severe contusions. They are generally complicated by lesions of the thoracic or abdominal viscera, which quickly cause death; if not, a hernial protrusion, most often of the stomach and colon or small intestine, more rarely the spleen or liver, takes place into the chest; such a *diaphragmatic hernia* may become strangulated. The rupture of the muscle is most frequent on the left side.

Primary complications of wounds of the chest.—(1) **External hemorrhage** from wound of a parietal vessel, or of one of the viscera. The intercostal vessels run along the lower borders of the ribs, and are protected from injury. When wounded the blood usually spurts out *per saltum*, and the bleeding is arrested by pressing with the finger against the lower border of the rib. To distinguish hemorrhage from the chest wall from bleeding from the lung, Richter recommends that a folded card should be introduced deep into the wound, with its concavity directed upward. Blood from a wounded intercostal artery will flow along the channel of the card only, while that from the thoracic cavity will escape around the card. The bleeding should be arrested by forcipressure if the vessel can be seized; if not, a tampon may be introduced into the wound. If these means fail, the wound should be enlarged along the rib, and the periosteum separated from the lower half of the rib; this membrane will carry with it the intercostal vessels, which can be then tied, or a piece of the rib may be excised.

The *internal mammary artery* may be injured by wounds close to the edge of the sternum; the blood may escape externally, or into the pleura, pericardium, or mediastinum. The hemorrhage

is to be arrested by forcipressure, or by ligature of the artery in the wound.

Wounds of the lung may cause profuse external hemorrhage, the amount varying with the extent and position of the wound, and the freedom with which the blood can escape externally. Such hemorrhage is most abundant during expiration, and the blood is frothy from admixture with air; cough, hemoptysis, dyspnœa, traumatopnœa, and general distress, or threatened syncope, also point to the injury to the lung. If possible the wound should be closed, and the patient placed on the injured side, and then every care should be taken to calm excitement and to prevent movement or talking. When the wound cannot at once be closed, it should be cleansed, and a firm dressing be fixed over it. In this way the movement of the injured lung is reduced to a minimum, and if the blood accumulates in the pleura it compresses the lung, and so arrests the hemorrhage. Inhalation of turpentine and the subcutaneous injection of ergotine should be employed when the bleeding is profuse.

2. Internal hemorrhage.—(a) *Hemothorax*, or effusion of blood in the pleura. The usual cause of hemothorax is a lesion of the lung and pulmonary pleura; but a wound of an intercostal artery, or the internal mammary artery, may induce it. The blood collects in the lowest part of the serous cavity, and gradually pushes the lung aside. Blood in the pleura speedily coagulates, and is then rapidly absorbed, with little irritation of the serous membrane. If, however, air is admitted to the pleura from the outside, there is a great danger of decomposition of the blood and acute purulent inflammation; air that escapes through a wound in the lung is so thoroughly filtered that it does not set up decomposition of the blood. *The signs* of hemothorax are dullness in the lower part of the chest, with loss of vocal fremitus and resonance, and distant weak bronchial or absent breath sound; there may be great dyspnœa and general signs of loss of blood; these symptoms come on quickly after an injury. In many cases ecchymosis of the loin is noticed a few days later from transudation of the blood. Hemothorax may be combined with pneumothorax.

Treatment.—The first indication is to

stop the hemorrhage. Should the accumulation of blood in the pleura threaten suffocation, the wound should be opened or enlarged, or if no wound exists a free incision may be made, and the clots allowed to escape; the necessity for such a step can only very rarely arise. If signs of suppuration supervene (fevers, rigors, superficial œdema, increasing dullness and respiratory difficulty), the mixture of pus and blood should be liberated by a free incision and antiseptic drainage, or by opening up the original wound.

(b) *Hemo-pericardium* is accumulation of blood in the pericardium from wound of the heart, of a coronary artery, or of the internal mammary artery. It occasions great embarrassment of the circulation, with increased cardiac dullness, loss of the heart's impulse, and enfeeblement of the heart sounds.

(c) *Hemo-mediastinum*, or effusion of blood in the mediastinum, is a very rare condition.

3. Hemoptysis occurs from wounds of the lungs; it may be very slight or profuse, and may be fatal from the blood filling the bronchi.

4. Pneumothorax, or escape of air into the pleural cavity, may be caused by an external wound opening the pleura, or by a wound or rupture of the lung and visceral pleura.

When there is an external wound, air passes into the pleural sac with each inspiration; when there is a wound in the lung air is passed through it into the pleura with each expiration until the resistance to its escape equals that opposed by the narrow orifice of the glottis. As the air accumulates the lung collapses and respiration is greatly embarrassed. Under favorable circumstances the air is absorbed, the oxygen being first removed and replaced by carbonic acid gas. When due to an external wound suppuration is liable to occur and *pyo-pneumothorax* results.

The signs of pneumothorax are dyspnœa and orthopnœa, distension of one side of the chest, which is tympanitic on percussion; over the same area the respiratory murmur is lost or amphoric, the voice sound is amphoric, bronchial râles have a metallic tinkle, and the "bell sound" is heard when one copper coin is struck against another placed on the chest. When pneumothorax threatens life by suffocation, the cavity of the

pleura should be opened by a trocar and canula.

5. **Emphysema** is the name given to the infiltration of air in the cellular tissue. It may be produced in the following ways:

(1) *Subpleural rupture of the lung*.—Air escaping from the air cells passes along the interalveolar tissue to the root of the lung, and thence by way of the mediastinum to the root of the neck, whence it spreads over the shoulders and trunk. This is a rare accident.

(2) *A valvular wound* through the chest walls into the pleural sac; air passes into the pleura without difficulty during inspiration; when expiration follows it is unable to escape externally, and it accordingly infiltrates the cellular tissue. The conditions are still more favorable when at the same time the lung is wounded.

(3) *A subcutaneous wound of the lung*, as when the fragments of a broken rib lacerate it; air may then pass into the pleura with each inspiration; during expiration the wound of the lung is closed as by a valve, and the air is forced out through a wound in the parietal pleura, whence it passes into the subcutaneous tissue. In many cases of emphysema there is no accompanying pneumothorax, but the air passes directly from the lungs to the chest walls. This is generally explained by the wound of the lung having occurred at the seat of an old adhesion; the air then passes along this adhesion and is shut off from the general pleural cavity.

(4) In rare cases of *non-penetrating wounds of the chest wall* air is sucked in during inspiration, and, owing to the valvular nature of the wound, with every expiration is forced farther and farther into the cellular tissue; this can only happen in the case of sinuous wounds.

Symptoms.—The presence of the air causes a soft ill-defined swelling of the chest wall; the skin over it is of healthy color; on light percussion the note elicited is hyper-resonant or tympanitic in character, the swelling is unaltered by a strong inspiration or expiration, and on compressing it a fine dry crepitation is plainly felt, caused by the passage of the air from space to space into the cellular tissue. When due to subpleural rupture the swelling appears first at the neck; when due to a wound of the lung it is

first noticed around the wound. As a rule, the swelling attains only a moderate size, but it may extend all over the body and cause great embarrassment to respiration and circulation, and even be fatal in its effects.

Treatment.—When slight, nothing is required beyond the application of strapping or a bandage to the chest. If the emphysema is very extensive and causing inconvenience, multiple punctures in the skin will allow the air to escape.

6. **Prolapse of the lung**, or protrusion of a part of the lung through a wound in the thoracic walls, may occur in any case in which the pleural cavity is opened; it is a rare accident, and is most likely to occur in extensive wounds. The protrusion occurs during expiration, and is probably caused by the air expelled from the opposite lung passing into the injured lung and distending it where it has lost its usual support. The prolapsed mass varies in size; it is smooth on the surface, dark in color, crepitates when compressed, and expands with forced expiration or a cough; it may be reducible on gentle pressure. The protruded mass becomes congested and eventually gangrenous, the pleura at its base becoming adherent to the costal pleura.

Treatment.—If seen early, reduction should be attempted. If this is impossible, or if the lung is too seriously congested to render it safe to return it, it may be left to nature to detach the sphacelus, or the surgeon may remove it after applying a stout ligature to the base.

7. **Foreign bodies in the thorax**.—Bullets of various kinds and portions of dress are the most common foreign bodies introduced into the thorax. These, in the chest walls, present no special peculiarities. Bullets in the pleura fall to the bottom of the serous sac unless prevented by pleural adhesions; they are apt to excite purulent pleurisy. Owing to the impossibility of determining their position, as well as to their innocuousness in some cases, no effort should be made to remove them at once. If empyema occurs, a free incision should be made and the pus and foreign body evacuated. Foreign bodies in the lung may become encysted and remain innocuous, or they may excite a localized suppuration, the abscess discharging through the bronchi or externally, and healing up after the expulsion

of the foreign body. They may set up rapidly fatal spreading pneumonia. If the track of the wound is distinct, and the foreign body can be plainly detected, very gentle careful efforts may be made to remove it; in other cases the surgeon should leave the foreign body alone, and wait.

Secondary complications of injuries of the chest.—1. Subpectoral abscess.—

As a result of contusion of the front of the chest, with or without laceration of the pectoral muscles, inflammation of the cellular tissue between and beneath these muscles may occur and run on to suppuration. The inflammation occasions a painful swelling of the part, with œdema of the skin, and great pain in attempting to raise the arm in front of the body. Owing to the great depth of the pus fluctuation may not be detected.

Treatment.—The pus should be evacuated early, and a grooved needle may be introduced to determine its presence. If possible, the incision should be made from the axilla; but if the abscess does not project in this direction it must be opened from the front. In either case, after the division of the skin, a director should be pushed through the deeper tissues until pus appears in its groove, and along it dressing forceps should be passed and opened widely to expand the deeper part of the wound.

2. Peripleuritic abscess is a very rare sequel of contusions and punctured wounds of the chest. The pus forms between the pleura and the ribs, and generally points externally, but may burst into the pleura or mediastinum; it is therefore necessary to open the abscess as soon as it is recognized.

3. Pleurisy ensues upon all wounds of the pleura; if the injury is subcutaneous, as in many cases of fractured ribs, the traumatic inflammation is dry, and gives rise only to pain and a friction sound heard over a limited area of the chest. The two surfaces of the membrane adhere, and to some extent close the serous sac. When, however, external air is admitted into the pleura, and especially when blood clot or a foreign body is also lodged in the sac, decomposition occurs, and acute inflammation is excited. The fluid at first is serous but slightly turbid and flaky, but quickly becomes purulent.

Empyema.—This acute inflammation of the pleura is attended with high fever,

and the formation of pus may be marked by the occurrence of one or more rigors. The local signs are dullness on percussion over the lower part of the chest, which gradually increases in extent upward, either absence of breath sounds over the same area, or weak distant bronchial or tubular breathing and loss of vocal fremitus. If the wound is closed, the side is enlarged, and neighboring viscera, such as the heart and liver, are displaced; if the wound remains open, there is an abundant and often a very profuse discharge of fluid from it.

Treatment.—Dry pleurisy occurring with fracture of ribs requires no special treatment; the fixation of the part indicated by the fracture will also relieve the pain of the serous inflammation. When, however, acute purulent pleurisy arises, active surgical treatment is called for. If there is a wound it should be enlarged, and any foreign bodies, blood clots, or pus removed, and the cavity cleaned with some antiseptic lotion such as dilute Condyl's fluid or solution of bichloride of mercury; free drainage should be then secured. If the wound is in such a situation that it does not afford a proper aperture for drainage or cleansing of the cavity, a counter-opening in the lower part of the chest should be made.

4. Pneumonia.—All bruises and wounds of the lung are followed by a certain amount of traumatic pneumonia, which, as a rule, is limited to the injured area, and gives no sign of its existence unless extensive. When the lung is wounded by a weapon which pierces the chest walls, and external air is admitted to the injured surface, or a dirty foreign body lodges in the lung, the blood clot that seals the wound and plugs the alveoli may decompose, and the irritating products of this change will excite a more intense inflammation, with a tendency to spread and to run on to suppuration. But even in these cases the inflammation may be limited in area, and may after a time subside and allow the wound to cicatrize. Traumatic pneumonia is distinguished from idiopathic lobar pneumonia by the limited area of the organ involved, and by its occurrence at any part of the lung without distinction. It may terminate in *abscess*, especially if a foreign body is impacted, or in *gangrene*; an abscess in the lung may open into a bronchus and discharge its contents

through the larynx ; or into the pleural sac ; or may burrow its way through the chest walls and discharge its contents externally.

The *symptoms* may be entirely masked by other effects of the injury, for bruising and wound of the lung lead to rusty expectoration, and the existence of pneumothorax or pleurisy may obscure the physical signs of pneumonia. When the inflammation is septic, the general disturbance is severe, with high fever and rapid pulse, and the danger of death is very great. An abscess of the lung may declare itself by the sudden discharge of matter externally or by the mouth, and the usual signs of a moist cavity may then be detected. Gangrene of the lung will be recognized by the intensely foul odor of the breath.

Treatment.—Traumatic pneumonia does not call for surgical treatment.

5. **Pericarditis, endocarditis, and myocarditis**, may follow injuries of the pericardium and heart ; they are usually fatal.

6. **Mediastinal abscess** is a very rare sequel of contusions or wounds of the chest ; it also results from abscess beneath the deep cervical fascia, ulceration of the esophagus, and suppuration of the lymphatic glands. The pus tends to point above, or below, or at either side of or through the sternum ; but the abscess may burst into the pleura, pericardium, esophagus, or heart. So soon as the presence of pus can be verified it should be liberated by a free incision.

7. **Hernia of the lung.**—**Pneumocoele** is a protrusion of part of the lung through a weakened portion of the chest wall, either from severe contusion with fracture, from the yielding of a cicatrix, or a slow giving way of the intercostal muscles under the strain of frequent severe coughing. The tumor is most commonly situated in front over the fourth or fifth interspace ; it is of either sudden or slow formation, soft, compressible, crepitant under the hand, resonant to percussion, shrinking with each inspiration, expanding with a distinct impulse on coughing or violent inspiration. On listening over it a loud vesicular murmur is heard. The tumor is more or less reducible. It needs to be distinguished from a "pointing" empyema. The only treatment required is external support by a well-fitting pad.

The surgical treatment of pleuritic effusions.—Surgical interference with

pleuritic effusions is of two kinds, tapping and drainage. Tapping is practiced when the fluid is serous in character, but, except in some cases in children, empyema requires to be treated by drainage of the cavity.

Tapping the pleura.—The special object to be kept in view in this operation is to evacuate the fluid without admitting air to the pleural sac, or inflicting injury upon important structures.

(a) *Choice of an instrument.*—A simple trocar and canula will evacuate the fluid, but offers no security against the access of air during an inspiratory effort. This objection to its use may be met in one of three ways. The canula may be passed through the center of a piece of linen soaked in carbolic acid solution (five per cent.), so that on withdrawing the trocar the linen falls over the mouth of the canula ; it then offers no impediment to the escape of the fluid from the chest, but it at once blocks the canula if, during an inspiration, air is drawn toward the pleura. Another plan is to have a stop-cock on the canula, and to close it immediately the trocar is withdrawn ; a rubber tubing is then fastened on to the end of the canula, and allowed to fall into a vessel of carbolic solution (five per cent.) ; on opening the stop-cock the pleural secretion flows into this vessel, but no air can be sucked into the chest. A simpler method is to have a cross-piece on the canula, to which the rubber tubing is attached, and the trocar so made that it can be withdrawn beyond the orifice of this cross-tube, but no farther ; this is known as a "syphon trocar." Southey's fine trocar and canula can also be used, with the end of the tubing in a vessel of carbolic solution. Better than any of these, however, is an inspirator. Of these there are many forms ; the simplest is the "bottle aspirator," in which a vacuum is made in a bottle and then connected with the pleura ; some prefer direct aspiration by means of a properly made syringe, and the combination of this with a syphon (the "syphon aspirator") is an exceedingly good instrument. Either a hollow needle or a trocar and canula may be used, and each instrument has its advocates and its merits. The advantage of the needle is, that if, as soon as the opening into its barrel is passed under the skin, it is connected with the vacuum of the aspirator, and the needle

then steadily and slowly pushed on ; as soon as the fluid is reached it appears in the bottle or barrel of the instrument, and there is no danger of thrusting the sharp needle too far. The disadvantage of the needle is its sharp point within the pleura, which may possibly scratch the expanding lung, and has been known to cause fatal hemorrhage ; this accident is little likely to happen if the instrument is used as described above. The advantage of the trocar and canula is, that the blunt end of the canula can do no harm ; but the disadvantage of it is, that there is no means of knowing exactly how far it should be introduced to reach the fluid.

(b) *Place of puncture.*—The most convenient spot is the sixth intercostal space in the mid-axillary line ; but a space higher or lower may be taken, and the puncture may be made farther back if preferred. In loculated pleurisy the cavity must be tapped over the center of the fluid accumulation, and in such cases the preliminary insertion of a fine hypodermic syringe to demonstrate the presence of fluid should always be practiced ; indeed, this is to be commended in all cases of pleuritic effusion submitted to operation.

(c) *Mode of procedure.*—The side of the chest and hands of the surgeon should be washed with carbolic lotion, and the whole aspirator or other apparatus flushed with the same. The place of puncture having been chosen, and the existence of fluid having been determined by a syringe or by auscultation and percussion, the upper border of the rib forming the lower boundary of the space to be punctured is felt for, and the skin having been drawn up or down over it, a small puncture with a knife is made through the skin, and then the needle or trocar is thrust into the pleural cavity. The fluid is then allowed to flow out or be drawn out by the aspirator. Care must be taken not to allow the evacuation to go on too rapidly, and from time to time it is well to stop the flow for a few seconds. Spasmodic cough is an indication for stopping the flow for a time, and if the fluid becomes mixed with blood the instrument should be at once removed. As the needle or canula is withdrawn a pad of boric lint should be placed over the puncture and fastened in place by strapping. Blocking of the evacuating tube by a plug of lymph is one of the accidents that

may interfere with the operation ; it causes an abrupt cessation of the flow of fluid, which differs from the gradual stoppage of the stream as the cavity empties. The most convenient way of removing the obstruction is to reverse the current for a moment and force the plug back into the pleura ; when this is impracticable it is necessary to reintroduce the trocar or pass a stylet along the hollow needle.

2. **Draining the pleura.**—This is a more serious operation, and one that requires the administration of an anæsthetic. It consists in making a free opening into the pleural cavity and inserting a drainage-tube for the continuous escape of the secreted fluid.

(a) *Position of the opening.*—In loculated empyema a spot a little below the center of the dull area is the best. In simple empyema several spots have been recommended. One that has many advocates is the fifth space in the mid-axillary line, and it is contended that this part of the pleural sac, being the last to close, is therefore the best in which to place the drain. Marshall has recommended the spot immediately below and outside the junction of the fifth rib and its cartilage, on account of the thinness of the coverings of the chest at this spot ; there are no clinical facts to warrant a preference for this spot. Others choose a spot lower down and farther back, such as the seventh space in the axillary line, or the ninth space in the post-axillary line ; and occasionally it is found necessary to open the lowest part of the pleural cavity, in the tenth or eleventh interspace.

(b) *The operation* should be conducted with full antiseptic precautions. If the ribs are widely apart, so that a good-sized drain can lie between them without being compressed, the incision should be made along the center of an interspace, and the dissection carried steadily down to the pleura, all bleeding being stopped by ligature and torsion. The costal pleura should then be divided for the whole length of the wound, when the pus will flow out and air be sucked in. The finger should be introduced to ascertain the size and the relations of the cavity, and the presence or absence of bands of adhesion across it, and then a good-sized tube without lateral openings, and long enough to reach well into the cavity, should be inserted and fast-

ened in position. If it be determined to excise a portion of rib, it is better to make the incision along the rib, and to carry it down to the bone; with a rasp the periosteum can then be stripped off the bone, and with bone pliers an inch or more of rib can be cut away; should the intercostal artery be wounded it should be at once twisted or tied; the pleura is then to be incised as before. Some form of antiseptic absorbent dressing should be applied, and changed as required.

(c) *Excision of the ribs.*—This is practiced for two purposes: to admit of sufficient drainage, and to allow of the falling in of the chest. It is of great value for the former purpose; without it, it is often impossible to have a sufficiently large tube lying in the pleura uncompressed by the ribs; the removal of an inch of a single rib is quite sufficient, and the bone is so quickly generated that it is sometimes necessary to repeat the excision. Such an operation has little or no influence upon the retraction of the chest, and if this is the surgeon's aim he must remove a considerable length of several ribs; this has been done, but the success achieved, as yet, hardly compensates for the severity of the procedure. A serious hindrance to the closure of the cavity in chronic empyema is the dense thickened false membrane lining the costal pleura, and it is a good plan to excise this thick membrane as freely as possible after the removal of a portion of one or more ribs.

(d) *The tube.*—A common rubber tube may be used, but I prefer one attached to a silver tube long enough just to reach the pleural cavity, and provided with two small rings at its outer end, by which it can be attached to the chest. A short length of tube within the cavity suffices. The rigid part of the tube remains patent, in spite of the falling in of the ribs, and keeps a free vent for the pus. If a common rubber tube is used, it may be fastened by transfixing its outer end by a hare-lip pin, or a safety pin, and attaching the pin to the chest; or by passing a square piece of oiled silk or rubber tissue over the outer end of the tube, slitting this into four ends, and fastening them to the four corners of the square. When the amount of discharge is reduced to a small quantity of serous fluid, a smaller tube may be used.

(e) *The removal of the tube* must not

be attempted too soon, as the opening in the chest wall rapidly closes, and if the pleural cavity is not closed, fluid accumulates in it and necessitates a further operation. The surgeon should therefore wait until the discharge consists of the secretion of the sinus in the chest wall only.

(f) *Fistulous empyema.*—Chronic cases of fistulous empyema sometimes present themselves for treatment. The cavity should be explored, and if it is found that the opening is in an unfavorable position for drainage a counter-opening at the lowest part of the sac should be made; in all cases free drainage should be secured; excision of the ribs and thickened pleura may be practiced if the inability of the chest to retract is the obstacle to cure.

The Surgical Treatment of Pericardial Effusions.—**Tapping the pericardium** is now a recognized surgical procedure which has been many times carried out for pericarditis with effusion. The aspirator is the proper instrument to use. The puncture should be made in the fifth or the fourth left intercostal space, two inches from the border of the sternum. The pericardium may also be punctured close to the sternum, between that bone and the internal mammary artery. The structures to be avoided are the internal mammary and intercostal vessels, the pleura and lung, the heart and the great vessels.

Drainage of the pericardium has been practiced in a few cases of pyo-pericardium. The presence of fluid should previously be demonstrated by the insertion of a fine syringe. The pericardium should then be opened by an incision carried along the upper border of the fifth or the sixth rib (the more prominent of these two spaces being selected) and having its center two inches from the left border of the sternum. The dissection is carried carefully down until the pericardium is reached; this is then carefully but freely excised, the contained pus allowed to flow out, and a sufficiently large drainage-tube inserted. Antiseptic precautions should be employed.

Injection of the pericardium with iodine solutions has been practiced in a very few cases.

Pneumotomy or opening lung cavities is an operation which has been performed for phthisical or bronchiectatic cavities

for abscess or gangrene of the lung, and for hydatid tumors. Before tapping a lung, great pains must be taken to localize as exactly as possible the cavity to be opened. The operation consists of two steps: finding the cavity, and inserting within it a drain. Through an incision made down to the pleura a trocar and canula are thrust until pus or putrid gas escapes. This acts as a guide for the further steps. The exposed pleura is incised, and if the two surfaces of the pleura are adherent a fine bistoury is passed carefully in along the canula, the incision dilated by forceps, and a drainage-tube inserted. Hydatid tumors of the lung may be treated by aspiration of the cyst, and if that fail, by incision and drainage.

Pigeon breast.—This is a common deformity produced during childhood by the yielding of the chest walls under the pressure of the atmosphere during inspiration. When from any cause, such as diphtheria, chronic pulmonary catarrh, or enlarged tonsils, there is an obstruction to the entrance of air during inspiration, if the chest walls are weak they yield under external pressure, especially in the rib cartilages and at the junction between the ribs and the cartilages; when the obstruction is great, the chest may be seen to shrink during inspiration and enlarge during expiration. The deformity consists in a protrusion forward of the sternum, and a straightening of the ribs in front of their angles; in extreme cases the widest part of the chest is opposite the angles of the ribs. It is often combined with more or less of a lateral constriction running outward from the xiphoid cartilage. The effect of the deformity is to lessen the size of the chest and the degree to which it expands during expiration.

A. PEARCE GOULD.

Symptomatic *Indications.* — See WOUNDS.

CHEYNE-STOKES' RESPIRATION.—An undulating type of breathing in which the respirations gradually become more frequent and, at the same time, deeper, until a certain point is reached, when they slowly become more shallow and less frequent, until the person finally seems to have stopped breathing; after a pause, which may be as long as half a minute, the respiration begins again very slowly, but gradually increases

in frequency and depth, and thus the cycle is established. This condition is most common in the last stages of tubercular meningitis, but it is also met with in some forms of cerebral hemorrhage, and in fatty disease of the heart, when presumably it is due to the influence of insufficiently oxygenated blood on the medulla oblongata.

CHICKEN POX (Varicella).—An acute and highly contagious disorder, characterized by the appearance of successive crops of vesicles. It is most common in children under four years of age, but older children are also liable to it, and in rare instances the disease occurs in adults.

Symptoms.—The invasion may be quite sudden, or its onset may be heralded by febrile symptoms and general malaise, but it is rare for the premonitory symptoms to last more than a few hours before the appearance of the rash. This comes out, as a rule, first on the back or chest in the form of scattered, slightly raised, round, red or rose-colored spots, which disappear when the skin of the part is stretched. In a few hours each spot becomes raised, by the accumulation of serous fluid in the underlying layers of skin, into a small vesicle containing an almost clear or slightly yellowish fluid. The vesicle is round or oval, tense, varies in size from a hemp-seed to a split-pea, and has no central depression. In the course of twenty-four or thirty-six hours the contents of the vesicle become cloudy, its apex falls in, and it gradually shrivels up, so that by the fourth day it is reduced to a mere scab, which may then crumble away leaving no trace of its existence, but, as the scabs often itch and are scratched, it is quite common for a few scars to be left here and there. On the following morning a new crop appears, generally far more numerous than the first, and not confined to the trunk; the limbs, head, and sometimes the face being attacked. As the disease advances a fresh crop of spots makes its appearance every morning for four or five days, so that by the fifth day the eruption may be studied in all its stages, from the initial red spot to the final crumbling scab. The total number of spots may vary from ten or twenty to one or two hundred or even more. A red areola is frequently seen, though it is by no means necessarily

present in any stage of the vesicle. Vesicles are not infrequently seen on the palate, mucous membrane of the cheek, and sides of the tongue, and also on the labia or prepuce. In its early stages the vesicle contains septa dividing it off into compartments, but when fully developed the septa all become absorbed, and the vesicle is then undoubtedly unilocular. The marking of the scars, however, so closely resembles what is seen in smallpox as to make it almost certain that there must have been septa in the vesicle at the time of its original formation. The temperature does not, as in variola, subside when the eruption appears, although in some cases a slight fall may occur until the evening, when it again rises. Sometimes there is no fever throughout and no feeling of ill-health.

The *period of incubation* is uncertain, but it is probably long, lasting a fortnight, if not more.

Mr. Hutchinson has described under the name of varicella prurigo some cases in which, after undoubted chicken pox, there has been a persistent eruption exactly like the original disease, and accompanied by much prurigo. In a few instances, generally in unhealthy and tuberculous children, the vesicles have taken on a gangrenous ulceration, and the child has succumbed. Acute tuberculosis, too, has been known to supervene so soon after chicken pox as to suggest something more than a coincidence; organic disorders of the central nervous system have also, in rare instances, been noticed to follow an attack of chicken pox.

Diagnosis.—The chief difficulty is to distinguish between this affection and modified smallpox. If the eruption be observed to go through the successive stages above described, there is no room for doubt; but when the patient is only seen once and in the early stage, the difficulty may be very great. In smallpox there will almost always be a history of two or three days' malaise before the first appearance of the eruption, which may have been preceded by a scarlatini-form rash, and the papules will have from the first a hard, shotty feel which is never present in chicken pox. It will often happen that a certain diagnosis cannot be made on first seeing the patient.

Concerning the identity of smallpox and chicken pox, suffice it to say, that an attack of the one does not protect against

the other, that vaccination affords no protection against chicken pox, and that a person while suffering from chicken pox can be successfully vaccinated.

No special *treatment* is needed, but it is prudent to keep the patient in bed while the eruption is developing, and to isolate him from those who have not had the disease.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Aconite* is the most useful remedy in the beginning, particularly when the premonitory stage is well marked, with sthenic fever, and in the majority of cases will be all that is needed. A congestive condition, with throbbing headache, flushed face, and sore throat readily yields to *belladonna*. Gastric disturbance requires *antimony crude*. When there are much burning and itching of the vesicles *rhus tox.* or *apis mel.* will usually give prompt relief. Severe cases, with a tendency to suppuration, require *mercurius*.

CHILBLAIN (*Pernio*; *erythema pernio*) is a local inflammation of the skin resulting from exposure to cold. The condition is occasionally observed in old persons, but is far more common in the young, especially in those of lymphatic constitution, with a tendency to suffer "blanched fingers," "cold blue hands," and other manifestations of a weak peripheral circulation. Anæmic girls are particularly liable to the affection, and in them it occurs in the most aggravated and obstinate form. After full development is attained, the affection is far less frequently met with.

Chilblains always appears first in winter, and generally cease spontaneously when the weather becomes warm. The hands, especially the fingers and knuckles, the margins of the feet, the heels, toes, ears, and the tip of the nose are the most favorite seats.

The lesions generally develop during the night, when the body is at rest; they consist of variously sized, single or multiple, circular, raised, erythematous spots or patches, which are at first of a delicate pink color, but soon assume a red and subsequently a purplish hue. Itching, smarting, or burning is severe and is aggravated by warmth. If the inflammation progress, vesication occurs over the patch, and ultimately large bullæ containing clear or blood-stained serum may

form. The cuticle covering the bullæ may separate and leave a denuded, sloughy surface, the most advanced stage of the affection. Recovery then takes place slowly by granulation, and shallow scars may result, comparable to those produced by erythematous lupus, with which affection this disease has much in common.

Treatment.—Young persons liable to chilblains and allied conditions ought to be forced to take regular and vigorous exercise. Standing in front of a fire for considerable periods is specially likely to induce the condition. The clothing must be warm and woolen, thick gloves and stockings being worn. The boots must on no account be tight or of the kind known as “elastic sides.” The sleeping chamber should be warm.

On the first appearance of the signs of chilblains, the parts should be rubbed with cold water or even snow, in order to restore the circulation gradually; afterward rest, moderate warmth, and a little calamine lotion (3j ad ʒj with glycerine) suffice to prevent their further development. If the erythematous stage be reached, tincture of iodine is useful, and for application to exposed tracts it may be decolorized by the addition of ammonia. If a little more stimulation be necessary, equal parts of the liniments of camphor belladonna, or of turpentine and iodine, or of soap and chloroform are all efficacious, and may be followed by a lead or soap plaster. Should vesication occur, painting with compound tincture of benzoin, followed by smearing with resin ointment, answers admirably; the same treatment may be applied to the bullæ after the removal of the epidermis. In other cases more soothing applications (*e. g.*, calamine or borax ointment) are preferable. Sometimes erythematous patches, which constantly threaten to “break,” persist indefinitely; they are best treated by painting with a solution of nitrate of silver in spirits of nitrous ether (grs. xv ad ʒj or with liquid gutta-perchæ containing 5 per cent. of salicylic acid. Galvanism, as in Raynaud’s disease, may often be used with advantage.

The constitutional treatment is of much importance; it embraces good food, hygienic surroundings, regular exercise, and the administration of tonics, especially quinine, strychnine, and iron.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *agaricus*, which is specific for the simple form, with itching, burning, and redness of the part affected. *Arnica* is also useful, internally and externally, particularly for chilblains from bruises or pressure. It should never be applied externally to broken chilblains. More severe cases with bright-red shining swelling, with throbbing pains, may require *belladonna*. *Pulsatilla* is useful in blue-red swelling with shooting pains, worse in the evening. Inflamed swellings with excessive itching, worse when at rest are relieved by *rhus tox*.

CHILL.—It is difficult to assign its proper value to this term. There is probably no disease which has not justly or unjustly been attributed to taking a chill. It is often the only assignable cause of the most varied affections. A chill consists in a sensation of cold and shivering coming on within a few hours of exposure to cold or wet.

Symptomatic Indications.—*Acon.* or *gels*.

CHLOASMA (*Melanoderma*; *measma*) is an acquired condition characterized by the presence of smooth, pigmented patches, or a diffuse general pigmentation of the skin, the tint of which may vary from yellow to dark brown. In a few well authenticated cases diffuse pigmentation has appeared suddenly after strong mental emotion or acute disease, but in the great majority of cases the disease is secondary to disorders of the female generative organs.

Chloasma uterinum affects chiefly the forehead, temples, cheeks, the nipples, and the skin of the abdomen along the middle line. It is often very marked during pregnancy, and subsides—but only partially—after parturition; in a milder degree it may affect brunettes at the menstrual periods, or women suffering from any form of ovarian or uterine derangement; it usually disappears after the menopause. Chloasma may also follow dyspepsia, and is popularly associated with hepatic disturbance (*C. hepaticum*, liver spot). This form of the disease may be mistaken for *tinea versicolor*. It is noteworthy that the local pigmentation resulting from the application of mustard, cantharides, iodine, or chrysarobin may sometimes be permanent.

Diffuse pigmentation of the skin.

—The skin often becomes of a deep bronze tint from prolonged exposure to the sun's rays or to vicissitudes of climate ("morbus erroneus"). A similar condition may accompany Addison's disease, Graves's disease, chronic tuberculosis, carcinoma, and malaria, or may result from the prolonged administration of arsenic or of nitrate of silver ("argyria"); in the latter case the color is grayish-blue, and is due to the deposit of the reduced metal in the skin. Pigmentation of the skin may complicate varicose eczema, senile atrophy of the skin, scleroderma, leucoderma, lepra, psoriasis, and any chronic eruption accompanied by severe itching and scratching, especially pediculosis and prurigo. Deep pigmentation follows the subsidence of some forms of papular syphilis and erythema, also of purpura and lichen planus. Occasionally, malingerers and hysterical persons paint the skin to simulate disease. The pigment is always easily removed with a dilute solution of chlorinated lime.

Treatment must first be directed toward remedying any accompanying constitutional disturbance. Pigment is best removed by the continuous application on lint of a sufficiently strong alcoholic solution of corrosive sublimate to remove the epidermis and with it the pigment (usually about 1 per cent.), dressing the part afterward with starch powder. The new epidermis is at first devoid of pigment, but it usually returns subsequently. The same purpose may be more slowly but less satisfactorily accomplished by dilute solutions of acetic or hydrochloric acid used as lotions. Quite recently Unna's salicylic acid plasters, applied for twenty-four hours consecutively, have been much used.

J. J. PRINGLE.

CHLORAL HYDRATE, POISONING BY.

—The *symptoms* of an overdose of hydrate of chloral are profound sleep; stertorous breathing, and flushed face; at first, the person can be roused, but the coma gradually increases, the body temperature sinks, and death follows with more or less of collapse. Dangerous and fatal symptoms are more readily produced in drunkards than in healthy subjects. The drug is frequently used in combination with bromide of potassium,

which aids it in producing dangerous symptoms.

The *post-mortem appearances* present nothing at all characteristic; there will be the usual signs of death from asphyxia, and the brain may show an excess of cerebro-spinal fluid.

Treatment.—The chief object is to combat the loss of body heat; placing the patient in a warm atmosphere and surrounding him with hot bottles, the inhalation of warm air, and stimulation of the skin by friction are the best methods to attain this object. Artificial respiration and the application of both the constant and induced currents to the chest and limbs may be tried to overcome the coma. The stomach pump should be used or emetics given, and the hypodermic injection of strychnine (gr. $\frac{1}{25}$).

Chronic poisoning.—Among the ill effects of the habitual use or abuse of this drug, those relating to the nervous system are the most notable. Mental enfeeblement, melancholia, and mania have sometimes been traced to abuse of chloral. An erythematous or scarlatinal rash is apt to appear, and is often followed by desquamation and albuminuria. There may be acute general eczema. The use of the drug should be at once abandoned.

CHOROSIS is the most common form of idiopathic anæmia; it receives this name from the peculiar greenish tint of the complexion which characterizes it. The affection is practically limited to the female sex, and is most common about the period of puberty and early womanhood. It is often, but not invariably, associated with amenorrhagia, rarely with menorrhagia; and, although styled "idiopathic," its occurrence is favored by many conditions, which possibly may operate in conjunction with the essential cause, which as yet remains unknown. It is common in girls who follow sedentary occupations, or are exposed to fatigue, or live secluded from sunlight. So far as an examination of the blood goes, the chlorotic condition would seem to be more allied to imperfect formation of corpuscles than to their excessive disintegration, a derangement of hemato-genesis rather than of hemolysis.

The *blood* in chlorosis is paler than normal, owing to a marked deficiency in hemoglobin rather than of red corpuscles, for, although the latter are below the normal in number, the percentage

amount of hemoglobin is almost invariably less than that of the corpuscular richness. It is also more watery than normal, and the corpuscles do not tend to form rouleaux so readily as they do in healthy blood. It is said to be deficient in serum-albuminates. As to the corpuscles themselves, there is no manifest disproportion between the numbers of the white and red globules, but the latter occur in greater variety as to size than in health, many being smaller (microcytes) and some larger (megalocytes) than the average.

Symptoms are those common to pronounced anæmia. The skin is often of a waxy pallor, with, perhaps, a slightly greenish or yellowish-green tint, easily distinguished from jaundice by the pearly whiteness of the sclerotics. The cheeks have a pinkish flush which contrasts markedly with the surrounding pallor. The lips are pale and bloodless, and the conjunctiva, observed by everting or drawing down the lower lid, is markedly pale. The bed of the nails shows well the pale and bloodless character. The general nutrition is apparently unaffected, or there is no loss of subcutaneous fat, often indeed the reverse—viz., a tendency to an excessive deposit of this tissue. But in contrast to this apparently good nutrition there is marked debility, or rather muscular feebleness, the subject being readily fatigued. As regards the nervous system, the chlorotic is generally rather slow in intellect and prone to sleep. She presents often in a well-marked degree the condition described as “neurasthenia.” Effort, both mental and physical, is a weariness to her, and although her sleep is heavy, it is unrefreshing, and frequently in the morning hours she will be torpid and somnolent, becoming bright and wakeful toward evening. Sometimes, however, the condition is rather the reverse of this, and she is irritable and restless, suffering much from headaches, which are not specially localized, being mostly either frontal or occipital. Hysterical phenomena are not very common. One of the most frequent symptoms complained of is breathlessness, especially after exertion. She finds it increasingly difficult to mount stairs, or do any work requiring effort, without panting for breath. Yet the lungs exhibit no physical signs of embarrassed circulation. The characteristic signs are those of the circulatory system. Subjectively the

patient may complain of palpitation. The heart's action may be rapid, and is always easily excited. On examination there is generally to be found evidence of enlargement (? dilatation) of the left ventricle, shown by a slight outward displacement of the apex beat, and increase in the lateral dullness. Sometimes also a faint pulsation is visible in the third left interspace near the sternum (? auricular). There is invariably a systolic bruit, loudest over the pulmonary area, but often audible over the whole precordia. The character of this bruit is mostly soft and blowing, but is sometimes so remarkably harsh and grating as to be mistaken for pericardial friction which may be due to an unusual dryness of the serous membrane. As to its precise mode of production, the two main views are (1) that it is generated in the pulmonary artery, by the altered quality and perhaps also the diminished quantity of the blood; and (2) that it is a true mitral reflux, from the closure of the valve being rendered imperfect by the weakening of its muscles and the dilatation of the ventricle, the unusual site of a bruit so generated being explained by the retraction of the lung uncovering the auricular appendix. Besides this bruit, systolic murmurs are often heard over the aortic and tricuspid area and in the larger arteries on the slightest pressure, perhaps because of the more yielding nature of the vessel walls. Almost as invariable is the jugular hum, or “bruit-de-diable,” or “humming-top bruit,” which can be heard over the jugular vein at its termination, often better over the right than the left vein. This murmur, when at all well marked, is invariably accompanied by a thrill. The bruit-de-diable is readily recognized by its continuous character, although its pitch rises with inspiration and falls with expiration. It is also louder when the patient is in the upright posture than when lying down. A similar venous hum may be heard occasionally on auscultation over the lateral sinus or the torcular Herophili. The order of appearance of the hæmic murmurs is usually as follows: (1) the venous hum or the bruit-de-diable; (2) the systolic murmur in the pulmonary area (second left interspace); (3) a systolic murmur at the apex, indicating the occurrence of mitral reflux; (4) a similar murmur in the tricuspid area; (5) a systolic murmur in the aortic area. The murmur

of mitral reflux is only present in advanced cases of chlorosis, and is usually the last to disappear when recovery is in progress. In well-marked cases of chlorosis there is slight œdema about the ankles which disappears after a night's rest, and perhaps slight puffiness of the lower eyelid. Perhaps the swelling of the optic disk occasionally found is really of dropsical origin. Marked neuro-retinitis has been met with in severe cases, but is very rare, nor are retinal hemorrhages frequent (*see* ANÆMIA, PERNICIOUS). The pulse is rather quick, and often of comparatively high tension. Or it may be soft and compressible. The digestion may be deranged. Gastralgia is common, and the appetite variable. Generally there is more or less pronounced anorexia and discomfort after taking food. Vomiting is not common. Gastric ulcer is an occasional, but by no means frequent, complication. Constipation is the rule. The urine is copious, pale, and of low specific gravity, but is variable in this latter respect, some observers finding that there is excessive excretion of urea and uric acid, although pigmentary matters are deficient. Amenorrhœa is a frequent concomitant, and for the most part must be attributed to the anæmic state. Lastly, there may be pyrexia, especially in severe cases.

The *diagnosis* of chlorosis is easy. If sex and age concur, and if there be no evidence of any anæmiating disease (and the possibility of phthisis must be always borne in mind and carefully excluded), then the case may fairly be included under this head. But difficulty arises in distinguishing this special form of anæmia and those forms which are more clearly traceable to conditions of life from the grave form of idiopathic anæmia, which proceeds sooner or later to a fatal termination, particularly as cases which at their outset conform to all the characters of chlorosis may ultimately pass into progressive pernicious anæmia.

Treatment is hygienic, dietetic, and medicinal. The withdrawal of the patient from insanitary surroundings, and the exchange of a town life for a country life, are measures of a certain value, and show the influence which exclusion from sunshine and pure air has in the production of the disease. Exercise should at first be reduced to a minimum, rest in bed having an especially good effect, particularly upon the overworked milliner or domestic

servant of town. Massage is useful, but seldom needed, recovery being often very rapid without recourse to it. The diet should be regulated, and, as soon as possible, meat should be given. An occasional aloetic purge may be necessary. For restoring the blood in cases of chlorosis there is no remedy equal to iron, which should be given in large doses. Bland's pill, composed of the dried sulphate of iron (grs. ijss) and carbonate of potash (grs. ijss) with pulv. tragacanth. (q.s.) (three, four, or five pills to be taken three times a day), are often all that is needed. Sir A. Clark, who attributes the anæmic state largely to the absorption of products of fecal retention, thinks more value is to be attached to purgation than to tonics. It is, however, rarely necessary to administer a purgative with Bland's pills. Iron in any form is useful, and when the sulphate or perchloride is ill borne, the milder preparations, or ferruginous waters, as those of Schwalbach or Pyrmont, may be tried. Iron rarely fails to rapidly increase the hemoglobin, but, when progress is slow, arsenic may be given, either in combination with, or in substitution for, iron. The mineral acids, especially hydrochloric, are of considerable service when digestion is feeble. Cold baths, and seabathing in moderation and with due precautions, are useful. Cases of chlorosis are specially liable to relapse if treatment be discontinued as soon as the color returns to the cheeks; it is therefore essential that the treatment should be persevered with for a prolonged period and recommenced on the first sign of a return of the condition.

SIDNEY COUPLAND.

Symptomatic Indications.—The main remedy in the simple form is *ferrum*, especially when there is great paleness of all the mucous membranes, and ashy pale or greenish color of the face, which becomes fiery red on motion. Bellows sound of the heart and anæmic murmur of the arteries and veins; palpitation of the heart and dyspnœa; all the muscles are feeble and easily exhausted from slight exertion. Next in value is *arsenicum*, which is indicated by great debility with cardiac complications. There is œdematous paleness of the skin; dyspnœa; languor. In chlorosis from loss of vital fluids; menstrual or vicarious bleeding, suppurations, etc., or which sets in after severe or protracted illness, *cinchona* is

the remedy. Deep-seated, chronic cases, with tubercular diathesis, or cases brought on by depressing mental influences, as grief, worry, or by exhausting bodily causes, as night watching, loss of blood, diarrhea, great nervous debility, require *phosphorus*. In cases dependent upon defective digestion or with atonic condition of the uterus *helonias* is valuable. It is also useful in cases in which *ferrum* appears indicated but fails to cure. Cases with gastric complications require *antimon. crud.* The patient suffers from headache, with great depression, and appears excessively lazy and weak; must lie down for hours; deep and unrefreshing sleep at night. Obstinate cases in persons of a scrofulous diathesis require *calcareo carb.* The patient has a disgust for meat, and craves sour or indigestible things, as chalk, coal, etc.; walking wearies and makes the heart palpitate; sitting causes severe backache and headache, therefore constant inclination to lie down. Chlorosis associated with amenorrhœa, or with scanty, delayed menses, usually yields to *pulsatilla*. Chilliness, melancholy and desire for cool, fresh air characterize this remedy.

CHOLECYSTOTOMY.—The gall bladder has been excised by Marion Sims; result fatal. George Brown tapped the gall bladder successfully.

CHOLERA is a generic term which has been somewhat loosely applied to a series of acute diseases, mainly characterized by copious intestinal flux; these are Asiatic cholera, English cholera (cholerine, cholera nostras), and Cholera Infantum.

Cholera Asiatica is an acute specific disease, occurring in temperate climates as an epidemic only, and characterized by copious discharge of watery fluid from the alimentary canal, suppression of urine, and collapse.

Symptoms.—The most prominent symptom of the *first stage* is the "premonitory diarrhea"; the stools are copious and watery, and the patient experiences great depression, epigastric sinking, and nausea. In severe attacks, and especially at the commencement of an epidemic, this stage may be absent, the patient becoming suddenly affected by symptoms characteristic of the *second stage*.

The stools are now very frequent, and the watery fluid passed ceases to be bile-

stained, and becomes colorless or opalescent, with floating flocculi—the rice-water stools. Vomiting shortly becomes a prominent symptom, the contents of the stomach being first rejected, and then all the water which the patient, impelled by a violent thirst, is eager to drink; this is mixed with mucus and epithelial *débris*, so that the vomited matter much resembles the stools. Painful cramps in the muscles of the extremities and the abdomen ensue; the pulse becomes rapid (90 to 100) and progressively weaker, the respiration hurried, and the temperature in the mouth and axilla subnormal; the patient is prostrate, restless, his voice husky, his face pinched, and skin inelastic.

The second stage, which lasts from two to fifteen hours, gradually passes into the *third, algid, cold, or collapse stage*.

The purging and vomiting now either cease or diminish, but the signs of prostration and imperfect aëration of the blood increase. The temperature in the mouth and axilla is 4° or 10° or even 20° F. below the normal, but the rectal (or vaginal) temperature generally ranges between 100° and 102° F., but may be as high as 108° F. in cases about to terminate fatally in this stage; the pulse is imperceptible at the wrist, and may also disappear from the brachial and carotid arteries; the first sound of the heart may be inaudible; respiration is very shallow and hurried. If a vein be opened, only a few drops of dark, viscid, "tarry" blood escape, and the imperfect circulation is evidenced by a leaden hue, especially marked in the extremities, face, and tongue. All the soft tissues of the body appear to shrink, the face becomes hollow, the eyeballs dry, sunken, and bloodshot, beneath half-closed lids. The skin is inelastic, often covered with clammy perspiration, and cold; the expired air also is cold. The excretion of urine and bile ceases, the voice is a whisper, and the patient, who is at once restless and apathetic, complains only of thirst, unless the cramps, which are a prominent symptom of the second stage, persist. Death may thus gradually be brought about after, on an average, twelve hours of the third stage. Occasionally the patient passes so rapidly into the collapse stage that diarrhea does not occur, the whole duration of the illness being only a few hours.

If death do not take place in about twenty-four hours *reaction* sets in. This

may be imperfect; if so, the patient becomes semi-comatose, the suppression of urine persists, the skin remains cold and clammy, but dusky red instead of leaden. Though the pulse at the wrist becomes perceptible, respiration is still hurried, and death ensues in a few hours. The reaction may be so little marked that the patient passes at once into convalescence by the mere cessation of symptoms and the re-appearance of urine. This is of especial frequency in cases of cholera occurring in the Tropics. Reaction may be well marked, and for ten or twelve days the symptoms may resemble those of enteric fever in the second week; the temperature is 2° or 3° above the normal, the pulse full and quick, the respirations are a little hurried, the face is flushed, the skin becomes red and hot, and may present an eruption (roseolar, or more rarely erythematous, urticarial, or vesicular). The stools, which are at first pale yellow, watery, and sometimes bloodstained, soon begin to contain bile, and have a pea-soup character, but are very fetid. The urine is scanty at first, and contains a very small proportion of the normal solids. In about half the cases it is albuminous, and it may contain casts. The tongue is dry and furred, and low muttering delirium is often present. Death during reaction may be preceded by cerebral symptoms (convulsions, coma), probably of uræmic origin; or it may be brought about by pulmonary engorgement and œdema, by gastro-enteritis, or by asthenia. Convalescence in more favorable cases may be delayed by subcutaneous abscesses, parotid suppuration, and sloughing of the cornea.

It is the duty of the physician in charge of a case of cholera to see that the stools and all soiled linen are thoroughly disinfected. This is best done with the solution of the perchloride of mercury (*see* DISINFECTION). Where cesspools are in use, the dejecta, after disinfection, should be buried in a deep pit, situated as far as possible from wells and streams.

The *diagnosis* of Asiatic cholera cannot be made by the presence of any pathognomonic symptom, as severe cases of simple cholera or choleraic diarrhea may present all the symptoms of mild cases of Asiatic cholera. The history of the individual as to recent residence in an epidemic area, or the probability of the locality having become an epidemic area,

are the most important elements in the diagnosis.

During the epidemic prevalence of cholera, cases of collapse from rupture of the stomach or intestine and cases of internal strangulation and poisoning by arsenic have been mistaken for that disease. At such times it is prudent to treat every case of severe diarrhea as a case of cholera, although the absence of the "cholera-voice" and the maintenance of a good pulse, together with the general aspect of the patient, may enable a physician with special experience of cholera epidemics to speak with confidence.

The rate of mortality varies from 10 or 20 to 66 per cent. of attacks in different epidemics, and is not less in temperate than in tropical climates; the average is stated at over 50 per cent.

Prognosis is always grave; the rate of mortality already obtaining during a given epidemic and the probability that the earliest cases observed in any locality will be the most severe must be taken into account. The early onset of the collapse stage is the most unfavorable sign; not more than one out of three patients in whom this stage is well established recover. During the second stage the condition of the pulse and heart is the best guide, early signs of cardiac failure, especially the disappearance of the radial pulse, being of very serious import. A high rectal temperature (104° F.) is also unfavorable. The more rapidly reaction is established the better is the prognosis. During the earlier period of the stage of reaction continued suppression of urine, high temperature, bloodstained stools, roseolar or other eruptions, and pulmonary complications are unfavorable signs.

Pathology.—Cholera follows lines of traffic. It is, however, not communicable directly from man to man, and can only become epidemic in places which present certain local conditions of atmosphere and soil. The disease ceases to spread or becomes extinct during a continuance of cold weather, and is favored by a moist, but not saturated, state of soil. It is most intimately related to water supply, but may be transmitted by milk (probably through added water) and possibly by other foods; persons residing in an epidemic area who do not drink water, or are careful to drink pure water only, generally escape, while those residing

without the area who drink the water of the area may suffer.

The *specific virus* is undoubtedly contained in the rice-water stools, probably in them alone; they are capable of rendering large bodies of water pathogenic, and their virulence increases for some hours or days after they have been passed. The conviction that the virus must be a living organism has led to the stools being very carefully searched. The only organism to which any importance can be at present attached is the so-called "comma bacillus" of Koch. If it be granted that cholera is a specific disease due to the presence of an organized virus, it seems probable that the organism develops in the intestinal canal, as the "comma bacillus" is known to do. Some, whose views have received confirmation by the discovery of ptomaines produced by the comma bacillus, believe that a chemical poison enters the blood, produces spasm of the arterioles, especially of the pulmonary arterioles, and so leads to local and general asphyxia. Upon this view the rice-water stools are a paralytic secretion due to inhibition of the abdominal sympathetic by the poison. Experimental section of all the nerves of the intestine produces a similar oversecretion of watery fluid.

The most distinctive *post-mortem appearances* observed when death takes place in the collapse stage are a shrunken, dry state of the tissues, a swollen injected condition of the gastro-intestinal mucous membrane, with detachment of the epithelium in flakes. Ecchymoses and a sticky state of the serous surfaces, distension of the right side of the heart and of the pulmonary artery, collapse of the lungs, which are also exsanguine, and an inspissated condition of the blood, are appearances commonly met with. Rigor mortis sets in early, and may cause curious post-mortem movements. The temperature usually rises after death. The detachment of the flakes of intestinal epithelium occurs post-mortem, but is a matter of dispute whether the distension of the right side of the heart occurs before or after death.

Treatment.—During periods of epidemic prevalence every case of diarrhea should be treated as though it were the diarrhea of the early stage of cholera. The first indications are rest in bed and the withdrawal of all food and drink, the patient being only allowed

to suck ice. Counter-irritation by a mustard poultice to the epigastrium, or a wet abdominal pack, made by placing a folded wet towel on the abdomen and swathing the body in dry towels, relieves the patient. In India the general practice is to give opium combined either with an astringent (*e. g.*, opium gr. j, plumbi acetatis grs. iv, dissolved in water, and repeated after each loose motion until three doses have been taken) or with a stimulant, or in combination with both a stimulant and an astringent. Calomel in a single dose of 2 to 5 or even 30 grains, followed by repeated doses of opium, has been recommended. Others, who regard the diarrhea as eliminative, recommend evacuant treatment by castor oil in doses of half an ounce, frequently repeated. All are agreed that when collapse is threatened or has set in, opium ought not to be given, and that during the second stage it does not check the colliquative diarrhea—is, in fact, probably not absorbed, and that, if given during collapse, it may subsequently produce toxic symptoms if the stage of reaction be reached. Sulphuric acid lemonade (m. xv in ℥ j) is grateful to the patient, if not useful. Cramp may be treated by hand-rubbing, by the hypodermic injection of small doses of morphine cautiously given, or by inhalation of ether. In the collapse stage no drugs are of much avail; brandy, iced champagne, and diffusable stimulants are of doubtful advantage; but, if the diarrhea have ceased, enemata of warm beef-tea and brandy may be given. A general bath at 98° to 104° F. relieves muscular cramp and the feeling of distress, and may be followed by sleep and recovery. The injection of warm saline fluid into a vein is followed by a remarkable improvement: the pulse improves, the patient regains his faculties, and is able to sit up; this amendment is usually of very short duration, but the treatment appears worthy of trial, and recoveries have taken place after a second injection. The fluids used have been: (1) Warm water containing phosphate of sodium and common salt, of each $\frac{1}{2}$ per cent; (2) warm water (110° F.) containing common salt 60 grains, chloride of potassium 6 grains, phosphate of sodium 3 grains, carbonate of sodium 20 grains, and absolute alcohol 2 drams, in 1 pint; (3) "artificial serum."

The treatment of the stage of reaction is chiefly that of the complications. Of

these the most serious is a continuance of suppression of urine; for this the patient should drink freely (Oss every second hour); dry cups or a mustard plaster should be applied over the loins, and a mixture containing liq. ammon. acet. $\frac{z}{3}$ ss, combined with tinct. digitalis m. v-x, or even tinct. cantharidis m. x, may be given every two or three hours, to six doses. Too much food should not be allowed during the stage of reaction. Iced milk, beef-tea, chicken-broth, and arrowroot may be administered in small quantities at short intervals. If vomiting be troublesome, beef-tea and brandy enemata may be given. In some cases, however, small quantities of solid food are retained by the stomach. Carbonate of sodium and chloride of sodium, given either with the food or in a mixture, will help to restore the salts of the blood.

Persons residing in a locality where cholera prevails ought to observe certain precautions; the water used for drinking should be boiled and filtered, or imported natural mineral waters should be drunk; all milk ought to be boiled; no food which has been in the room of a cholera patient should be used. Purgative and laxative remedies and fruit must be eschewed.

DAWSON WILLIAMS.

Symptomatic Indications.—For the premonitory symptoms and in the beginning of the disease the best remedy is *camphor*. The symptoms are those of collapse; icy coldness and blueness of the face and limbs; burning pains in the stomach and throat, with cramp in the calves. Patient lies half stupid and senseless, moaning and groaning in a hoarse, husky voice. In the second stage the most reliable remedy is *arsenicum*. Sudden prostration, with sinking of the vital forces, great anguish, restlessness, fear of death, violent thirst for cold water, which is immediately thrown up, violent, burning pains in the stomach and bowels characterize this remedy. *Veratrum album* is also valuable in this stage. The indicating symptoms are, excessive vomiting and diarrhea, with cramps in the calves, rapid prostration, small, almost imperceptible pulse, hoarse, weak voice, cold breath, and cold sweat over the whole body. For the cramps the best remedy is *cuprum*. It is also useful for the vomiting when that is one of the prominent symptoms. Violent cramps in the

stomach, fingers, and toes and convulsions of the extremities characterize this remedy.

CHOLERA INFANTUM is an acute disorder attacking infants and young children, observed only in warm weather, and characterized by uncontrollable diarrhea and collapse. It is closely allied to, if not identical with, cholera nostras, but is both more prevalent and more fatal. The onset of symptoms may be very sudden, the infant being seized with violent vomiting and purging, quickly followed by collapse. In other cases diarrhea comes on gradually, often accompanied or preceded by drowsiness, then vomiting begins, and lastly collapse ensues.

When the disorder is fully established, the *symptoms* are: vomiting, at first the contents of the stomach, then a watery fluid containing more or less bile; diarrhea, the stools being at first feculent, thin, and offensive, but soon becoming watery, inoffensive, and almost like urine; prostration, sunken eyes, pinched features, flaccid abdomen, inelastic skin, and an extraordinary shrinking in size of the whole body. The tongue is at first clean, but later is coated with a thin fur, which eventually becomes dry and brown; thirst is constant, but even water is generally vomited; the pulse is rapid, and the internal temperature raised (to 104° or more), although the extremities are cold to the touch; the patient is restless, but drowsy. With pronounced symptoms such as these, the child generally passes into deep collapse, drowsiness increases, diarrhea continues, vomiting ceases, the features become still more pinched and livid, the eyes half closed, and the temperature may rapidly fall below the normal. Death is generally preceded by coma. Convulsive phenomena, varying in intensity from clenching of the hands to well-marked general eclampsia, are almost always to be observed at some stage.

In favorable cases the rectal temperature falls, and the stools begin to be feculent; water is retained by the stomach; the diarrhea gradually ceases, and finally nourishment can be taken.

The disease is, as a rule, of short duration; it may terminate fatally in less than a day; death usually occurs on the third day; convalescence is usually established, if at all, on the fifth day, or sooner.

The *diagnosis* depends upon the pres-

ence of uncontrollable vomiting and diarrhea, intense thirst, rapid shrinking of the whole body, copious serous stools, and early collapse.

The *prognosis* in a well-marked case is extremely grave; when collapse is established, death almost invariably ensues. Early cessation of vomiting, the appearance of feculent matter in the stools, or a fall in temperature are favorable symptoms.

The *morbid anatomy* is not very characteristic; there is evidence of catarrhal enteritis, with denudation of epithelium and enlargement of the solitary and agminated glands; follicular ulceration is frequent; nephritis (parenchymato-glomerular) is always to be found; catarrhal pneumonia is generally present, and there is cloudy swelling of the cells of the liver and other viscera. The stools, which are watery and almost invariably offensive, contain casein, and frequently also some serum albumen derived from the undigested milk.

The *ætiological conditions* appear to be the same for all forms of acute summer diarrhea, whether observed in infants, children, or adults. The essential condition is a period of continued high temperature, during which the air temperature is never much below 60° F. A more exact parallel can be traced between the temperature of the earth at a depth of 4 feet and the epidemic prevalence of diarrhea; this does not begin until the 4 feet earth thermometer touches 56° F.; and the epidemic attains its maximum in the same week as the earth temperature reaches its highest point.

The conditions of town life, especially in the overcrowded dwellings of the poor, favor the disease, which attains its greatest virulence in closely built towns, where sanitation has been long neglected, and where a naturally loose and porous soil has become saturated with filth. Hand-fed infants suffer more than those at the breast, probably owing to decomposition or contamination of the milk.

The disease is probably in some way dependent on the activity of micro-organisms existing either in the soil or food, or in both, and there is reason to believe that it may be communicated by the emanations from the stools.

Treatment.—Milk should be withdrawn. If vomiting be marked, only iced water should be given. Iced white wine

whey, and chicken or veal broth, if retained by the stomach, constitute the best diet. Collapse must be combated by hot mustard baths (about $\frac{3}{4}$ j to the gallon), and brandy or ammonia in small and frequent doses. High fever and convulsions are indications for tepid baths (75° to 80° F.). Drugs by the mouth are generally rejected, and seldom produce much effect if retained. Among the drugs praised are mercury, in the form of the perchloride, gr. $\frac{1}{60}$, or gray powder gr. $\frac{1}{6}$ — $\frac{1}{8}$, or calomel gr. $\frac{1}{10}$ — $\frac{1}{20}$ (the latter combined with Dover's powder, gr. $\frac{1}{12}$). These should be frequently repeated at first. Nitrate of silver gr. $\frac{1}{12}$ — $\frac{1}{8}$; salicylate of lime (grs. iij—v every two hours at first) or salicylate of soda; naphthaline grs. iij—iv, resorcin gr. j, and other antiseptics may be tried. Hypodermic injection of morphine (by preference the sulphate), beginning with gr. $\frac{1}{30}$ in the earliest stage; bromide of potassium; enemata of ice-water, or of thin starch containing laudanum m. iij and sulphate of copper gr. $\frac{1}{4}$; irrigation of the intestines with warm water containing nitrate of silver gr. j to $\frac{3}{4}$ j, and even irrigation of the stomach. When colic is severe in the early stage, one or two large doses of bismuth (grs. x), with Dover's powder, or in mixture with laudanum, are sometimes successful. After the stools have again become feculent, chalk and catechu will usually check persisting diarrhea.

DAWSON WILLIAMS.

Symptomatic Indications.—In the beginning *aconite* is the most useful remedy, when the skin is hot and dry, and the child is restless and sleepless. The stools are green and watery with cutting pains and tenesmus. Later *veratrum album* is the most generally useful medicine. It is indicated by the suddenness of the attack, with excessive vomiting and diarrhea, and great prostration. The vomiting is brought on by the least motion. There is much thirst, but drinking increases the vomiting and purging. The skin is cold and clammy and covered with cold perspiration, particularly the forehead. *Arsenicum* is useful in the later stage of the disease. The skin is dry and shriveled, pale, and the countenance has a death-like look. The child drinks often but only in small quantities, and vomits immediately after drinking; is very restless and greatly prostrated. Cholera infantum occurring during dentition, when the attack

has followed exposure to cold, generally yields to *chamomilla*; the stools are watery, green, or like chopped eggs, often from any motion of the child, with crying, colicky pains and drawing up of the legs; sour vomiting of food or slimy substances. *Ipecacuanha* is frequently useful, particularly when vomiting is the predominant symptom. The face is pale, with blue margins around the eyes; almost constant nausea and vomiting; vomiting of food and large quantities of green mucus; stools green like grass, or fermented like yeast. *Podophyllum* is valuable when the predominant symptom is diarrhea; the stools are watery, with meal-like sediment, or of dark yellow mucus, smelling like carrion; the stools frequently change in character. There is not much vomiting, but much nausea with retching. Child lies with half-closed eyes, moaning and rolling the head from side to side. *Phosphorus* is useful when the child vomits after drinking as soon as the water becomes warm in the stomach; the stools are watery, containing little lumps like grains of tallow, undigested, or watery stools, pouring away as from a hydrant. *Camphor* is often valuable in last stage of the disease; the skin is as cold as marble, yet the child will not remain covered; lies half-stupid or senseless; utter prostration.

CHOLERA NOSTRAS (English cholera) is an acute disease characterized by a copious watery intestinal flux and by collapse. It resembles Asiatic cholera in its general symptoms, but is of a much less severe type, has a very low mortality, does not spread as an epidemic, though it is often endemic, and frequently occurs sporadically. The disease is not well defined and it is more than probable that the combination of symptoms to which the term is applied may be produced by more than one cause.

Symptoms.—In a typical case the patient is suddenly seized with nausea, perhaps ending in the rejection of the contents of the stomach, and speedily followed by purging, the stools at first being bile-stained. After a time the stools become less colored, and finally consist of a watery fluid containing a little albumen. From the first there is a feeling of depression, with epigastric sinking, which deepens into more or less severe collapse, in which the face is dusky and shrunken,

the eyes sunk, the voice feeble, the pulse small and frequent, and the respiration hurried. The temperature quickly becomes subnormal. The severity of the symptoms varies very greatly, and a mild attack is not to be distinguished from one of ordinary diarrhea, while a severe case may resemble one of mild Asiatic cholera.

The *diagnosis* from Asiatic cholera rests mainly upon the absence of an epidemic of this disease, the general mildness of the symptoms, and the less marked collapse.

The *prognosis* is always favorable except in the case of old or enfeebled persons or very young children (see CHOLERA INFANTUM).

Ætiology and morbid anatomy.—In fatal cases acute gastro-enteric catarrh has been observed. The symptoms appear to be due to the absorption from the intestinal tract of some poisonous material either ingested as such or produced there by micro-organisms.

Treatment.—The most important point in treatment is to withdraw all solid food and milk, allowing only iced barley-water and iced veal or chicken broth, and, best of all, iced water. The patient must remain in bed in a well-ventilated room. A mustard poultice or hot stupe should be applied to the abdomen; if there be much vomiting, it is better not to give drugs, and to allow only iced water, or lumps of ice. If much pain be present, laudanum m. xv, with either the compound tincture of camphor 3 j, or bismuth nitrate grs. x, may be given. Large doses of calomel (as much as a scruple) have been recommended in the early stage, but castor oil will generally be found efficient. Prolonged diarrhea may be checked by astringents, such as chalk and catechu, sulphuric acid (m. xij), and acetate of lead (grs. iij). Old, feeble, and very young patients often need free stimulation with brandy or iced champagne.

DAWSON WILLIAMS.

Symptomatic Indications.—In the first stage of the disease *aconite* is frequently valuable to restore the pulse and arouse vital reaction, also in the stage of collapse, when the collapse comes on rapidly, with deadly chill; great fear and anxiety of mind; fear of death; violent vomiting and purging, green stools. *Cinchona* is specific for summer choleraic diarrhea, spasmodic pains in the stomach; painless diarrhea, blackish, bilious or whitish

stools; prostration unto faintness. *Croton tig.* is useful when the stools are suddenly expelled and are copious; the discharge always comes on after drinking. Excruciating abdominal pains may be frequently relieved by *dioscorea* or *colocynth*. With the latter remedy the bowels are the seat of violent constrictive or cramp-like pains which draw the patient nearly double. See also CHOLERA.

CHOREA (St. Vitus's Dance) is an affection characterized by spasmodic movements of the voluntary muscles.

Symptoms.—The onset is usually gradual, being preceded for some little time by failure of the general health. The child becomes pale, excitable, restless, and fidgety, is clumsy with its hands, drops things, shrugs the shoulders, jerks the elbows, or has twitching movements of the fingers or face, from which latter it is often thought to be making grimaces. The gait is awkward—a sauntering, dawdling walk; sometimes one foot is turned in.

Gradually the patient becomes more clumsy, fidgety, and helpless, and the face acquires a vacant imbecile look, which is very characteristic. When asked to put out the tongue, no notice seems at first to be taken of the request, but after a pause the tongue is suddenly protruded and as rapidly withdrawn. The speech becomes indistinct, partly from impaired power of articulation and partly from an aphasic condition; all degrees of this state up to complete speechlessness may be met with.

The action of the heart is often irregular, and in a considerable number of cases a systolic murmur is present, sometimes at the base only, and then presumably hæmic, but more often at the apex. Should a systolic murmur at the apex or base vary much from day to day, it may be hæmic in origin; but if well marked and persistent throughout the attack, it is almost certainly due to organic change. Presystolic or double apex murmurs in chorea are invariably the result of endocarditis.

In many cases, particularly in the early stage, one side of the body is more affected than the other, but it is unusual for the affection to be limited to one side throughout the attack.

There may be at first no movements, but an apparent paralysis of one side of

the body, a condition subsequently replaced by chorea. The movements of chorea are distinguished from those occurring in any other form of nerve disorder by their non-rhythmical and purposeless character; the same muscles or group of muscles never twitch twice in succession. As a rule, the movements cease during sleep, but in the worst cases the movements are incessant, and sleeplessness becomes a marked feature of the case. Such patients emaciate rapidly, and sores form on various parts of the body, either from injuries or friction, the result of the constant movement.

Incontinence of urine or fæces is almost unknown.

Death may occur from exhaustion and sleeplessness, or may be ushered in by delirium. Another cause of death is pericarditis, which may carry off the patient during the height of the disease or when the movements have practically ceased.

Prognosis.—In children is generally favorable, as the disease, when uncomplicated and left to itself, lasts as a rule from eight to ten weeks. In young adults not so good, the danger being especially great in those cases which seem to get well very rapidly, as maniacal or other grave symptoms may appear with great suddenness.

Complications.—Rheumatism is the most important; it may occur with or without endocarditis, or endocarditis may develop without articular rheumatism. Another rheumatic manifestation sometimes met with in cases of chorea consists in the formation of subcutaneous nodules in the fibrous tissues, especially in connection with bony prominences. They are most common about the patellæ or olecranon processes, the spinous processes of the vertebræ, and along the occipital ridge or on the frontal bone, but may be met with elsewhere, and have been observed in the abdominal wall. The nodules, which are fibrous in structure, come out in successive crops, are not as a rule tender, and gradually disappear. Nodules are more common in cases complicated by endocarditis.

An eruption consisting of round, slightly raised red spots, which fade in the center, enlarge, and gradually disappear (circinate erythema), is not infrequently met with, and is also of rheumatic origin.

Post-mortem appearances.—Endocarditis is almost always found, in the shape of a fringe of fibrinous beads along the free edge of the mitral valve; sometimes the aortic cusps are also affected, less commonly the aortic alone. Pericarditis is often found, for, as already remarked, it is one of the causes of a fatal termination of the disease. In many cases the nervous centers have appeared to be healthy, but plugging of minute vessels in various parts has sometimes been found. Dr. Dickinson has described an appearance of dilatation of the medium-sized arteries and veins throughout the brain and spinal cord, also exudations and small hemorrhages into the neighboring tissues. It must be remembered, however, that it is only in the most severe cases that these changes have been found, and that, as in the very great majority recovery is complete, it is more probable that these changes are the effects rather than the causes of the disease.

Ætiology.—As no constant changes have been found in the nerve centers, chorea must be regarded as a functional disorder—a view supported by the fact, that recovery, when it occurs, is always complete, no permanent paralysis ever being left behind. It has been said that the affection sometimes becomes chronic, but such cases, when carefully examined, generally prove to be instances of repeated relapses, in which the intervals of freedom from movements have been overlooked.

Chorea is most common between the ages of five and fifteen, but is occasionally met with at an earlier age. It also occurs in young adults between eighteen and twenty-five. In children it is about three times as common in girls as in boys, and in adults, too, it is much commoner in women; in no inconsiderable number of the latter it accompanies pregnancy. There is almost always some hereditary nervous predisposition in the family.

There are two exciting causes, apart from rheumatism, which demand attention. Fright or sudden emotion in a child predisposed to chorea is undoubtedly capable of inducing an attack. To be attributable to the fright, however, the chorea must have come on within a few hours after the mental shock. The other great exciting cause is overpres-

sure in schools. It is not only the dull children, who are being constantly worried by their teachers, who become the subjects of chorea, but quite as often, if not more so, the bright excitable precocious children, who are already learned out of proportion to their years, and who are ambitious of more knowledge.

It is probable, also, that insanitary surroundings and insufficient food have something to do with the causation, for chorea is far more common among the children of the poorer classes than those of the well-to-do.

Treatment.—Rest is the most essential feature of the treatment; the child should not be allowed to go to school, and great care should be taken to avoid excitement. In the mildest cases no further measures will be needed, but, if the gait be at all seriously affected, the patient must be kept in bed or on a sofa, and on no account be allowed to do any head work. The diet is always a matter of moment. As a rule, in the mildest cases, meat may be allowed, but it must be pounded, as, owing to the involvement of the muscles of mastication, children are very apt to “bolt” their food. In more severe cases, milk, beef-tea, jelly, and milk puddings should constitute the main articles of diet. Stimulants are seldom called for, except in the most severe cases where there is great exhaustion and sleeplessness. If the movements be very violent, precautions must be taken to prevent the patient from being jerked out of bed, or wounding himself against the side of his bed, and a chorea bed has been devised, consisting of a sort of box with deep, well-padded sides, in the bottom of which the patient’s bed is made. In children, a better plan is to make a sort of hammock by fastening the sheets to the side of the cot, so that the child is suspended between, them; there is then no risk of his doing himself any harm; but it is very seldom that the disease is so severe as to call for this mode of treatment.

Of drugs, arsenic enjoys the greatest repute; the liquor arsenicalis may be given in 3-minim doses, to a child of six, three times a day, and the dose may be gradually increased till symptoms of poisoning appear, when it should be reduced, or the use of the drug suspended for a time. A child of ten years old will often be able to take 12 or 15 minims as a dose without ill effects. Conjunctivitis

and vomiting are the principal warnings that the drug has been pushed too far. As soon as the disease is somewhat under control, it is advisable to reduce the quantity of arsenic. Iron is also useful, especially in the form of the syrup of the bromide; 10 minims three times a day being the dose for a child ten years of age.

Sulphate of zinc in increasing doses has also been much recommended; a grain may be given three times a day, and 1 grain added daily until a maximum of 25 grains is attained, when the dose should be diminished in like manner as it was increased. It is worthy of note that, when thus administered, sulphate of zinc does not produce any ill effects, as children taking the maximum dose have a good color and look healthy.

In very severe cases morphine by the mouth or hypodermically may be required to insure sleep, but, as a rule, chloral answers better. In adults a full dose of 20 grains may be followed, if necessary, by half the quantity in two hours, 5-grain dose being subsequently given every two hours until some impression is made upon the disease. Some very severe attacks have been completely cut short in two or three days in this way, but in other cases the plan has failed; in such, possibly, hyoscine might be of benefit. The administration of chloroform may be necessary, and, without its aid, it is sometimes difficult to feed the patient either with the stomach-pump or through a nasal tube. Cold douches and ice to the spine have been recommended, but their use is not as a rule attended with much benefit. In the chronic forms massage is often most useful. In severe case, the limbs may be protected by being wrapped in cotton-wool. Any rheumatic manifestation or complication would be treated on general principles.

JOHN ABERCROMBIE.

Symptomatic Indications.—Simple cases; extreme restlessness and rapid prostration will usually yield to *arsenicum*. When caused by fright or other mental excitement, the remedy is *ignatia*. When the affected part feels numb, *nuxvomica*. Chorea in young girls, with menstrual irregularities, requires *caulophyllum*. From rheumatic irritation, after suppression of the menses, with uterine disorders; frequent alternation of heat and cold in different parts of the

body, *cimicifuga*. Periodical chorea, with twitchings, often confined to one side, or commencing in one arm and spreading over the whole body, causing the most terrible contortions and awkward movements, *cuprum*. In chronic cases, particularly after fright or suppression of eruptions on the face, *natrum muriaticum* is often useful. The patient has paroxysms of jumping high up without taking notice of the things about him, which sometimes results in serious injuries. When the general health suffers much from the disease, with great depression of spirits, *zinc* will prove a valuable remedy.

CHOROID DISEASES.—1, Hyperæmia; 2, Choroiditis; 3, Sclerotico-choroiditis posterior; 4, Tubercle; 5, Tumors; 6, Bone formation; 7, Coloboma; 8, Rupture.

Choroiditis may be (1) syphilitic, (2) simple, (3) suppurative.

Syphilitic choroiditis is the most common. It is characterized by the presence of numerous distinct patches scattered about fundus, but most abundant toward periphery; they are at first of a yellowish red appearance, which soon changes to yellowish-white or glistening white, according to the extent of choroidal atrophy. The patches are more or less pigmented. Vision is affected in proportion to the extent of the disease. Usually no pain. Generally a history of acquired or inherited syphilis.

Treatment.—Mercury combined with iodide of potassium. Rest of eyes by means of dark room. Artificial leech or dry cupping to temples. In the early stage mercury does great good, and in old cases where failure of sight is increasing it should be given. *Prognosis*, guarded.

Simple choroiditis.—In this form the patches of atrophy are similarly distributed but are confluent (compare with syphilitic form). Or large areas of incomplete atrophy are interspersed with separate patches, or there may be a widespread superficial atrophy with pigmentation. The field of vision is here also affected in proportion to the change.

Suppurative choroiditis is acute, and occurs in conjunction with similar inflammation of neighboring parts (panophthalmitis).

Sclerotico-choroiditis posterior is limited to the regions of the optic disk and

yellow spot, which present many varieties of localized change. It is common in myopic eyes, and the appearances thus produced are known as "posterior staphyloma," "myopic crescent," etc.

Tubercle of choroid appears in the form of small, circular, circumscribed spots (0.3 to 2.5 mm.) situated chiefly in the region of optic disk.

Tumors.—1, Sarcoma: 2, Carcinoma.

Bone formation sometimes occurs on the inner surface of choroid of eyes which have been long destroyed; it varies in thickness from a mere film to a dense osseous cup.

Rupture of choroid may occur from a blow on the globe and may exist with or without rupture of other coats. Hemorrhage at once occurs, and blood may be effused (1) between choroid and retina; (2) between choroid and sclerotic; (3) into vitreous.

HENRY JULER.

Symptomatic Indications.—The most generally useful remedy in choroiditis is *mercurius*, particularly if the disease is syphilitic; simple choroiditis usually yielding readily to *belladonna* or *gelsemium*. Cases of long standing require *phosphorus*; suppurative cases *rhustox*.

CHOROMIDROSIS.—*Definition.*—A very rare condition in which the sweat is said to be colored.

CHYLURIA.—A condition of the urine in which it presents the appearance of milk, believed to be due to the admixture of chyle and urine.

Characters.—The quantity of urine passed in twenty-four hours may be either normal or excessive—generally the latter. It is white, milky, and faintly translucent, being much clearer after a period of fasting. When quite fresh it has a distinctly milky odor, and in most cases sets as a fragile jelly. After an interval, varying from half an hour to a few hours, the jelly liquefies, and the urine then consists of a creamy layer on the surface, a pinkish deposit, and an intervening thin whitish fluid. The deposit is sometimes very considerable, and of a distinct blood color, so marked that a reddish tinge may be imparted to the whole fluid. The specific gravity, as in normal urine, generally varies inversely with the quantity, but it, like the reaction, has no special characters,

The urine decomposes rapidly, and acquires a peculiarly fetid odor.

Minute fat granules form the larger part of the microscopical appearances. With these are often found fibrin filaments and oval granular bodies (about four times the size of a red blood disk) which are probably immature ova of the *filaria sanguinis hominis*. Torulæ, leucocytes, red blood disks, epithelium, urates, oxalates, and triple phosphates may also be found, but never renal casts. Larval *filariæ* are either present in considerable numbers or entirely absent. The chemical analyses of different specimens vary within such wide limits that the averages obtained from them have but little value. This is especially true of the fatty matter, which varies from 0.47 to 1.3 per cent. The other constituents show a more constant proportion: viz., albumin, about 1.4 per cent.; salts, 1 per cent.; extractives, including urea, 2 per cent. A trace of glucose is sometimes present. The relative proportions of the different constituents are under no circumstances similar to those of normal chyle or lymph. The chylous character of the urine may altogether disappear for irregular periods.

Significance.—The majority of cases of chyluria are due to the presence of the *filaria sanguinis hominis*, and occur in those who have resided in tropical countries. The immature ova of this parasite are carried to and block the lymph streams in the glands or elsewhere. Anastomosing channels become distended, and a varicose condition of the lymph vessels has been found to obtain in many cases. From these vessels the contents may escape. When the lymphatics of the ureters and bladder are affected, and are thus filled with chyle, chyluria results. The absence of renal casts in the urine and of morbid appearances in the kidneys is said to disprove the occurrence of organic changes in these organs, but dilated channels in the neighborhood of the renal tubules have been observed. Other evidence of the presence of the *filariæ*, and also such symptoms as pain (lumbar, abdominal, or testicular) and dysuria, may be present. The red deposit so often found in chylous urine was formerly supposed to be due to hemorrhage, but Manson has suggested that when the lymph becomes stationary in the vessels its development is continued be-

yond the stage ordinarily reached in the lymphatics; hence the occurrence of red cells and the red color. The causes of the disease in Europeans who have never resided in the tropics have not been determined.

Treatment.—(1) *Prophylactic.*—The state of the drinking water must be carefully examined and its purity insured.

(2) *Therapeutic.*—Gallic acid (3 j–3 ij per diem) internally and perchloride of iron as a vesical injection have been used, but not with much benefit. A tourniquet applied to the abdomen over the lumbosacral prominence is supposed to produce its beneficial results by damaging the parent worm.

See *FILARIA SANGUINIS HOMINIS*.
H. MONTAGUE MURRAY.

CICATRICES.—Liable to neuralgia, contraction, ulceration, cheloid, epithelial cancers, besides other rare affections.

Cicatrices, Neuralgia of.—May arise from implication of a nerve, or the bulbous end of a nerve in a contracted cicatrix. Separate the cicatrix from the parts beneath, or, if necessary, excise the end of the nerve. If such a cause cannot be found, treat on general principles.

Cicatrices, Contraction of.—Is a natural process, and results from the escape of water from a new scar as it dries up and atrophies to ordinary connective tissue; most frightful deformities often result.

Treatment.—1. Preventive; hasten healing of large wounds by skin-grafting; prevent contraction during and for some time after cicatrization by splints and bandages. 2. Curative; divide carefully the contracted bands; keep the wound stretched during recicatrization; graft; transplant large piece of skin in suitable cases. When the contraction is merely linear, a V-shaped incision can be made, and when the tongue of skin thus formed retracts toward its base, the two outer sides of the V-shaped wound should be sewn together at and near the apex of the V. Pressure by strapping will weaken and make thin a thick cicatrix.

Cicatrices, Ulceration of.—Very likely to occur, especially in lower extremities, and in old and feeble people. Such cicatrices should be protected from friction and damp.

Treatment.—Stimulant applications; rest; good living.

Cicatrices, Warty (that is, indurated

and thickened).—May be blistered or painted with iodine. Do not mistake epithelioma for these.

Cicatrices, Cheloid of.—See *CHELOID*.
C. B. KEETLEY.

CILIARY REGION.—**Sympathetic irritation and sympathetic ophthalmitis.**—In sympathetic irritation the changes in the sympathizing eye are chiefly functional. In sympathetic ophthalmitis they are of a destructive, inflammatory kind.

Pathology.—The exact mode of transmission from the exciting to the sympathizing eye is not well known.

1. The change commences in the region of the ciliary body and iris of the exciting eye, and its effects are mostly seen in the corresponding part of the sympathizing eye. The region is richly supplied by branches of ciliary nerves (fifth, sympathetic, and third).

2. In exciting eye inflammatory changes are always found, and in some cases have been found to extend to the ciliary nerves. It is considered probable that the disease passes along the ciliary nerves, probably as neuritis, to some nerve center, and thence to the other eye.

3. The optic nerve is considered to have no part in the transmission of the inflammation; but the space between the dural and pial sheaths of the optic nerve is a probable channel of communication.

Symptoms in sympathizing eye.—1. *Irritation.*—Eye extremely weak and irritable; patient may be able to read No. 1 of Snellen's type, but soon becomes tired, because the power of prolonged accommodation fails. Eye sometimes reddened, may be watery; neuralgic pains common. Iris not affected. No plastic exudation nor disorganizing changes take place. Liable to recur. Excision of exciting eye at once cures the disease.

2. *Ophthalmitis.*—Begins from one to three months, or more, after affection of exciting eye. May be ushered in by irritation. May be well marked from the first, or may commence in a manner so insidious as to escape notice. It consists chiefly of irido-cyclitis or irido-choroiditis, the iritis evincing a tendency to the formation of tough and extensive synechiæ. There is a zone of ciliary congestion. Thickening and muddy appearance of iris. Tendency to formation of dots of opacity (keratitis punctata) on the posterior layer of the cornea. The vitreous, when the

condition of the pupil allows it to be seen, presents floating opacities. There may be neuro-retinitis. Tension of globe often increased. In the mildest forms of the disease there may be only slight serous iritis. In severe cases the eye either shrinks or may become glaucomatous with bulging of the sclerotic, total posterior synechia, secondary cataract.

Treatment.—1. When there is, as yet, neither sympathetic irritation nor sympathetic ophthalmitis the injured eye must be watched as to the seat of its inflammation, and, if this is found to threaten the iris and ciliary region, precaution must be taken to do all that is possible to subdue it. Atropine should be applied; patient kept in the dark room for long period; eye bandaged. Mild mercurials and iodide of potassium internally.

2. If irritation is set up, the foregoing remedies to be applied to both eyes, and if the exciting eye is past hope of recovery it should be excised at once.

3. If ophthalmitis is established and exciting eye quite blind it should be excised at once; but if any useful sight remains it should be saved, as it may prove the better eye in the end.

In the latter case, do all you can to save both the exciting and the sympathizing eye. (1) Use atropine drops every few hours; (2) rest the eyes by exclusion of light; (3) apply leeches, blisters, warm fomentations, etc.; (4) give mercurials.

Do not perform any operation on the eye until inflammation has subsided.

HENRY JULER.

Symptomatic Indications.—See OPHTHALMIA.

CINCHONISM.—A group of nervous symptoms produced by the too long continued use of quinine or by an overdose of that drug. The first warning is usually a humming or buzzing noise in the ears, accompanied by more or less deafness; sometimes the deafness is almost complete, and persists after all other symptoms have passed off. Frontal or temporal headache is generally present, and may be very severe; giddiness is also a common symptom. Dimness of sight, though less constant than affection of hearing, is tolerably common, and may amount to complete blindness; it is associated with pallor of the optic disks, narrowing of the branches of the retinal artery, and contraction of the fields of

vision. There is also a tendency for the heart's action to be weakened, a fact that should be borne in mind in the treatment of such a case, and the patient warned against any sudden effort which might induce syncope. After very large dose collapse has been noticed.

An erythematous rash, limited to the lower extremities, has occasionally, been noted as occurring after small doses of quinine.

To abandon the quinine is generally sufficient to effect a cure; carbonate of ammonia in 5-grain doses, and stimulants, may be administered internally, if there be any tendency to collapse. The headache will be best treated by the use of cold applications locally and by the administration of saline purgatives.

Pulsatilla will relieve the symptoms induced by quinine.

CIRCUMCISION.—Done for phimosis in children and for various diseases of the prepuce and glans penis in adults. With the penis in its natural position, apply a pair of long-bladed polypus forceps exactly on a level with the corona glandis, but inclined slightly forward rather than perpendicularly; as the glans slips back, compress the prepuce with the forceps; then slice off the prepuce close to the forceps; slit up the mucous membrane with the scissors right to the glans; stitch mucous flaps to skin flaps; check hemorrhage. In infants, instead of sutures, merely wrap a piece of lint round behind corona and also over all parts.

Prognosis.—Fatal result extremely rare.

CLAVUS.—An acute pain limited to a single spot in the head, and so called because the sufferer feels as if a nail were being driven in at the point affected. Clavus is generally associated with hysteria.

Symptomatic Indications.—Periodical attacks occurring monthly or bi-monthly, weight at back of head, yield to *ignatia*. Headache in one spot, as if a nail were being driven in, to *solanum*.

CLIMATE AND HEALTH RESORTS.—**Climate.**—In studying the climate of any country or district the following are the most important considerations: The general geographical position of the locality, whether conti-

mental or insular, and its relation to larger or smaller seas or oceans; the peculiarities of its atmospheric conditions, and the composition and nature of its soil.

A rough subdivision may be made by classing the climates of all the regions between the Equator and the 35th parallel of latitude as "hot," all between the 35th and 55th as "temperate," and all between the 55th and the poles as "cold" climates.

It is a characteristic of all large continents that the climate is less equable than that of islands, owing to the varying relations to the influence of the neighboring seas; the greatest inequality being observed at the greatest distance from the coast. The atmospheric conditions in like manner are greatly influenced by the proximity of seas and of mountain ranges, as regards relative moisture, purity of the air, and the prevalence of winds.

The nature of the surface soil, and more especially of the subsoil, has a marked influence upon local climate in respect of the purity and the relative dryness or moisture of the atmosphere.

The climate of the ocean is the most equable, and if the sanitary arrangements of the vessel be complete, the purest of all. The ocean atmosphere is greatly charged with moisture and with certain gaseous materials, such as ozone, iodine, and bromine, which have a marked tonic effect upon the human organism, and in addition is free from the myriads of organic particles with which the air of continents or islands is loaded. When at sea in the latitude of the "hot" climates the sudden cooling of the air at sunset leads to a rapid deposit of atmospheric moisture upon all parts of the ship and its occupants, but the sensations of cold thus produced are far less than those due to a similar cause on shore, and hence are less to be dreaded by the invalid.

The effect of the ocean climate upon the human body in health or disease varies considerably, according to the latitude and the peculiar features of each voyage. A voyage in a well-appointed sailing ship involves a very gradual transition from one kind of climate to another, and conduces to a dull and indolent habit of life, especially on the long voyages to Australia or New Zea-

land. In the fast steamships the transition takes place with surprising suddenness, and as a consequence the life of the traveler is more restless and active, the mind being either preparing for arrival at a new port or occupied with the departure from the old one. Under either set of conditions, however, a sea life involves a constant exposure to fresh, pure air and a complete freedom from many of the worries and cares of life on shore. It offers, indeed, the most perfect form of mental and bodily rest obtainable, provided that seasickness does not interfere with its enjoyment.

The principal voyages to be commended for purposes of restoring health are: (1) the Australian voyage round the Cape. This lasts, in a sailing ship, from seventy to ninety days, or sometimes longer, according to the weather experienced, and should be undertaken in the autumn, at the end of September or beginning of October.

Preparations must be made for cold as well as for hot weather, although the latter prevails over the greater part of the voyage. On nearing Australia, and especially after landing, the colder air and more marked contrasts of cold and heat must be guarded against. Risks of catching cold, which on shipboard may be run with impunity, cannot be so lightly regarded on shore after a long voyage, and hence precaution both as regards clothing and ordinary habits must be observed. The same remark applies with equal force to diet, and the somewhat natural tendency to compensate for a long series of shortcomings on board ship by an injudicious surfeit, as soon as the traveler gets on shore, is very likely to be followed by the penalty of overstrained and disordered digestion.

Exercise is a very necessary feature of life on board ship, and its neglect is sure to lead to digestive disturbances, especially if, as is very often the case, the naturally increased appetite be allowed full satisfaction at each meal. It is desirable that the diet at sea should be plain in quality and moderate in quantity, and especially so when passing through the hot regions.

(2) The voyage to the Cape can only be undertaken with comfort in a steamship or a yacht. Starting at the end of September, the voyage will be fairly calm throughout, although there are possi-

bilities of rough weather during the first few days out, and the last few when nearing the colony. The mail steamers call regularly at Madeira, and sometimes at St. Helena, and the voyage as a rule lasts about twenty-one days. The prevailing winds are south and southeast.

(3) The voyage to India presents fewer attractions from a health point of view, owing to the extreme heat which may be experienced during part of the voyage; but it is the most generally interesting of all the long voyages. Much depends, however, upon the time of year at which it is undertaken. Starting early in October, a very pleasant journey may be expected, subject to the risks of rough weather in the Bay of Biscay, and sometimes in the Mediterranean, but the rest of the voyage will almost certainly be passed on an even keel. The return voyage should be made in March or April, and it is always advisable to delay the return till the end of May, as the cold winds of spring are especially trying to persons arriving from tropical regions. A few weeks may be spent in Egypt, Malta, or Southern Italy.

(4) The voyage to South America, if undertaken in the autumn, is fairly suitable for invalids. It must be borne in mind that the hot season in Rio de Janeiro, Monte Video, and Buenos Ayres is our winter. The time occupied in getting to the latter port is about two weeks and the service of steamships is excellent. The ports of call in South America—Pernambuco, Bahia, and Rio—are full of interest, and from the latter port excursions can be made into the interior, where the scenery is in many parts very beautiful. Sufficiently good accommodation is obtainable for any but the most pronounced invalids. The coast is hot, and a good deal subject to epidemics of yellow fever, but a few miles inland the temperature becomes cooler, the nights being very pleasant, and the dangers of fever to the ordinary traveler reduced to a minimum.

(5) The voyage to the West Indies, although full of interest to the traveler and sight-seer, is of less value from the point of view of health, as the time taken to reach St. Thomas from New York is rarely more than four or five days, and the inter-insular voyages have to be made for the most part in small steamers, involving a good deal of change. The

traveler should start in the winter months, as the summer heat is too great for those in delicate health.

Island climates resemble those of the ocean in many respects, and particularly as regards their equability and the prevalence of steady winds. As health resorts their characters vary in different regions, and require special consideration. The Canaries and Madeira are easily accessible by steamers running between Liverpool and the West Coast of Africa.

The Canary Islands available for prolonged residence are the two central islands of the group, Teneriffe and Grand Canary. Santa Cruz is the chief town of the former, and Las Palmas of the latter, and both are now provided with good accommodation. Orotava, in Teneriffe, enjoys an almost perfect summer climate, and possesses a good hotel, open all the year round. A good hotel has also been established on the island of Palma. The climate of the islands is hotter, drier, and less equable than that of Madeira, and is more subject to heavy tropical rains. The average number of rainy days, however, is very small, being at Orotava only about forty in the course of the year.

Madeira, or rather its chief town, Funchal, has held its own as a sanitarium for many years. Its climate is equable, warm, and moderately moist, but the air is not bracing. The town of Funchal is built on a hillside, sloping down to the bay, and residence may thus be selected at any level above the sea. The town is protected from the prevalent winds, and is absolutely free from dust. The water-supply is good. There is much less of the chill at sundown than is usually experienced in such climates. The winter season begins in October; the rainy days are of the subtropical kind, heavy showers alternating with bright sunshine. The climate of other parts of the island is variable, and the weather often cold and stormy.

The drier and more bracing air of Teneriffe is often more suitable to sufferers from pulmonary disorders than the equable climate of Madeira, especially during the summer, and hence the seasons may be passed in either alternately.

The islands of Corsica and Sicily, like Madeira derive their popularity as health resorts from the position of their

chief towns. Ajaccio, at the head of a beautiful bay with a due southwest aspect, is well protected from the cold winds by the mountains to the northward, and has a warm, moist winter climate, with no excessive range of daily temperature. The rainy days of the winter are usually about thirty-five. The scenery is fine, and the accommodation good. Ajaccio is easily reached by regular steamers from Marseilles and Leghorn.

Palermo, one of the most beautifully situated of all the Mediterranean health resorts, possesses an equable winter climate, but is more moist and experiences more rainy days than most of the others. It is rather windy, but very free from dust. The sirocco is sometimes felt during a part of the spring months, and the liability to changes of this kind, and the excessive glare of the sun, are the chief drawbacks to residence in the town. The climate appears to be beneficial to the more excitable types of phthisical invalids, but does not by any means suit those of bilious or phlegmatic habit. It is best reached by steamer from Naples. Malta has nothing to recommend it as a health resort except the equability of its climate.

Corfu, formerly one of the most favored of the winter residences, has now become less fashionable, owing perhaps to the inconstancy of its climate, which is moister, rather colder, and less equable than that of many other islands. It is very rainy during November and December. High winds are often prevalent, and create much dust. Corfu is best reached by steamer from Brindisi.

The island of Capri, situated between the Bay of Naples and the Gulf of Salerno, presents one of the most perfect island climates, being very equable, fairly dry, and, although rather windy, well sheltered. The evening chill is much less felt than on the neighboring mainland. The island is rather difficult to get at, and is approached either by open boat from Sorrento or else by one of the steamers from Naples, the voyage in either case being sometimes uncomfortable. The Bermudas, from their convenience to America, are usually preferred as having a dry, equable climate, with ample accommodations.

The climate of the seacoast stands next in importance from the therapeutic

point of view. Two classes of coast climate may be recognized, having respectively a bracing or stimulant, and a soothing or sedative effect upon the human organism. In England the eastern shores are almost without exception of the former class, while the southern and western shores are more marked by the latter quality, although certain parts are more sedative and relaxing than others, owing to their peculiar natural features. The most striking characteristic of the climate of the British Isles, as a whole, is the constant liability to change, even within the space of a few hours. Except during a few weeks in the middle of summer and occasionally during the winter also, changes of barometric pressure, and in the direction of winds, may occur in the most irregular succession, rendering it wholly impossible to forecast the state of the weather for more than twenty-four hours in advance.

The south coast, between Dover and Portsmouth, enjoys a rather higher mean temperature and as low a rainfall as any part of the east coast; but from Portsmouth to Start Point the rainfall is higher, and over Cornwall it is very much higher, than over the rest of the southern shores. The winds of the south and west are less keen, and there is a larger proportion of sunshine. The west of Scotland has a very moist climate during all but the hottest months of the year—a marked contrast to the dry and bracing atmosphere of the eastern counties. Wales, except upon the actual coast, has also a moist and variable climate. Ireland, like England and Scotland, is drier and more bracing on its eastern shores than on the west; the rainfall is rather less than that of either of the other British Isles, except in the province of Munster.

The extensive seacoast of the United States, extending from Maine to Florida on the Atlantic shore, and from Oregon to Lower California, affords a large number of seaside resorts, which present a very great diversity of climate and are adapted to needs of invalids at all seasons. The seaside resorts of the Atlantic Coast, as a rule, possess a bracing or stimulant effect; those of the Pacific Coast and the Gulf of Mexico, a soothing or sedative effect. The seaside resorts of the Northern coast, Bar Harbor, Newport, Long Branch, Atlantic City, Cape May, etc., are, with the exception of Atlantic City, suited

to invalids during the summer season only, the winters being too severe for persons having a tendency to bronchial or lung disease. The coast resorts of Florida are most agreeable and beneficial during the winter and early spring, the mildness of the climate adapting them particularly to the needs of those suffering from pulmonary diseases. The coast resorts of the Pacific shore, particularly those of Lower California, are similar to those of Florida, but somewhat more bracing.

France.—The average temperature is higher than that of the British Isles, the summer heat in the south averaging 80°. The winter temperature of the west and south coasts is much higher than that of any other part of the country, and the climate is rather more equable. Central France is colder, and very bleak in places. The south coast, especially about Marseilles, is subject, during about half the year, to the northwest wind known as the mistral—a clear, cold current, generally most keen in the late afternoon, and often ceasing at night. It commonly produces clouds of dust, but is usually followed by a bright, unclouded sky.

The south coast of France enjoys a very large proportion of sunshine throughout the year. Coupled with this, however, are certain drawbacks. The whole of the coast is subject to searching winds during the spring months, especially to the mistral already referred to, and the northeast wind, or greco. A hot wind from the southeast is also felt and is a part of the sirocco, to which the South of Italy is exposed. The day temperature of most of the health resorts of the western Riviera is not very high in the shade, but may rise excessively in the sun. At sundown there is a sudden and uniform fall of temperature, always trying, and sometimes disastrous, to invalids. This is generally followed by a slight rise after the lapse of an hour. The annual rainfall is considerable, but the number of rainy days is not very great, nor is the air moist, as a rule. The winter climate of the Riviera must not therefore be looked upon as by any means perfect, or as fulfilling all the requirements of invalids during the cold season, but it is, as a whole, a great deal better than most varieties of winter climate to be met with in the British Isles.

Algiers possesses a pleasant winter

climate, subject to a good deal of variation in different years. As a whole, the climate is hot and dry, but not excessively so. The rainfall is considerable, and the number of rainy days somewhat higher than in other places at the same latitude. The rain comes in heavy showers, and the ground dries rapidly. Cold winds may be felt occasionally, but they are less easily borne here than elsewhere, owing to the contrast with the prevailing warmth. The sirocco blows but rarely. The temperature is apt to fall suddenly at sundown, but the nights, as a rule, are mild and balmy.

Egypt has an exceedingly dry, but inequable, climate, except in the neighborhood of the Delta, and hence Alexandria and the northern towns are not suitable as health resorts. Cairo is popular from its social comforts and advantages, but is not much to be commended to invalids. Although close to the desert, it does not reap the advantage of desert air, and is much subject to dust. The sanitary arrangements are very defective.

Mountain climates have been much employed of late years for the treatment of the various stages of pulmonary phthisis. Their common characteristics are rarefaction of the atmospheric air, with consequent diathermancy for the sun's rays, and purity and freedom from organic particles; clear skies, with abundant sunshine, and a fairly uniform low temperature in the shade. The effect upon the human organism is essentially bracing, the altered density of the air leads to increased respiratory movements and a more thorough interchange of gases. Appetite is increased, and all the functions of the body appear to be stimulated, always provided that the powers of the lungs, and more particularly of the heart, have not been reduced below a certain level by previous disease or overwork.

S. C. BEALE.

CLITORIS, DISEASES OF THE.—

This organ may be absent or malformed, such conditions being usually associated with other malformations. Hypertrophy of the clitoris is met with, and is often associated with hypertrophy of the labia minora. It occurs as a racial peculiarity in Hottentots, forming the so-called "apron." It is less common in cold countries than in the tropical zones. Venereal excesses are

supposed to favor its occurrence. Removal of the clitoris has been practiced for the purpose of curing the habit of masturbation, but there is no trustworthy evidence that the operation has any effect upon the patient's condition or habits other than, considered as a mutilation, a harmful one. But should the clitoris be so large as to cause annoyance to the patient, its removal will be the only treatment. Hypertrophy differs from elephantiasis in that the clitoris remains of its natural shape, and the parts from which it springs are healthy.

Elephantiasis of the clitoris is often associated with similar disease of the labia. Together they may form a mass weighing as much as 20 lbs. It is an overgrowth of the submucous connective tissue, associated with dilatation of the lymphatics and veins, thickening of the skin and mucous membranes, and an irregular warty polypoid overgrowth.

It is rare, except in tropical countries. It occurs during the years of sexual activity. Instances of its transmission by inheritance have been described, but these perhaps should more properly have been called hypertrophy (*see* FILARIA SANGUINIS HOMINIS).

Etiology.—Its causes (other than the presence of parasites) may be generalized as those of chronic inflammation, together with pruritus, injury, erysipelas, syphilis, gonorrhea, excessive sexual excitement, and eczema. Pregnancy usually augments the growth. From the dependent position of the growth it is very liable to venous congestion, œdema, and ulceration.

Treatment.—Removal is the only cure.

Cancer occasionally affects the clitoris. It usually begins at the tip, and presents itself as a bright red, hard, warty, ulcerated swelling, at first movable, having a narrow base of healthy tissue. In time the inguinal glands become affected. It should be treated by prompt excision.

Removal of the clitoris is best effected by cutting with the platinum knife of the Paquelin thermo-cautery, as the part is very vascular.

G. E. HERMAN.

CLONIC.—Spasms are called clonic when they intermit at short intervals, during which the muscles are in a state of relaxation. Clonic spasms succeed the tonic spasms of the first stage of an epileptic fit.

CLUB-FOOT.—Four types: 1, talipes varus; 2, talipes valgus; 3, talipes equinus; 4, talipes calcaneus. Talipes equino-varus (a combination of 1 and 3) most common.

Causes.—The cause of congenital talipes varus, or equino-varus, is arrested development. At the commencement of their development, the lower extremities are so placed that, if extended, the feet would point backward; hence they have afterward to rotate on their axes; when this rotation is not fully accomplished in the foot, club-foot results. Talipes valgus is only another name for flat foot, which results from excessive standing or walking when the general strength is small; the muscles, being then weak, do not sufficiently assist the ligaments, which give way to the strain. Infantile paralysis leads to equino-varus, because that is the position in which gravity places a foot uncontrolled by healthy muscles.

Symptoms.—*Pure varus.*—Very rare; in it only inner border of foot is raised, and anterior part of foot is bent inward on posterior half.

Equino-varus.—In this the heel is more or less raised; in severe cases the bones are much altered; the dorsum of the cuboid and fifth metatarsal bone sustains the weight of the body. The scaphoid and inner edge of the metatarsus look upward; the inner malleolus almost touches the scaphoid, and the astragalus is pushed outward. Fibula lies in a line beyond tibia; tuberosity of os calcis looks upward; in talipes calcaneus the heel is down and the front of the foot up. The tendons contracted in each case will be mentioned under the head of treatment.

Course.—If left alone, patient learns to walk on deformed foot; callosities form where there is friction or pressure; the leg wastes; the foot and leg thus get the peculiar clubbed appearance.

Treatment.—Mild cases do not require tenotomy; apply friction, and twist the foot for a quarter of an hour three times a day into its natural position, pulling and fixing foot in position with strapping; strapping combined with splints; Barwell's elastic bands, shoes, etc., for talipes. The above contrivances used after tenotomy.

Tenotomy.—For equinus, divide tendo-Achillis; for equino-varus, tendo Achillis after tibialis posticus and anticus (sometimes also plantar fascia, and some plantar muscles). Valgus and calcaneus seldom require tenotomy (*see* FLAT-FOOT).

Tenotomy knives, blunt-pointed and sharp-pointed; pads of lint; hot-water can and strapping; bandage; splint. Tendo Achillis: position, on face. Assistant makes tendon tense; pass a sharp-pointed knife beneath tendon, one inch from insertion; place left forefinger over it; cut gently with sawing motion toward skin; assistant should relax when he feels that the tendon has gone; withdraw knife and instantly place finger over wound; then put on pad instead of finger; strap, bandage, and splint. Tibialis posticus: one inch above inner malleolus. Inner edge of tibia. In fat infants, midway between anterior and posterior borders of leg. Insert sharp tenotome half an inch, so as to open deep fascia. Substitute blunt tenotome; pass this with one surface toward tibia, and other toward tendon. Assistant meanwhile holds foot inverted. Now foot is inverted, at same time edge of tenotome is turned to tendon. If blanching of foot and much bleeding show wound of post-tibial artery, merely pad and evenly bandage, and confidently expect good result. But postpone instrument treatment for a fortnight. Tibialis anticus: merely extend foot, insert tenotome, and divide tendon from behind forward. Peronei: sometimes divided for valgus. Divide behind external malleoli, or a little higher; adduct foot.

After-treatment.—Three or four days after tenotomy, commence to extend by strapping splints, Scarpa's shoe, elastic bands, or some other mechanical contrivance, according to gravity of case. In infants, extension should be effected in a month. In adults, three or four months may be occupied. At first the instrument should be shaped to fit the deformity; never force a foot into an ill-fitting instrument; attend daily to the case; beware of pressure sores; plaster of Paris bandages may be used instead of movable apparatus.

Process of healing in a divided tendon.—The divided ends of the tendon retract, and the neighboring cellular tissue presses in between them, filling the interspace. In this cellular tissue, corpuscles and lymph (inflammatory new formation) are poured out, which organize into fibrous tissue, uniting and exactly resembling in structure the divided tendon. The process resembles that by which the external callus unites a fractured bone. The advantage of tenotomy is that this new

uniting medium is so much more extensible than the original tendon. Many surgeons now put up the foot in plaster of Paris as soon as the tendons have been divided; and Ogston treats even severe cases of club-foot with plaster of Paris, and without previous tenotomy.

C. B. KEETLEY.

COAL GAS, POISONING BY.—This may occur in a variety of ways, but it commonly arises from an escape of gas into a room owing to faulty pipes or joints, or from carelessness in turning off. When the leak is underground and the gas permeates the soil before gaining access to the room, symptoms resembling those of typhoid fever are apt to be produced, headache and malaise being the most prominent. When the escape of gas takes place into a bedroom during the night, the occupant may pass into a state of insensibility without being aroused.

Dullness or stupor, passing on to coma, is the earliest symptom; the face becomes livid, the respirations shallow, the pulse feeble, the conjunctivæ suffused, and convulsions sometimes occur—a symptom of unfavorable omen. With regard to the pupils there is nothing characteristic. Vomiting is not uncommon, and the breath and vomited matters may smell of the gas.

If the person be not speedily removed from the impregnated atmosphere death is certain to follow, and even after removal it may happen unless active treatment be properly adopted.

Treatment.—A free current of fresh air and artificial respiration should be first tried; brandy should be administered if the action of the heart be weak, and if there be much lividity the patient should be bled. Relapses are very common after improvement has commenced, and constant vigilance is therefore needed.

COCCYGODYNIA.—Pain in the coccyx. It occurs almost exclusively in women who have had children, and usually dates from a confinement. As a rule, it is due to injury during delivery; to overstretching or rupture of the ligaments uniting the coccyx to other bones, or to periostitis, dislocation or fracture of the the coccyx. It is sometimes referred to accidental injury, or to excessive horse exercise.

Sometimes the presence of a fracture or dislocation, or of inflammation, can be

ascertained by the signs indicating these conditions, but generally there is nothing to be perceived except that the patient points to the coccyx as the seat of pain, and pain is produced by pressure on, or movement of, this bone. The patient therefore often cannot sit comfortably, and defecation is painful. Sometimes the coccygeal pain is merely part of a general pelvic pain, due to some morbid condition within the pelvis.

Treatment.—General tonic treatment (quinine, iron, and nux vomica) should be tried, in the first instance, together with rest and an aperient to insure a daily soft evacuation of the bowels (mag. sulph. 3 j, vini aloes 3 j, in water every morning). In the majority of cases this will in time cure the patient. Should the pain be very severe, morphine may be injected subcutaneously over the coccyx. If there be a dislocation or fracture of the coccyx, causing it to be fixed in an abnormal position and so painfully press upon the integuments, the best plan will be to remove it altogether. In cases in which pain on moving the coccyx has been very persistent and other treatment has failed, good results have been reported from the subcutaneous division of the ligaments, muscles, and fasciæ attached to the bone.

G. E. HERMAN.

Symptomatic Indications.—Coccygodynia when the result of injury, or pressure during labor, usually yields to *arnica*; the part has a bruised, sore feeling, with pain on motion. Should *arnica* fail *cicuta* may be useful, particularly when the pain is tearing and jerking, with stiffness in the lower limbs. Resort may also be had to *ruta* when the pain extends from the coccyx to the sacrum, feeling as if caused by a blow. *Ruta*, well diluted with water, may be used as a lotion.

COLD, EFFECTS OF.—The first effects of cold applied to the living body is to produce some congestion of the superficial blood vessels; this is quickly followed by their rapid and extreme contraction. To this, in the healthy and robust, and provided the exposure to cold has been but moderate, the period of reaction succeeds, and is indicated by the ruddy appearance of the surface resulting from the redilatation of the capillaries and the augmented energy of the circulation. If the exposure to even a moderately low temperature be prolonged, and

after but a short exposure to severe cold, especially in the case of the weakly and debilitated, no reactionary glow ensues, but a lengthened period of vital depression, which is accompanied by enfeebled nutrition, and followed by a tedious recovery. The exposure may be so prolonged, or the cold so intense, as to induce not merely local and temporary vascular syncope, but local, or even absolute and general, physiological death; beyond this point the physical and chemical effects only of cold continue in force. Complete (physical) freezing of a tissue is never followed by recovery of the part.

The immediate and ultimate effects of cold are dependent upon: (1) The condition of the individual; the feeble, the aged, the young, the intoxicated, and those not previously inured to exposure succumb with comparative rapidity; (2) the method of its application—*e. g.*, water and moist air are good conductors of heat, and thus chill rapidly; heat is also quickly abstracted by the convection of strong winds, while exposure to *still* air at a remarkably low temperature can be borne with comparative impunity; (3) the area of the surface exposed; (4) the part of the body exposed—*e. g.*, outlying portions, such as the toes, fingers, the extremity of the nose, and the tips of the ears, where the circulation is most easily checked and less readily restored, not uncommonly suffer local death from “frost-bite” without any great disturbance of the general health, whereas prolonged application of but moderate cold to the head or the abdomen has been productive of fatal results.

The *local effects of cold* upon the tissues are illustrated by CHILBLAINS, FROST-BITE (*q. v.*), and gangrene (*see* DERMATITIS GANGRENOSA).

Dying from cold is attended with shivering, pallor, and lividity, puckering of the skin, increasing muscular stiffness and weakness, confusion of the senses, profound unconsciousness; there may also be, for a while, intense thirst, obstinate insomnia, and almost every symptom, subjective and objective, of cerebral disturbance; and in such instances the symptoms may be, and have been, mistakenly ascribed to the effects of alcohol. Death ultimately results from shock, syncope, coma, or asphyxia; or, as in most cases, from various combinations of these conditions.

The *post-mortem appearances* in cases of death from cold are mainly a waxy anæmia of the surface, varied by bright red patches on the more exposed parts of the body, and a corresponding congestion of internal organs, with extreme rigor mortis, very marked contraction of the external genitals, and overdistension of the bladder. The reddish-brown stains corresponding to the course of superficial blood vessels are not pathognomonic of death from cold, but are a post-mortem change due to the physical effect of cold in disintegrating the blood cells, and the subsequent diffusion of their coloring matter through the vascular walls.

Treatment.—The treatment demanded by cases of exposure to cold, whether the exposure have been moderate or severe, and whether the whole body or only a part have suffered, consists essentially in the *gradual* application of external warmth, and the equally gradual but effective restoration of the natural heat-producing power of the organism; and, as a broad rule, the less severe the exposure, the more quickly and energetically may artificial warmth be employed. In extreme cases, the sufferer should be promptly stripped of his clothing, wrapped in blankets or other woolen coverings, and placed in still, dry, cold air, as in a cold, empty room, the temperature of which is to be gradually raised as recovery proceeds. The surface should be stimulated by gentle friction, at first with snow or ice, and later with dry flannel or with the hands.

When practicable, the whole body may be at once immersed in a bath of ice-cold water, to which warm water is gradually added from time to time, while continuous hand-friction of the limbs and trunk is maintained. The bladder, if found to be distended, must be emptied by the catheter. So soon as the power of swallowing is restored, small quantities of warm fluids, such as tea, coffee, and beef-tea, may be administered; later on (but on no account at first), small quantities of wine or spirit, well diluted with warm water, may be given.

As consciousness returns, the sufferer may be placed in bed between the blankets, and the temperature of the room gradually raised. When the natural body-heat has been reestablished, a nutritive enema may be administered and a disposition to sleep encouraged. Serious

cases are often followed, under the most favorable circumstances, by a tedious recovery; and rest, careful nourishment, and tonics are needed for a long time. In every case of extreme exposure the remedial measures indicated above should be resorted to with all possible expedition, and they should be steadily persevered in for a long time, however hopeless the restoration of vitality may at first appear.

As a *cause of disease*, immediate and remote, exposure to cold, and preëminently to damp cold, forms a most important factor in the death-rate of this as of other countries with a temperate climate.

C. E. SHELLY.

COLD, THERAPEUTICS OF.—As a therapeutic agent, cold commands an extensive field, and subserves various ends. These will be best appreciated by remembering that what is commonly called the “application of cold” is really the incidence of a sudden and transient physiological stimulus *plus* the physical “abstraction of heat,” and that this latter may be slight or extreme, rapid or slow, limited and local, or general and extensive, momentary, repeated, or continuous. The method employed, the area affected, and the duration of the process are the factors which chiefly determine the character of both the immediate and ultimate results.

The general effect of applying a good conductor at a low temperature to any part of the living body is to lower the temperature, to contract the blood vessels, to diminish the nervous sensibility, and to lessen the bulk of the part. If the application be only temporary, its withdrawal may be followed by the restoration and local increase of vital activity known as “reaction.” But if the application be longer continued, its physiological effects may persist, and even continue to increase, after it has been withdrawn. Hence cold acts, both generally and locally, as an *antipyretic*; when moderate in degree, and followed by reaction, as a *tonic* and *stimulant*; it first excites, and finally abolishes, reflex action; it acts as a *sedative* to the vascular, cardiac, and nervous systems; as an *anodyne* and, in a more extreme degree, as an *anæsthetic*; locally as an *anaphrodisiac*; and when the system is under its influence the action of drugs is less rapid, less marked, and more uncertain.

Affusion.—Cold affusion consists in

the sudden application of a considerable volume of cold water to the whole or to some part of the body. It may be used in several forms. In the collapse sometimes observed in cases of high fever, where pulse and respiration fail, and the surface becomes cold, although the internal temperature (as taken in the rectum) continues abnormally high, two or three gallons of water at 50° Fahr. may be poured over the patient, beneath whom a waterproof sheet has been placed; energetic reflex action is thus excited, the cardiac and respiratory functions restored, the surface becomes warm, and the temperature in the rectum falls.

A stream of cold water may be similarly applied to the head of a robust child suffering from convulsions; to the throat and upper part of the chest during laryngeal spasm; to the head and neck in cases of sunstroke, except when the skin is cold and clammy, with other evidences of greatly depressed vitality. Its powerful reflex action as a respiratory excitant makes the cold douche valuable in cases of threatened death from narcotic poisoning (*e. g.*, chloroform, opium, alcohol); and it has been found serviceable in exciting contraction of the uterus, the bowels, and the urinary bladder.

In hysteria and chorea and allied affections of the nervous system the cold douche and the shower-bath exert both a calmative and, by their tonic after-effects, a curative effect.

The cold douche is absolutely contraindicated in all cases of extreme weakness with feeble pulse, low-muttering delirium, and cool, clammy skin.

Anæsthetic uses of cold.—Small superficial operations—such as the opening of abscesses, the insertion of sutures, and the removal of small tumors—may be performed without pain upon parts which have been previously “frozen” by the application of a freezing mixture (salt and ice or snow, equal parts), or—more conveniently—by the ether spray. But the thawing of frozen tissues is apt to be attended with pain; and the value of this method of local anæsthesia has been greatly lessened since the discovery of cocaine.

Anodyne effects of cold.—The pain of inflamed surfaces, bruises, commencing abscesses, strained joints, etc., is often greatly relieved by the continuous application of cold. But in many instances

experiment alone can decide whether cold or moist heat, in the form of a poultice, will be most comforting to the patient.

Baths.—See BATHS.

Compresses.—Two or three folds of absorbent material wrung out of iced water may be applied with benefit over painful regions—*e. g.*, to an inflamed throat, a bruised limb, etc. They must be applied directly to the skin, and should be frequently renewed—about every five minutes—in order to be really effective. If covered with oiled silk, and allowed to remain *in situ*, they soon act as tepid poultices.

Dry cold is usually applied by means of an india-rubber bag, or a bladder, filled with ice or snow, or a “freezing mixture.” Ammonic chloride and potassic nitrate, of each 5 parts, mixed with 10 parts of water, will cause the thermometer to fall from 50° to 10° Fahr.; ammonic nitrate 1 part, snow 2 parts, and water 1 part will produce a reduction from 50° to 40° Fahr.; 2 parts of snow to 1 part common salt causes a fall from 32° to 4° Fahr.; and 5 parts of ammonic nitrate with 5 of common salt and 12 of snow or ice causes the mercury to sink from 18° above to 25° below.

If a bladder be used, a fold of lint or flannel should be interposed between it and the skin, lest heat be too rapidly abstracted. When an ice-bag or ice-cap is applied to the head it should be suspended by means of a cord, so that it may not press unduly upon the part. Cold in this form has been applied with advantage for many hours and even days at a time, in cases of fracture, and in commencing vertebral caries, also to the eye after operations, to an inflamed testicle, over the ovarian region, to the throat in diphtheria, and to the shaven scalp in cases of meningeal and cerebral inflammation.

Dry cold is conveniently applied to many situations by means of Lieter's apparatus—in which cold water continuously circulates through the closely approximated bends of a small metal tube, which is sufficiently pliable to allow of the whole apparatus being molded to the contour of the part on which it lies.

Douche.—See AFFUSION (*supra*).

Irrigation is a simple, ready, and valuable method of applying moderate cold continuously and without disturbance of the part to inflamed and injured joints,

severe bruises, etc. Above the injured part a vessel containing cold water is fixed; some threads of worsted, or a piece of lamp-wick, well wetted, are so placed that while one end reaches to the bottom of the vessel, the other—and longer portion—falls over the edge and side of the vessel so as to siphon the water, drop by drop, on to the desired spot, whence it is conducted to a rubber sheet suitably disposed beneath the limb. The fluid may, of course, be variously medicated if so desired, and, by allowing it to flow through a tube from a reservoir of sufficient capacity, the rapidity with which heat is abstracted and the extent to which the part is “flushed” by the stream will both be increased. Injured joints have thus been irrigated with antiseptic solutions for weeks together, and with good results.

Injection.—Ice-cold water may be injected into the vagina or the rectum in order to stop severe hemorrhage, but it appears to be less efficacious than very hot water. The practice of injecting a few drams of cold water into the rectum after each action of the bowels affords much relief, and exerts a locally tonic and astringent action in cases of bleeding hemorrhoids.

Lotions.—Cooling and evaporating lotions are applied to relieve local heat, pain, and swelling, and their influence tends to promote the absorption of extravasated blood. They are best applied by means of a single thickness of lint or rag saturated with the lotion and applied directly to the skin of the part. As soon as the lint begins to get dry or warm it should be removed, and another similar piece applied in its place; the greater the facilities afforded for evaporation from the lint, the more marked will be the cooling effect. In addition to cold water or vinegar and water, the following are effective cooling lotions: Spirits of wine, or eau de Cologne (or other scent), and water; sp. vin. rect. 3 vij in 1 pint of water; or the same with the addition of 5 or 6 drams of potassic nitrate or ammoniac chloride; and ammoniac chloride 3 v, acid. acet. dil. 3 v, sp. vin. rect. 3 v, in 1 pint of water.

Pack.—The cold pack is a useful means of reducing the body temperature in cases of hyperpyrexia, or when, with high fever, violent delirium, much restlessness, and a hot, dry skin are present;

but it is less efficacious than the cold bath. The patient is wrapped in a sheet previously wrung out of cold water; as the sheet becomes warm, it is replaced by a fresh cold one, or iced water may be squeezed over it from a sponge, or lumps of ice placed upon and around it. When the body temperature has been sufficiently reduced—or immediately on the appearance of any signs of collapse—the wet sheet should be removed, and replaced by a light covering, not a blanket.

In less severe cases the temperature may be appreciably reduced, and much comfort afforded to the patient, by repeatedly and regularly sponging the surface of the body with cold water, or toilet vinegar and water.

In addition to the several methods of applying cold externally, chips of ice slowly swallowed are often valuable in relieving inflamed conditions of the mouth and fauces and also in the treatment of nausea and irritability of the stomach.

C. E. SHELLY.

COLIC, INTESTINAL.—Painful, irregular, and spasmodic contraction of the intestine (not necessarily of the *colon*), unattended with fever.

Symptoms.—In a typical case the patient complains of severe—sometimes agonizing—paroxysmal pain of a twisting, griping character, commonly at the outset referred to the region of the navel, and thence spreading to other parts of the abdomen. The belly is usually distended (except in LEAD COLIC, *q. v.*), but its muscles are subject to irregular contractions, and the varying outline of coils of distended and contracting intestine is visible through the abdominal walls. The pain is relieved by steady pressure and, temporarily at least, by the expulsion of flatus or fæces. There is a general pallor and coldness of the surface and extremities, without pyrexia or increase in the rate of the pulse, which may even become feeble and slow. There may also be vomiting and diarrhea, and severe cases are attended with great suffering and depression.

On the removal of the cause of the attack (*e. g.*, the expulsion of irritating ingesta) the paroxysmal pain usually gives place to some sense of general abdominal soreness; but occasionally it remains for some time unsubdued. The

violent peristalsis occasionally results in enteritis or peritonitis, and is sometimes followed by a kind of catarrhal dysentery. An attack of colic is only very rarely fatal.

Intestinal colic is distinguished from a similar affection of the *stomach* by the site of the pain in the latter case being higher in the abdomen—about the ensiform cartilage—by the deeper percussion note elicited over the area of the distended stomach, and by the absence of the visible or palpable distension and contraction of the coils of intestine. In *rheumatism of the abdominal wall* it is the contraction of the muscles, and not that of the intestines, which causes the pain, the latter being much increased by palpation with the tips of the fingers. Special signs distinguish *renal*, *hepatic*, and *lead colic*.

Ætiology.—Painful spasm of the bowel may be caused by (a) irritation due to the nature and condition of the intestinal *contents*, such as the fermentation or decomposition of long-retained fæces, fecal accumulations, undigested or irritating or partly decomposed food, by taking ices or cold drinks, by the presence of excess of or morbidly acrid bile, of gall-stones, bundles of round worms, coils of tapeworms, or irritant poisons; (b) by morbid states of the *wall* of the bowel—adhesions, contractions, volvulus, strangulation, intussusception, local inflammation, ulceration, or occlusion, as by the pressure of neighboring organs; (c) *reflex irritation* from other abdominal viscera—*e. g.*, the kidneys, liver, uterus, ovaries, or bladder—from sudden and violent emotion, from exposure to cold, particularly of the feet, legs, and lower part of the abdomen; (d) by certain forms of general *blood-poisoning*, as rheumatism, gout, or malaria, or the presence in the system of lead, arsenic, or copper.

Young, nervous, and excitable individuals—especially females—and those who lead sedentary lives and are subject to constipation, the gouty and rheumatic and dwellers in malarial districts, are predisposed to attacks of colic. In hysterical females the attack is often attended—sometimes followed—by a marked degree of flatulence; and in some instances it is of an epileptiform character, and may be preceded by an *aura* in the shape of numbness, fornication, or choreic movements of a limb.

Treatment.—Such causes of mechanical obstruction as a hernia, twist, adhesion or local contraction of the bowel must be sought for, and, if possible, relieved without delay. Pain may be promptly alleviated, and the spasm allayed, by a subcutaneous injection of morphine; the effect of chloroform inhalation is less lasting, but when opium in any form is contra-indicated, inhalations of amyl-nitrite, or frequent drop-doses by the mouth of a 1 per cent. solution are valuable. At the same time the bowel should be emptied of its irritant contents, which may be effected by a large warm-water enema, while a combined sedative and purgative is given by the mouth—*e. g.*, a grain of opium with 5 to 10 grains of calomel, or 20 grains of rhubarb followed by repeated doses of a saline aperient with some carminative, until all irritant ingesta and all hardened and knotty fæces have been evacuated.

The hot bath is always useful, and mustard or turpentine stupes, followed by hot fomentations sprinkled with laudanum, or large light linseed poultices, are grateful to the patient. Sometimes steady friction with warm oil or opiate liniments gives the greatest relief at first. The diet should be restricted to liquids, including small quantities of stimulants if necessary; copious draughts of hot water are often of service both in relieving pain and in favoring evacuation of the bowel, as well as in checking vomiting when this exists.

The colic-like enteralgia of nervous women usually yields to 20-grain doses of sodium salicylate. Colic occurring in malarial subjects is best treated with quinine and arsenic. Generally speaking, during the attack aperients should be combined with sedatives.

Treatment subsequent to the attack must be mainly prophylactic in character. The diet must be properly regulated, a fair amount of daily exercise insisted on, and a regular and sufficient daily evacuation of the bowels secured by a suitable combination of laxative and tonic drugs until their natural and spontaneous action has been reestablished. The patient should be instructed to wear a knitted woolen abdominal belt and warm woolen drawers and stockings.

C. E. SHELLY.

Symptomatic Indications.—Spasmodic, flatulent colic, from indigestion.

with severe cramp-like aggravations, usually yields to *nux vomica*, particularly when there is a tendency for the attacks to recur. Next in value is *colocynth* for violent, cutting, griping spasmodic pains, with feeling as if the intestines were being squeezed, better from bending double, colic with diarrhea; *colocynth* is especially useful in flatulent colic of infants. *Belladonna* is particularly valuable in the colic of children; the pains are clutching or clawing, appearing suddenly and suddenly ceasing. Constriction around the umbilicus as if a ball or lump were forming. The transverse colon sometimes protrudes like a pad from flatulence. *Chamomilla* is useful in flatulent colic of women and children, with continuous drawing, tearing pains, which cause great impatience, anger, and restlessness. With the colic are often associated nausea, vomiting, and diarrhea. Colic from indigestion, with tympanitic distension of the abdomen, particularly after eating, yields to *cinchona*. Severe flatulent colic will often yield to *iris vers.* after other remedies have failed. It is particularly useful in the treatment of the infantile colic, with constipation, after chamomilla; *colocynth*, and *nux*. Colic of children, with diarrhea, uneasiness, screaming, and tossing about, constant nausea and vomiting, yields to *ipécacuanha*. Bilious colic, with remittent, griping pains, which radiate from the umbilicus, is relieved by *dioscorea*. Intense pain, as if cut with knives, with nausea and vomiting; cold sweat on the body; great weakness and prostration; great thirst for large quantities of cold water, calls for *veratrum album*.

COLOTOMY.—*When required.*—In obstruction to the large intestine, as from stricture of rectum (malignant or otherwise), or imperforate anus; in disease of rectum or colon, *e. g.*, ulceration, or rectovesical fistula, where it is desirable to prevent the irritation of feces in the diseased parts. Three operations, viz.: 1, Amussat's in right lumbar region; 2, Amussat's in left lumbar region; 3, Littré's in left groin. The left lumbar operation is sometimes named after Callisen, who merely attempted but never effected an operation.

Amussat's in left lumbar region.—Scalpel, forceps, retractors, director, handled needles, etc.; incision midway

between last rib and crest of ilium, transverse or oblique, *e. g.*, parallel to nerves; extent, 5 inches: center half an inch posterior to middle point of crest of ilium (Allingham); outer edge of quadratus lumborum thus exposed; now divide, from quadratus outward, on a director, the muscles to the extent of the skin wound (*latissimus dorsi*, *obliquus externus* and *internus*, and *transversalis*); secure vessels; distinguish, if possible, *transversalis fascia* from peritoneum; divide fascia; find colon; pass two ligatures through skin at both edges of wound, piercing colon on their way; make opening in bowel big enough to admit forefinger; pull out loops of ligatures and divide them, thus making four ligatures; tie each. Oil margins of wound and place patient in bed. Occasionally difficulty in finding bowel, especially when there is not complete obstruction and it is nearly empty. Use of distending injection before operation. Bowel must not be sought for too far out from spine; always lies in front of or below kidney. Roll patient on his left side, keeping finger in wound, bowel will sometimes then fall upon finger; not much danger of wounding peritoneum if bowel be distended. Much danger of wounding peritoneum in infants, because descending mesocolon often exists. Operation in right lumbar region done in a similar manner.

After-treatment.—Sedatives at first; dress with oakum; protect edges of wound with zinc ointment; india-rubber bag and soft bandage afterward; give good diet early; if opening contracts, use sponge tents; lower part of intestine should, after convalescence, be occasionally washed out with warm water.

Prognosis—According to Cæsar Hawkins two-thirds recovered. But many more cases have since been recorded, and the fatal cases appear to die not so much from operations as from original disease; therefore operation should be done in time.

C. B. KEETLEY.

COMA.—"A state in which insensibility or a defect of consciousness is associated with a tendency to death, chiefly by asphyxia."

All degrees of it may be met with, from a mere impairment of mental and bodily power, up to complete insensibility, from which the person cannot be roused, para-

lysis of the voluntary muscles of the body being absolute and complete. In this extreme form the patient lies motionless, except for the movements of the chest, lips, and cheeks during respiration; the breathing is stertorous, foam accumulates at the mouth, the sphincters are relaxed, the pulse may be full and regular, the face livid, the lips dusky, and the extremities cyanosed. The pupils are dilated and sluggish, or insensible to light, and the parallelism of the optic axes is lost. The eyes no longer move in concert, a slight degree of divergence will almost certainly be found, and one eye may remain stationary while the other is in motion, or they may move in opposite directions.

The *prognosis* in a case of absolute coma is always grave.

The *treatment* would depend entirely upon the cause. Coma is met with in such widely differing states as cerebral hemorrhage, abscess or tumor of the brain, meningitis, sunstroke, epilepsy, diabetes, and uræmia (*see* CONSCIOUSNESS, DISORDERS OF).

Symptomatic Indications.—The principal remedy in the treatment of coma is *opium*, which is indicated by stertorous breathing; open and distorted eyes; red face, sinking of the lower jaw; convulsive motions of the muscles of the face and extremities, or tetanic stiffness of the whole body. *Gelsemium* is useful in coma from intense passive congestion, with great heaviness of the eyelids. *Belladonna* in slight cases; long or deep sleep, with immobility. *Helleborus* in coma with automatic motion of one arm and leg; paleness of the face; squinting, lower jaw sinks down.

COMA-VIGIL.—A peculiar condition, in which partial unconsciousness is associated with insomnia.

It is occasionally met with in the later stages of typhoid and typhus fevers and delirium tremens. The patient lies with his eyes wide open, but is insensible to all that goes on around him, although his appearance suggests that he is awake. The pupils are generally of natural size, but sluggish; the pulse is frequent, and the breathing free from stertor.

Prognosis is very unfavorable, the condition almost invariably ending in death.

COMEDONES.—A comedo is a minute elevation formed by the reten-

tion of sebum, epithelial cells, and small hairs in the distended efferent duct of a sebaceous gland, the protruding portion of which usually becomes blackish from the accumulation of atmospheric impurities.

A small mite—the *acarus*, or *demodex folliculorum hominis*, is frequently found in the contents of the sebaceous follicles, but its presence is devoid of pathological significance. The *acarus* may be seen under a low power of the microscope, after mixing the sebaceous matter with oil, and measures from $\frac{1}{12}$ to $\frac{1}{6}$ of a line in length; it has a distinct head, thorax, and abdomen, and four legs attached to each side of the thorax; it lies with its head directed toward the deepest part of the follicle.

The *distribution*, *general ætiology*, and *treatment* of comedones are practically those of *acne vulgaris*, of which they constitute the first stage and to which reference may be made.

CONIUM, POISONING BY.—Independent of poisoning by pharmacopœial preparations of conium, fatal accidents have occasionally occurred owing to the resemblance between the leaves of hemlock and those of parsley.

The *symptoms* of poisoning by hemlock are extreme weakness and numbness, commencing in the legs and spreading upward; dryness of the mouth and throat, giddiness, impaired vision, paralysis of accommodation, dilated pupils, slowing of the pulse, and death from cardiac and respiratory paralysis, or from convulsions and coma.

Post-mortem appearances.—These present nothing characteristic; there are the usual signs of asphyxia, and, when the leaves have been taken, a green pulpy mass may be found in the stomach.

Treatment.—This would be the same as that recommended for narcotic poisons (*see* OPIUM, POISONING BY). Tannin and astringents are especially recommended, to neutralize the alkaloid as far as possible. Atropine in hypodermic injections ($\frac{1}{40}$ of a grain) may be tried as a stimulant to the cardiac and respiratory centers. Strong tea and brandy, ether, or ammonia are also useful.

CONSCIOUSNESS, DISORDERS OF.—1. *Perversion of consciousness* occurs in the various forms of insanity, in

the delirium of fever, in diseases of the brain, in meningitis, and in cases of poisoning by narcotic drugs.

Delirium may be divided into three forms: (1) *Low, muttering delirium*, when the patient lies in a quiet condition, mutters to himself in a rambling fashion, and picks at the bedclothes; (2) *delirium tremens*, a result of alcoholic excess. In this form the patient is very restless and sleepless, has illusions and hallucinations, feels all manner of horrid animals creeping about him, is very suspicious, and keeps up a perpetual rambling conversation with himself; his movements are tremulous, and occasionally he has violent outbursts of raving delirium; (3) *raving delirium*, in which the patient is very violent, raves furiously, and exhibits tremendous strength for a considerable period. In such cases there is often a fixed delusion. Delirium is most common during the period intervening between wakefulness and sleep.

2. **Partial loss of consciousness** occurs in some forms of hysteria, in somnambulism, trance, hypnotism, and catalepsy. In this condition there appears to be a complete loss of recollection of sensory perceptions, and there is subsequently no remembrance of what happened to the patient during the state. Consciousness can usually be restored at once by the application of external stimuli. Motor actions are readily performed in an automatic fashion without causing any perception.

3. **Complete loss of consciousness** may occur from a variety of causes, which may be thus classified: (1) Poisons from without, such as alcohol, ether, chloroform, opium, and other narcotics; (2) poisons from within, as in the uræmia of Bright's disease, and in the coma of diabetes; (3) asphyxia from any cause preventing access of air to the lungs and due aëration of the blood; (4) syncope from failure of the heart's action; (5) concussion or compression of the brain; (6) epilepsy; (7) apoplexy, from hemorrhage into the brain substance, or blocking of the cerebral vessels by a thrombus or an embolus.

It will be useful to point out the *symptoms* by which the cause of the loss of consciousness may be determined. In some cases the *diagnosis* can be readily made; in others it is exceedingly difficult, and in some almost impossible.

(1) When loss of consciousness is caused by *poisons* from without, the onset is gradual, and there is often a history of the poison having been taken. The pupils are usually dilated and react to light, and the conjunctival reflex can be obtained unless the coma be very profound; but in opium poisoning the pupils are contracted to pin-point size. The patient can usually be roused by external stimulation. The presence of the odor of alcohol cannot be relied upon, as it may have been given after the onset of the symptoms for the purpose of restoring the patient. Violent struggling and the absence of convulsions are in favor of alcoholism, as opposed to apoplexy.

(2) In *uræmia* the urine contains albumen, but this is also frequently the case in apoplexy. A peculiar "hissing" breathing is present, unlike the stertorous breathing of apoplexy. The patient can be aroused to answer questions, but immediately relapses into the previous drowsy condition. The onset is gradual in chronic nephritis, but in acute nephritis it may be sudden. A history of anasarca may be obtained, and also of general convulsive fits. The presence of albuminuric retinitis points to uræmia but does not exclude apoplexy. The temperature is usually depressed, and does not tend to rise as in apoplexy. The face is pale, the pupils are equal, and may be either dilated or contracted; they react slowly to light. The pulse is often hard and tense.

(3) In unconsciousness due to *asphyxia* the diagnosis can usually be readily made from the history of the case, the marked cyanosis, the physical signs of the non-entrance of air into the lungs, and from the fact that, if the obstruction be not speedily removed, death ensues.

(4) In *syncope* the onset is sudden, the pulse is very feeble or imperceptible, there is extreme pallor of the face, the respirations are irregular and sighing, reflex action is usually preserved, and the sphincters are rarely relaxed.

(5) In *concussion and compression* there is a history of an injury, or an actual fracture of the skull may be found.

(6) In loss of consciousness after an *epileptic fit* there is a history of a fit having occurred; the face is cyanotic, the breathing stertorous at first, but the stertor soon passes off; the pulse is rapid, the pupils are widely dilated, and

do not react to light; the limbs are relaxed and the plantar reflex is abolished. There is often blood about the mouth, from the tongue having been bitten. The urine and fæces are evacuated involuntarily. The urine does not contain albumen except after a rapid succession of fits. Many of these symptoms are present in apoplexy, but after an epileptic fit the patient usually recovers in from five to ten minutes, which is not the case in apoplexy. Immediately after an epileptic fit there is often conjugate deviation of the eyes to one side, but this passes off in from three to five minutes.

(7) In *apoplexy* the onset is sudden, the breathing is stertorous, the pupils may be unequal or dilated, and do not react well to light. The superficial reflexes are abolished either on one or on both sides. There is no failure of the heart's action. The limbs are relaxed, or there is rigidity on one side. The face is suffused, and there may be a persistent conjugate deviation of the eyes and turning of the head to one side. Albumen may be present in the urine. If the attack begin with a fit the convulsions are frequently one-sided. It must be remembered that hemorrhage into the pons Varolii produces contraction of the pupils similar to that found in opium poisoning. The temperature is depressed, but this is soon followed by a rise above normal, unless death ensue rapidly.

In dealing with cases of unconsciousness supposed to be due to drink, it is a wise rule, especially in hospital practice, *never* to send a patient away until he is so far recovered as to be able to walk and to give his name and address.

Feigned loss of consciousness is a favorite symptom with malingerers, and should not be overlooked; the diagnosis is assisted by observing that the pupils are equal, and react readily to light; that winking is produced by touching the conjunctiva or by suddenly aiming a blow at the open eye.

The *treatment* of the various diseases which may give rise to loss of consciousness will be found under their respective headings.

C. E. BEEVOR.

Symptomatic Indications.—The principal remedy for syphilitic condylomata is *nitric acid*, especially when occurring on the glans penis, or in complication with chancroid. For the non-syphilitic vari-

ety, the main remedy is *thuja*; condylomata on the glans, prepuce, scrotum, or anus, with moist, mulberry surface; condylomata with hard chancres require *mercurius*. *Aurum met.* is frequently useful for condylomata on the prepuce and anus of syphilitic origin. *Antimony tart.* has been successfully used when other remedies have failed.

CONJUNCTIVA, DISEASES OF.—

Ophthalmia.—This term is applied to all forms of conjunctivitis. Chief forms are 1, purulent; 2, muco-purulent; 3, membranous; 4, granular.

Purulent ophthalmia is generally due to contact with pus from the urethra or vagina, which may be gonorrheal or otherwise. The quality of the infecting discharge greatly influences the nature of the ophthalmia. When caused by gonorrhea the course is very violent. When occurring in newly-born children it is called O. Neonatorum.

Symptoms.—In from twelve to forty-eight hours after infection there are itching and slight injection of the conjunctiva; these soon become intense; then chemosis, tense swelling of the lids, great pain and discharge, at first serous, then turbid, then uniformly purulent. If untreated the discharge ceases in about six weeks, leaving the palpebral conjunctiva thickened, relaxed, and more or less granular. Cicatricial changes follow. The cornea is in danger from two chief causes, viz. (1), strangulation of the vessels from pressure, and (2), the influence of the discharge. If within the first few days the cornea be hazy and dull, it may partly or entirely slough. In milder cases transparent ulcers may appear and sometimes cause perforation. In many cases no corneal opacity occurs.

Treatment.—When one eye only is affected, carefully protect the other by a watch-glass strapped on. Frequently and thoroughly remove the discharge by free douching with water. Use astringent or caustic lotions or drops every hour in severe cases, *e. g.*, lotio aluminis, gr. x ad $\frac{3}{4}$ j; lotio zinci, gr. x ad $\frac{3}{4}$ j; lotio hydrarg. perchlor. gr. i-viii ad $\frac{3}{4}$ j; lotio argent. nit. gr. ij ad $\frac{3}{4}$ j. Apply simple ointment to the eyelids to prevent adhesion. Evert the lids and brush a strong solution of nitrate of silver (gr. x or xx ad $\frac{3}{4}$ j) freely over the conjunctiva once daily, and well wash off imme-

diately afterward either with water or with solution of common salt. Repeat less frequently as the discharge diminishes. In case where the lids are so swollen that nothing can be applied to their conjunctival surfaces, the outer canthus can be divided, or Mr. Critchett's method of dividing the upper lid by a vertical incision can be adopted.

Treatment should be continued as long as any discharge or granulations remain on the lids, for fear of a relapse, which is apt to occur.

Muco-purulent ophthalmia (Catarrhal ophthalmia).—Very common, very contagious, mostly attacks both eyes, differs in severity in members of the same household, who are generally attacked at the same time.

Symptoms.—Congestion of conjunctiva with patches of ecchymosis. Gritty pain, sometimes severe. Spasm of lids. Free muco-purulent discharge. Lids somewhat swollen and red, never tense. The cornea seldom suffers. Spontaneous recovery takes place in about two weeks.

Treatment.—Any mild astringent lotion or drops will cut the malady short. An outbreak of this malady in a crowded community is serious. Very common in pauper schools,

Membranous ophthalmia (Diphtheritic ophthalmia).—Very rare in this country, and must not be confused with muco-purulent or purulent ophthalmia, in which there is often a distinct layer of inspissated pus beneath the lids. In membranous ophthalmia the whole thickness of the conjunctiva is occupied by the solid exudation, which is called "diphtheritic" by some surgeons. It may appear in patches, or may cover all the whole inside of the lids.

Granular ophthalmia.—Very common.

Symptoms.—First appearance as of small granules like sago-grains on the inner surface of the lower lid, due to inflamed lymphatic follicles. These extend to the upper lid; then progressive changes in the palpebral conjunctiva in which it becomes thickened, vascular, and roughened by granular elevations. New tissue is formed in the deep parts of the conjunctiva, which afterward is partly absorbed, and partly undergoes critical contraction.

Causes.—Feeble health. Prolonged residence in badly ventilated dwellings.

Treatment.—Generally tedious. Evert the eyelids and apply a solution of nitrate of silver (gr. xx ad $\frac{3}{4}$ j) with camel's hair brush, once, twice, or thrice a week; or apply the mitigated nitrate of silver stick; in each case wash the lids with water before inverting them. Solid sulphate of copper may be used instead of these. Glycerine of tannin applied daily is beneficial.

Results.—(1) Haziness of cornea; (2) Pannus (*see* CORNEA); (3) Entropion, Trichiasis.

Xerophthalmia (Xerosis. Cuticular conjunctiva) is a condition of excessive dryness of the ocular and palpebral conjunctiva.

Pterygium is a triangular patch of thickened conjunctiva, generally placed opposite the palpebral fissure, its apex pointing to or encroaching upon the cornea. Rare in this country.

Treatment.—Dissect up from the apex and transplant it into a cleft below the cornea. This is said to be more effectual than excision or ligature.

Pinguecula, a harmless patch of yellowish white thickened conjunctiva situated near margin of cornea.

Lupus may occur on conjunctiva.

Warts are sometimes seen on the ocular palpebral conjunctivæ; they are cauliflower excrescences. To be snipped off with scissors.

Epithelioma and sarcoma may occur on the conjunctiva.

HENRY JULER.

Symptomatic Indications.—The most generally indicated remedy in simple conjunctivitis is *belladonna*; the eyes are intensely congested, with throbbing pains which may involve the entire head, the eyes are dry, or secrete hot, salt tears; the sclerotica is vividly red, and there is great intolerance of light or noise. In catarrhal ophthalmia *euphrasia* is the principal remedy, the congestion is not so intense as with *belladonna*, and there is copious secretion of acrid tears, and of acrid, thick, and yellow mucus. Gonorrheal or scrofulous ophthalmia yields most readily to *mercurius*. The inflammation is intense and the eyes are vividly red, with cutting, burning pains, worse at night. There are vesicles and pimples on the sclerotica, and pustules and scurfs around the eyes and on the margins of the lids. *Mercurius* is also useful in ophthalmia neonatorum, with thin, excori-

ating secretion. Ophthalmia neonatorum may require *chamomilla*, when the lids are much swollen, with bleeding of the conjunctiva when separating the lids; the child is fretful and wants to be carried about. *Calcareo carb.* is useful in scrofulous ophthalmia, when the eyes are red and inflamed, with purulent secretion; profuse yellowish-white discharge; redness and swelling of the eyelids, with nightly agglutination; specks and ulcers on the cornea. In chronic cases *arsenicum* is the most important remedy; the conjunctiva and sclerotica are dark with congested vesicles; the pains are burning like fire, the secretion acrid and corrosive; the disease is attended with great anguish and restlessness.

Chronic cases in scrofulous persons are frequently relieved with great promptness by *sulphur*. Itching and burning in the eyes and eyelids, worse from moving them, or from sunlight. A profuse bland discharge, worse in the evening and in a warm room, with pressure and burning in the eyes as from sand; neuralgic pain in the eyeball yields to *pulsatilla*.

CONSTIPATION (Costiveness).—

An undue retention of fæces, owing to delayed, infrequent, or imperfect evacuation of the bowels.

The motions consist of a few small, hard, dry, fecal lumps, or of large masses compacted of an agglomeration of such scybala, and sometimes smeared with mucus or streaked with blood. They are passed with difficulty, often with pain; they may be very dark or light and clay-like in color, and are apt to be very offensive in odor. These hard motions may alternate with, or even be accompanied by, diarrhea, a symptom of the intestinal irritation caused by the retained scybala; or, again, the patient may complain only of diarrhea—frequent, painful, loose motions, attended with griping abdominal pains (*tormina colic*)—until by appropriate treatment the retained fecal accumulations have been dislodged.

The most common sites of fecal accumulation are the cæcum, the colon, the sigmoid flexure, and the pouches of a relaxed and distensile rectum. These masses may produce overdistention of the bowel, with consequent paresis and extreme atrophy of its walls; or, by more localized irritation, may beget sacculation,

inflammation, ulceration, and perforation of the gut. They may accumulate, with the result of its complete occlusion; they can readily induce colic, catarrhal dysentery, and sometimes jaundice; and by the pressure which they exert upon the abdominal nerves and blood vessels—especially on those within the pelvis—may give rise to congestion of the uterus and ovaries, with catarrhal leucorrhœa, menorrhagia, or metrorrhagia. Hemorrhoids, spermatorrhea, and prostatitis, pain in the course of the great sciatic nerve, numbness and pain in the thighs, and coldness of the feet and legs may result from constipation.

Among the more remote, but frequently observed, effects of chronic constipation are anæmia, with a dingy sallow skin; amenorrhœa, anorexia, headache (usually frontal), vertigo, nausea, flatulence, thirst, and lithæmia; foul tongue, fetid breath, lassitude; hypochondriasis and irritability of temper are also occasionally symptoms of this condition. These symptoms, being mainly attributable to a sort of general blood-poisoning by reabsorption from unduly retained fæces (and closely analogous to certain forms of sewer-gas poisoning), are sometimes grouped under the term copræmia.

Recent researches tend to show that these symptoms are probably manifestations of the toxic effect of animal alkaloids, ptomaines (*q. v.*) or leucomaines.

Ætiology.—The immediate causes of constipation are: (a) Mechanical obstruction of the lumen of some part of the intestinal canal; (b) scantiness or excessive dryness and hardness of the contents of the large bowel; (c) paresis of its muscular coat.

More precisely the cause may be distinguished as: (1) *Local*, including blocking of some part of the intestinal tube by accumulated scybala, fecal concretions, masses of round-worms, or by foreign bodies introduced by the mouth or per rectum; the development of polypi or other new growths; cicatricial contraction rigidity from inflammation, ulceration, carcinoma, or syphilis of some part of bowel-wall; enfeebled muscular contraction and atrophy of the bowel-wall resulting from prolonged overdistention of the gut with fæces or gas, or from inflammation, adhesion, or lead-poisoning; also in cases of general enfeeblement and senile atrophy; pressure exerted by

extra-intestinal tumors, especially on the rectum, as by a displaced or gravid uterus, by uterine fibroids, ovarian tumors, or enlarged prostate; enfeeblement of the abdominal muscles, by repeated pregnancy, or by obesity; a painful state of the abdominal walls, as in rheumatism, and conditions in which attempted defecation provokes pain, such as inflamed piles, fissure of the anus, chronic dysentery, and the like; the reflex inhibition sometimes induced by painful and inflammatory states of the pelvic viscera.

(2) *General*, including depressed vital activity, as from anæmia or excessive venery; excessive muscular exercise or mental application or sedentary habits; the abuse of enemata and purgatives, neglect of the habit of regular defecation; prolonged sleep; the use of certain articles of food, such as salt meat, cheese, tea; the abuse of opiates, tobacco, spirits; the imperfect clothing and undue exposure of the feet, legs, and lower abdomen, especially in young children; a dietary yielding too small a proportion of innutritious residue, or too scanty in amount—the result in either case being fæces too small in bulk to excite full intestinal peristalsis.

Constipation is apt to be a prominent symptom in certain diseases of the stomach, liver, heart, and nervous system; in some febrile conditions, in diabetes, during prolonged lactation, and after excessive perspiration or exhausting discharges.

Treatment.—The causes of mechanical obstruction or pressure and painful conditions of the anus, rectum, and of the abdominal walls must be removed or palliated. Habits of sloth and indolence must be amended, and regular open-air exercise, especially walking and riding, should be taken early in the day, while excess in muscular exertion, as well as in mental application, are avoided. A daily solicitation of the bowels at the same hour should be persevered in, however meager the result may be at first, and the desire to defecate should not be thwarted or resisted; nor should the act be unduly hurried over; its efficient performance is much aided if the opening in the closet-seat be so narrowed laterally as to afford ample support to the buttocks—not merely to the thighs in front, as is usually the case. Regular friction

and kneading of the abdomen over the course of the large bowel, beginning at the cæcum, may be practiced with advantage. Early rising, immediately followed by a cold bath or the cold douche to the abdomen; the application of a cold-water abdominal compress; ample woolen clothing of the lower limbs and abdomen, and support of a pendulous belly by an appropriate belt or bandage; faradization of the abdominal walls, or the galvanic current with one pole in the rectum, are all useful measures in certain cases.

The diet should consist largely of green vegetables and of ripe fruit, and the latter may often be taken at or before breakfast with advantage; coffee rather than tea or cocoa at this meal, and a moderate allowance of light bitter ale or porter at luncheon or dinner, answer well in some instances. Coarse oatmeal porridge, brown bread, hominy, and fats should—when they can be digested—be taken in preference to fine white bread and starchy food-stuffs; a considerable amount of fluids—especially water, toast-and-water, homemade lemonade, aerated waters—may be taken. A tumblerful of hot water, slowly swallowed at bedtime, and one of *fresh* cold spring-water sipped while dressing, often prove effective in the milder class of cases.

On commencing treatment it may be requisite to soften and break up fecal accumulations in the rectum by enemata of oil or warm water, and even to remove them piecemeal by the scoop (or handle of a large spoon). Should a second day pass without any evacuation, a small enema of cold water or of a dram or two of glycerine may be used at the usual hour of defecation. A pipe or cigar after breakfast or dinner is effective in some cases.

Drugs are quite secondary to general hygienic and dietetic treatment, but their employment is often necessary. The object of medicinal treatment is to relieve pain or spasm of the bowel, as, for example, by a full dose of opium or of nepenthe; to improve the tone of the muscular coat of the intestine, to exalt peristalsis, and to increase the flow of intestinal mucus. To this end several drugs may often usefully be combined: *e.g.*, a pill containing extr. aloes aquos. gr. j, pulv. rad. ipecac. gr. $\frac{1}{4}$, extr. nuc.vom. and extr. belladonnæ aa gr. $\frac{1}{6}$, taken every night or every alter-

nate night, and gradually relinquished; extr. cascar. sagrad. gr. j to grs. iij may advantageously replace the aloes in some cases. Rhubarb, colocynth, and podophyllin, with hyoscyamus or belladonna, are also of value; and a small quantity (gr. $\frac{1}{10}$ or $\frac{1}{12}$) of calomel may frequently be added with advantage. In anæmia and debility, iron—especially the sulphate—arsenic, and quinine are indicated; iron is well given, combined with rhubarb and aloes, in pill; and in the constipation of amenorrhœa a teaspoonful of the confectio sulphuris every morning greatly aids the effective action of a ferruginous aperient taken overnight. Aloes is a drug generally unsuitable in cases of hemorrhoids, and in congested or inflammatory conditions of the pelvic viscera, when the laxative electuaries are preferable. A dose of some effervescent saline laxative or of an aperient mineral water, taken on rising, is a useful adjuvant to other measures, but should not be relied on exclusively, or habitually taken for too long a period. A teaspoonful of the compound licorice powder of the Prussian Pharmacopœia is generally useful. A few drops of syrup or of honey or of olive oil often act well in very young children; and a teaspoonful of olive oil, cod-liver oil, or castor oil, every morning before breakfast, suits some persons. When the secretion of bile is deficient, and after much bilious vomiting, pills containing 2 or 3 grains of dried ox-gall are valuable; nux vomica, belladonna, and small doses of carbolic acid are useful where flatulence is a troublesome symptom.

In treating constipation it is most important to avoid any approach to excessive or exhausting purgation; the bowels are first to be thoroughly relieved of distending fecal accumulations, and must then be strengthened and educated to do their own work unaided. As regards drugs, laxatives must be combined with intestinal tonics, and, as the normal function of the bowel is by degrees reëstablished, the aperient agent should be gradually withdrawn from the prescription, while the tonic ingredient may often be usefully continued for a considerable time.

C. E. SHELLY.

Symptomatic Indications.—The most generally useful remedy is *nux vomica*, particularly when the stool is large, hard, and passed with difficulty, and in constipation of persons of sedentary habits, or

in pregnant women, or when the result of rich and highly seasoned food. After *nux vomica sulphur* follows well, particularly in chronic constipation, with hard knotty stools, with hemorrhoids. The first effort at stool is often painful, compelling the patient to desist. Constipation from torpor of the bowels, after chronic diarrhea, or from abuse of cathartics, usually yields to *opium*. Stool consists of small, hard, black balls. This remedy is also valuable in paralysis of the bowels, and in constipation of persons of sedentary habits, brain workers, and aged persons. *Plumbum* is frequently useful when opium appears indicated but fails; motion consists of small, hard, black balls, resembling sheep's dung. Violent colic, with drawing in of the abdomen and drawing up of the anus. Difficult expulsion of scanty stools, adhering to the parts like soft clay may be relieved by *platina*, which is also useful in constipation while traveling. Constipation in young children or infants is usually relieved by *alumina*, which is also indicated in constipation from inertia of the rectum, even a soft stool being passed with difficulty. Obstinate constipation of young children is frequently overcome by *lycopodium*; this remedy is also valuable in the treatment of constipation with indigestion, rumbling, and gurgling through the bowels; acidity and heartburn. Constipation with piles, with dry, uncomfortable feeling in the rectum, lameness, and aching in the back yields to *æsculus hipp.*

CONSUMPTION.—See PHTHISIS.

CONTUSIONS.—A contusion may be defined as a laceration of tissue without breach of surface continuity. When the skin or membrane is broken the injury is known as a contused wound.

The extent of the lesion varies from slight extravasation into the skin to rupture of the trunk vessels and nerves, and even fracture of bones. The force may be applied directly, the part being squeezed or struck; or indirectly, *e. g.*, when the spine is contused by a fall upon the shoulders. The quantity of blood effused depends upon: 1, the degree of violence; 2, the number and size of vessels implicated; 3, the proximity of resisting structures. Thus the effect of a blow upon the skull or shin will be very different from that of one inflicted upon the fleshy part of the

thigh. Again, the greater the elasticity of the skin the more marked will be the contusion; 4, the tendency to bleed; this is very pronounced in the subjects of hemophila. It is also increased by degeneration of the blood vessels, whether from age or disease. The extravasated blood is known under different names. When it is widely diffused along the subcutaneous or intermuscular planes it is called a sugillation; when moderate in amount and limited in distribution, an ecchymosis (the latter term is employed chiefly in reference to surface contusions); when profuse and circumscribed, forming a more or less obvious swelling, a hematoma. Familiar examples are furnished respectively by: 1. Hemorrhage into the loose areolar tissue of the scrotum. 2. An ordinary "bruise" of the skin. 3. An accumulation of blood beneath the scalp. In subcutaneous laceration the greater part of the extravasated blood is derived from the veins, for the arteries, being stouter and more elastic, are better able to resist injury.

Contusions of vessels.—In addition to the inevitable rupture of numerous small vessels, the main trunks are occasionally torn, and this is the more likely to occur where the contusing force acts immediately over a bone; *e. g.*, the brachial artery may suffer partial or complete rupture through the arm being caught between two buffers.

In some cases of simple fracture, especially of the leg, a large artery may be lacerated by a splinter of bone. Subcutaneous hemorrhage, although it may be profuse, is not immediately fatal, unless it happens that the blood escapes into a cavity, like that of the pleura; for the tension of the surrounding structures, together with the pressure of the extravasation, tends to check the bleeding; moreover, the wound in the vessel being a lacerated one, it does not gape, and the shreds of the vascular walls and sheath not only offer a mechanical obstacle to the bleeding, but, acting as foreign bodies, they induce coagulation.

When an artery is only partially ruptured hemorrhage does not ensue directly upon the injury, but it may come on some days later; the bruised tissue, which in the meantime has undergone degenerative softening, giving way under the blood pressure. On the other hand, thrombosis may occur at the seat of injury, and the

lumen be permanently occluded, the same as after ligation; or lastly, the wall of the artery having lost its elasticity and power of resistance, may become stretched, and form the sac of circumscribed traumatic aneurism.

As regards contused or lacerated veins, the chief danger lies in the subsequent phlebitis, with its possible sequelæ; *i. e.*, suppuration and dislodgment of clots. The walls of a vein being readily compressible, and the blood pressure within being much less than in an artery of corresponding size, hemorrhage is more easily restrained. But if one of the large serous cavities is opened at the time of the accident, a fatal result may quickly supervene.

It should be borne in mind that the force which lacerates a trunk vessel is certain to rupture many smaller ones in this vicinity, and for this reason the danger of gangrene is greater than would at first sight appear; *e. g.*, a child had its arm squeezed in a gate, and the brachial artery was contused in two places, the inner and middle coats being torn from the outer. The injury was quickly followed by occlusion, from thrombosis, and this, in conjunction with rupture of numerous subcutaneous and intermuscular veins, caused complete stoppage of the circulation and death of the limb.

Contusions of nerves.—The nerve trunks are rarely injured severely in subcutaneous lacerations, since, for the most part, they lie deeply, and are well protected by the soft parts. The chief exceptions to the rule are the ulnar nerves, just below the elbow; the muscular-spiral, at the outer aspect of the arm; and the peroneal, below the head of the fibula. Contusions in these situations not uncommonly cause a certain amount of paralysis, from bruising or partial tearing of the nerve involved. But, apart from these serious lesions, the nerves also suffer from the effects of the *concussion* in the same way as the brain and spinal cord. The molecular disturbance in the axis cylinders causes temporary diminution or abolition of conductivity, so that sensation and motion are for the time impaired or lost in the areas of distribution of the injured nerves. It is possible that violent concussion of a limb may be the starting-point of secondary peripheral degenerations of the nerves. Contusion of a nerve, short of complete destruction, causes at first

feeling of numbness at the spot and along the distal course of the nerve. This is succeeded by a burning pain. The pain may be very severe; in fact it may bring on syncope. But fainting may also arise in a reflex manner, the brain suddenly becoming anæmic from contraction of the arterioles, the result of powerful stimulation of the sensory nerves. The immediate effect of concussion or contusion of a nerve will vary according to the seat of injury; *e.g.*, the functional disturbance is greatest when the large sympathetic plexuses are involved.

Contusions of muscles.—When a muscle is extensively lacerated there is copious bleeding, for the tissue is richly supplied with vessels. In complete rupture the ends become widely separated, owing to contraction of the muscular fibers, and the interval is soon filled with extravasated blood. Volitional control is lost; in short the muscle is for some time powerless for action. It is worthy of note that contusions of all living tissue elements diminish their vital activity, and as the condition may be long enduring, it has an important bearing on the question of regeneration. This is best exemplified in the case of the nerves, for their repair largely influences the nutrition of the structures supplied by them.

Diagnosis of contusions.—The effect of a contusion is known to some extent at once by the state of the vessels and nerves. The surgeon is further guided by the course of events. When the blood is effused into the skin it assumes the form of spots and streaks, and presents a dull red appearance. The color of the blood is also manifest in extravasations beneath the conjunctiva. Subcutaneous hemorrhages give a steel-gray or purplish tint, according to the thickness of the skin. When an artery of considerable size has been lacerated there may be pulsation of the seat of injury, and a loud or subdued bruit. The bruising becomes more marked a few days after the injury, owing to the staining by the hemoglobin set free from the blood corpuscles and taken up by the fluids which permeate the tissues. For the same reason the discoloration is more widely distributed than the laceration of the vessels. An ordinary bruise takes from one to three weeks to disappear, and during this time the color changes from red, reddish-black, green, to lemon yellow.

Hematoma.—This is a collection of

blood surrounded by lacerated tissues. It is well seen in extravasations beneath the scalp and pericranium. At first it is soft and fluctuating throughout, then it becomes firmer, from coagulation of the blood within and inflammatory effusion around. Later on it may regain its fluid condition from liquefaction of the clot, the contents being then of tarry consistency and color. At this time its margin, which is well defined, gives a crateriform character to the swelling, the finger passing over an incline, and then suddenly falling down a steep declivity. This is most marked in cephalhematomata.

Changes in hematomata.—These are: 1. Absorption. 2. Suppuration. 3. Decomposition. 4. Encapsulation, with concentric lamination throughout, the fluid part of the blood being absorbed. 5. Cystic degeneration, especially in firm tissues like the brain. 6. Calcification, which is very rare.

Absorption is by far the most frequent event. Suppuration may arise either from the severity of the injury or from the introduction of septic matter. As permanent vestiges of contusions we may find orange or ruby-red crystals of hematoidin, and groups of black granules of coloring matter, and tracts of cicatricial tissue.

Treatment.—Unless specially contra-indicated apply gentle pressure; this checks the hemorrhage, and favors the absorption of blood. In the early stages employ cold continuously. In the event of acute inflammation poultice the part. If suppuration takes place, open antiseptically. If the hematoma be very large or persistent, drain off the fluid contents with the aspirator, and if this fails it may be advisable to lay open the tumor and let it heal by granulation. Under all circumstances enjoin rest.

Brush burn.—This is produced by some part of the body coming in contact with an object in rapid motion, such as the straps of machinery. The surface of the skin is excoriated, and the tissues beneath formed into an eschar.

Treatment.—Protect the wound, and apply iodoform ointment.

Traumatic malignancy.—There can be no doubt that in many cases mechanical irritation is the sufficient cause of epithelioma and other forms of true cancer, and it is highly probable that connective tissue tumors may own a similar origin. That a contusion is sometimes the de-

termining factor in the development of sarcomas is beyond speculation, the only question being whether there exists a special predisposition to malignancy, or merely an instability of nutrition, which in one case leads to inflammation, and in another to a new growth. My experience leads me to adopt the former theory.

AUGUSTUS J. PEPPER.

Symptomatic Indications.—See WOUNDS.

CONVULSIONS.—May be defined as involuntary contractions of the muscles and either intermittent and interrupted, with intervals of relaxation, the movements being often of a jerky character—clonic spasms; or more or less continuous and persistent—tonic spasms, these in their extreme form culminating in permanent rigidity. If accompanied with severe pain, they constitute the condition known as cramp. The violent tonic contractions observed in lockjaw and strychnine poisoning are named tetanic.

The spasmodic movements vary considerably in their severity and extent, and also as to the parts of the body which they involve. They may be slight and localized, unilateral, or more or less general. Some writers include under convulsions all forms of motor disorder in which there are unusual involuntary movements, such as fibrillar trembling of muscles, muscular flickerings, various kinds of tremor, and choreic movements. Ordinarily, however, the term implies more or less marked spasmodic movements, and these may be so violent as actually to rupture the muscles. Eclampsia is a word which is now often used to characterize all forms of powerful convulsions of a more or less epileptiform type, whatever their cause may be. Not uncommonly convulsions are accompanied or followed by partial or complete loss of consciousness. They are of much importance in children, in whom a series of convulsive fits are liable to occur from very slight causes—infantile convulsions. They are frequently preceded by premonitory indications of nervous disturbance, such as twitchings, grinding of the teeth, restlessness, or peevishness, which in children should be looked upon as warnings. The chief dangers in connection with convulsions arise from implication of the respiratory muscles or glottis, leading to grave interference with breath-

ing, from obstruction to the return of blood from the brain, and from the exhaustion which the extreme violence or frequent repetition of the fits may cause, especially if they prevent sleep for a long period. Serious sequelæ may follow as a direct consequence of convulsions, such as hemiplegia, strabismus, loss of sight, smell, or hearing, defect of speech, or impairment of mental faculties.

Ætiology.—All forms of motor disorder are referable to some kind of irritation, acting upon some portion or other of the nervous system. Convulsions have been immediately attributed to “an abnormal discharge of unstable gray matter.”—(Hughlings Jackson.) They originate in some irritation or discharging lesion, either direct or indirect, affecting this gray matter. The main causes may be arranged thus: 1. Centric. *a.* Injuries to the head, especially fracture of the skull, with irritation of the gray matter by spiculæ of bone. *b.* Various organic diseases of the brain and cord or their membranes, viz., all forms of meningitis, hydrocephalus, cerebral hemorrhage, rupture of an aneurism, embolism, softening tumor. *c.* Idiopathic, dynamic, or essential. Here the convulsions are independent of any obvious organic mischief, but are supposed to result from some vascular or nutritive disturbance in the brain, as in some cases of epilepsy, hysteria, or the convulsions induced by strong emotions. *d.* Circulation of abnormal blood through the central nervous system, as exemplified by the convulsions which in children sometimes usher in, or occur during the course of acute specific fevers or inflammatory disease; uræmic convulsions; and those which may be associated with imperfect aëration of the blood, or, it is said, with rheumatic fever, jaundice, syphilis, tuberculosis, and rickets. In the two conditions last mentioned, however, the nervous system is probably highly susceptible, and convulsive movements may be excited by very slight reflex disturbance. 2. Eccentric, reflex, or sympathetic. In this class of cases the convulsions are due to some reflex irritation, particularly in connection with dentition; digestive disorders; intestinal worms; the passage of a gallstone or a renal calculus. Occasionally they result from direct irritation of some local nerve, the pricking of a pin in the clothes of a child, the application of a blister, of a burn of

the skin. Puerperal convulsions are either uræmic or reflex in their origin.

The most favorable periods of life for the occurrence of general convulsions, independent of organic disease, are childhood, especially during the periods of dentition, puberty, when cutting the wisdom teeth, and at the change in life. In children the ordinary causes are reflex irritation, the onset of some acute fever or inflammation, tubercular meningitis, or the presence of some chronic constitutional illness. Later in life they are most frequently associated with epilepsy, with organic affections of the nerve-centers, or with uræmia.

Treatment.—In treating spasmodic movements, especially if they are of the nature of general convulsions, the indications are: 1. To look for any reflex irritation, and to remove this if possible, particular attention being paid in the case of children to the teeth and alimentary canal, the gums being lanced, or an aperient or emetic given if required; at the same time regulating the feeding. It is also well to examine the clothes for any source of irritation. 2. To treat any disease with which the convulsions may be associated, such as rickets, tuberculosis, epilepsy, central organic disease, or blood-poisoning. 3. To mitigate or check the spasmodic movements. During a paroxysm of convulsions the recumbent posture, freedom from every disturbance, relaxation of the clothing about the neck and chest, and a free current of cool fresh air are needed. It is not advisable to restrain the movements except in so far as to prevent injury to the patient. Water may be sprinkled over the face and chest. If the convulsions continue, a warm bath containing mustard, the application of ice to the head, warm pediluvia, cold or warm affusion, the application of sinapisms to the nape of the neck, epigastrium, or extremities are the chief remedial measures which may be employed. Many practitioners resort at once to the application of leeches to the temples or back of the neck, or to venesection, especially in the case of robust children; but in most cases this is needless or injurious, and as a rule removal of blood is only indicated when there are signs of serious interference with the respiratory functions. The principal medicinal remedies available are narcotics and antispasmodics, especially

bromide of potassium, hyoscyamus in full doses, opium, hydrate of chloral, chloroform by inhalation, and asafetida by enema. Of course most of these drugs need due caution in their administration. It is of the greatest importance to endeavor to procure sleep if this is much interfered with, particularly should there be much exhaustion. The milder forms of spasm and cramp may often be considerably mitigated by friction, dry heat, judicious restraint, and other measures. 4. To treat the consequences of convulsions. The chief dangers are from suffocation and exhaustion. To obviate the former, removal of blood and artificial respiration are indicated. To prevent or counteract exhaustion, it is extremely important to administer abundant liquid nourishment, especially in the case of weakly or badly fed children, and if it cannot be taken by the mouth, enemata must be employed. Alcoholic stimulants are also most useful in many cases, being sometimes required, in considerable quantities, along with medicinal stimulants, such as ammonia, ether, camphor, or musk. The administration of food and stimulants often promotes sleep most efficiently.

FREDERICK T. ROBERTS.

CONVULSIONS, PUERPERAL.—See PUERPERAL CONVULSIONS.

CONVULSIVE TREMOR.—This is a non-rhythmical tremor or clonic convulsive movement, which is unattended with loss of consciousness, but which, nevertheless, is paroxysmal in character.

Sexual and alcoholic excess and sun-stroke are a supposed cause in three cases observed. In others no approach to a relation of cause and effect was established. There are paroxysms of clonic convulsions affecting the voluntary muscles and unattended by loss of consciousness, or by mental aberration, though sometimes there is emotional disturbance. Vertigo and pain in the head are also occasional symptoms. The disease is amenable to proper treatment.

Treatment.—Bromide of zinc given in solution, either in water or simple syrup, in the proportion of one dram to the ounce. Give ten drops three times a day for two weeks, then fifteen drops three times a day for two weeks and so on, increasing five drops for the doses of each

subsequent two weeks. Continue for from three to six months, and then gradually reduce the dose.

Symptomatic Indications.—The most generally useful remedy is *belladonna*, particularly when the convulsion is of cerebral origin as shown by congestion of the head, flushed face, convulsive motion of the facial muscles and eyes. *Belladonna* is of special value in convulsions of children. Convulsions of spinal, rather than of cerebral origin require *ignatia*. This remedy is of special value in spasms during dentition. The child suddenly starts from a light sleep, with loud screams, and trembling all over. It is also useful when convulsions occur every day or every other day at the same hour, and in convulsions of parts of the body or of single muscles. *Gelsemium* is also valuable in convulsions during dentition, and in spasmodic rigidity from cerebral disease. Convulsions with cramps require *cuprum*. This remedy is particularly valuable in convulsions from retrocession of scarlatina or other exanthematous eruptions. Convulsions from fright are relieved by *opium* or *stramonium*. With opium the person lies as if stunned, with heavy, difficult breathing. With stramonium there is tossing of the limbs and involuntary evacuations of the fæces and urine.

COPPER, POISONING BY.—All the salts of copper are, when taken in sufficient quantity, irritant poisons.

The prominent *symptoms* are a coppery taste in the mouth, a sense of constriction in the throat, thirst, and pain and tenderness in the abdomen. Vomiting and retching soon set in, the vomited matters being blue or green; purging and tenesmus are also present, the stools sometimes containing blood. Jaundice, suppression of urine, and cramps in the extremities are among the later phenomena; the breathing is hurried and difficult, and the extremities cold. Death may ensue from coma or convulsions.

Post-mortem appearances.—Inflammation of the mucous membrane of the alimentary canal is the chief change present; ulceration is rare; the liver may be fatty and friable, the cortex of the kidneys swollen and pale.

Treatment.—To get rid of the poison by the use of the stomach-pump and emetics is the first and chief indication; albuminous substances, such as white of

egg, should be administered to render the poison inert. For the rest the treatment would be symptomatic, opiates or stimulants being used, if necessary.

Chronic poisoning may result from the use of copper vessels in cooking, or from exposure to the effects of copper in certain trades. The chief *symptoms* are a general and increasing loss of power, colic, constipation, or diarrhea and jaundice; retraction of the gums and a purple line along them have been described.

COREDIALYSIS.—See IRIS, DISEASES OF.

CORN (Clavus) and CALLOSITY.

—Intermittent pressure on, or friction of, yielding portions of skin causes hypertrophy of the horny layer of the cuticle, the rete Malpighii and subjacent papillæ being also somewhat inflamed and infiltrated.

Callosities thus produced constitute familiar “trade-marks” of various occupations (coachmen, oarsmen, smiths). A *corn* differs from the preceding form mainly in the involution and downward growth of the hypertrophied horny layer to form the so-called “root” in the center, which, pressing upon the subjacent papillæ, either causes their inflammation or atrophy. The pain due to the pressure of this peg of tightly packed, hard epidermic cells upon the sensory nerves is either dull or exquisite, and often radiates widely, causing a feeling of extreme fatigue in the limb. It has lately been shown that the underlying sensory nerves undergo enlargement. Some corns, apparently from their hygroscopic properties, give rise to most pain in damp weather, the advent of which they sometimes prophesy with unfailing certainty; while others cause most annoyance in dry and frosty weather. Corns are almost invariably produced by tight or badly fitting boots, the two conditions being often combined, and their commonest seats are the ball of the big toe, the outer side of the little toe, and the dorsal surface of the intervening toes. When situated between the toes, corns are “soft” owing to persistent maceration.

Treatment.—Callosities may be reduced, when expedient, by the prolonged application of a 10 per cent. solution of salicylic acid in ether, or of a simple ointment of salicylic acid of the same strength.

Corns are best treated by prolonged soaking in hot water, subsequent shaving, and the excision of the "root." Many cases, however, yield to the persistent application of Unna's salicylic acid plaster-mulls, or to daily painting with a saturated solution of salicylic acid in flexible collodion. The inunction every morning of a little soft soap is generally sufficient to prevent their recurrence, always provided that proper boots be worn.

J. J. PRINGLE.

Symptomatic Indications.—*Arnica* or *Ruta* internally and externally.

CORNEA. — Inflammation of the cornea may be circumscribed or diffused; may involve its proper layers, or may be confined to its anterior or posterior epithelial layer. It may be local, leading generally to suppuration or ulceration, or it may arise from constitutional disease, as inherited syphilis. It may exist with other inflammations, as in kerato-iritis, cyclo-iritis.

Local Keratitis (Corneitis).—*Symptoms.*—Commences with a more or less perfect zone of pinkish-red vessels around the margin of the cornea. Photophobia more or less severe. Cornea becomes hazy, and has a steamy or ground-glass appearance. Generally there is lachrymation, and frequently pain in and around the eye.

Pathology.—The intercellular substance becomes opaque from infiltration with leucocytes, which are supposed to have emigrated from the surrounding vessels. The cells of the corneal tissue proper also undergo proliferation into small corpuscles, greatly resembling leucocytes. The disease often has a tendency toward recovery, but more frequently leads to suppuration and ulceration.

Ulceration of cornea is preceded by inflammatory infiltration, and the inflamed part breaks down at the center, forming an ulcer with more or less infiltrated base and edges.

Symptoms.—Photophobia, congestion more or less, consisting of a circular zone of vessels beneath the conjunctiva at periphery of cornea, and sometimes also of conjunctival vessels. Pain sometimes acute.

Ulcers may be (1) small and central, with infiltration of base and edges. These generally heal quickly, but leave a hazy

(nebula) or an opaque spot (leucoma). (2) Small and central, without much infiltration. These heal slowly and with loss of tissue, perhaps without opacity, but give a faceted appearance to the cornea. (3) Phlyctenular ulcers (*Herpes corneæ*). (4) Serpiginous ulcers. (5) Acute suppurating ulcer following abscess or otherwise.

Treatment.—First secure rest, either by bandaging the affected eye, and so reducing friction against eyelids, or by shading both eyes. Soothe local pain by atropine drops. In suppurating cases apply hot fomentations to lids; if abscess is defined, open by valvular incision. When indolent, stimulate ulcer by astringent drops, ointment of yellow oxide of mercury, calomel powder, eserine drops (grs. iii ad $\frac{3}{4}$ j), etc.

Counter-irritants to temple, as seton or blister. Constitutional treatment.

Hypopion signifies a collection of pus or purulymph in the lowest part of the anterior chamber. The pus is divided (1) from the rupture of an abscess through the posterior layer of the cornea; (2) from suppuration of the epithelioid layer covering Descemet's membrane; (3) from surface of iris.

Onyx is a term applied to that condition in which pus is observed between the layers of the cornea at its lower part.

Syphilitic keratitis (Interstitial K. Parenchymatous K.). *Symptoms.*—The visible changes of the cornea are usually preceded for a few days by some ciliary congestion and lachrymation; then there is cloudiness in one or more patches, and after a few weeks a ground-glass appearance. Frequently accompanied by iritis and posterior synechiæ. Blood vessels often appear in the layers of the cornea, extending from the ciliary vessels; they are thickly set in patches (salmon patches), of a reddish-pink color, and of various shapes; they may extend all over the cornea, except, perhaps, to the immediate center. The disease is always symmetrical (contrast with local keratitis,) but second eye is usually attacked a few weeks after the first. Age generally between six and fifteen. Often accompanied by inflammation of the ciliary region and iris, which may give rise to secondary glaucoma, to stretching and elongation of the globe in the ciliary zone, or to softening of the eyeball; but, as a rule, the cornea throughout its whole structure undergoes a chronic inflammation, show-

ing no tendency either to suppuration or ulceration, the inflammatory products being partially or entirely absorbed after several months.

Cause.—Inherited syphilis. Other signs of inherited syphilis are usually present. If no other signs are shown in the patient, a history of infantile syphilis can generally be ascertained either in the patient or his brothers and sisters; or a history of acquired syphilis in the parents may be traced. A few cases have been seen in which this disease has occurred as the result of acquired syphilis.

Treatment.—A long but mild course of mercury. Mercurial inunction, gray powder, blue pill, etc. Iodide of potassium may be combined with these. Keep a strict watch against salivation. If the patient be anæmic or strumous, give iodide of iron, bark, quinine, etc. Keep the eyes shaded. Use atropine drops daily, as iritis may occur without being detected through the opaque cornea. When inflammation has subsided, apply calomel powder, or ointment of yellow oxide of mercury to the cornea daily, in order to promote the absorption of the opacity.

Keratitis punctata is characterized by the presence of small dots of opacity on the posterior elastic lamina of the cornea. They are generally arranged in the form of a triangle, having its apex at the center, and its base toward the lower margin of the cornea. This condition is generally secondary to some form of inflammation of iris. It is frequently seen in sympathetic ophthalmitis.

Arcus senilis is caused by fatty degeneration of the corneal tissue just within its margin.

Pannus is the result of friction from a granular condition of the upper lid, trichiasis, etc. It is characterized by haziness of the cornea, with vascularity, the vessels being continuous with those of the conjunctiva, and the anterior layers of the cornea more or less infiltrated with plastic matter.

Treatment.—1. Try to cure the granular lids. 2. The operation of syndectomy or peritomy—that is, the removal of a zone of conjunctival and subconjunctival tissue from around the cornea—is strongly recommended by Mr. Critchett in old intractable cases of pannus. 3. Very severe and universal pannus is best treated by inoculation with pus from

purulent ophthalmia, or even from gonorrheal discharge. It is a severe remedy, and may be followed by sloughing of cornea. It should never be resorted to if there is any portion of the cornea transparent.

Conical cornea is caused by a bulging forward of the central part of the cornea forming a blunt conical curve, which gives rise to irregular astigmatism and myopia. In advanced cases the protrusion of the cornea is very evident, and the apex of the cone may become nebulous. In some cases vision may be improved by concave glasses in combination with a screen having a narrow slit or small hole in it. In advanced cases operation is needed: (1) Graefe's. Shave off apex without entering anterior chamber, then apply mitigated nitrate of silver stick to the raw surface to cause ulceration and cicatrization. (2) Cut off apex with a cataract knife, enter anterior chamber, leave wound to unite by itself or use sutures; use atropine drops.

Wounds of cornea.—When penetrating, if iris is prolapsed push it back with a blunt instrument, and order atropine drops; if iris not protruding, order atropine drops. If only abraded, still order atropine drops. Close the eye with a bandage to prevent friction.

HENRY JULER.

Symptomatic Indications.—In keratitis from cold or mechanical irritation, with acute inflammation, stinging pains, the remedy is *aconite*. Intense congestion, with throbbing pain, or neuralgic pains which appear and disappear suddenly, requires *belladonna*. When ulceration threatens, with burning pain and restlessness; burning profuse, acrid lachrymation *arsenicum* is the remedy. Simple diffuse keratitis, stinging burning pain and œdematous swelling; staphyloma yields to *apis mel*. Syphilitic keratitis; keratitis with pannus; swollen and inflamed cervical glands require *aurum mel*. Suppurative keratitis; abscess of cornea, scrofulous diathesis, indicates *calcium sulphide*, which limits and controls suppuration. *Mercurius solubilis* is useful in interstitial keratitis, and in syphilitic keratitis; with chalk-white appearance of the cornea; intense photophobia, and acrid, corrosive lachrymation. *Mercurius cyan.* in trachoma with pannus; intense pain in eyeball and about the eye.

COUGH.—A cough is a violent and sudden expiration, whereby the closed glottis is forced open and any accumulated mucus in the larynx or trachea is expelled. A cough is generally a symptom of some affection of the lungs or respiratory tract, but it is also very often due to some morbid condition of the throat—*e. g.*, enlarged tonsils, elongated uvula, or granular pharyngitis—and in a considerable number of cases it is of purely reflex origin, and depends on gastric irritation, disease of the ear, or other distant lesion. The *treatment* of cough is given under its various causes.

Symptomatic Indications.—The principal remedy in the treatment of loose cough is *antimonium tartaricum*, no remedy having a wider range of action, the cough being loose, without expectoration, the chest seeming full of phlegm but none comes up, or the cough is moist, with profuse easy expectoration. It is also useful in rattling or hollow cough, worse at night, with suffocative spells; sweat breaks out at every coughing spell; nausea and vomiting of large quantities of mucus. Next in value to antimonium tart. in range of power is *phosphorus*, which covers both the dry, tickling coughs excited by reading aloud, talking, laughing, or by draughts of air, and the moist coughs of bronchial and lung disease. Short and dry coughs, of recent origin, from exposure to dry, cold west winds, yield to *aconite*. The respiration is impeded, the lungs feeling as if they would not expand. Aconite is especially useful in the dry coughs of children, when every expiration ends with a hoarse, hacking cough, or the child gasps at the throat with every coughing fit. *Belladonna* is useful for dry, spasmodic cough, with constant tickling in the throat, causing an irresistible desire to cough. The cough of *bryonia* is dry from tickling under the sternum, stitches in the chest, when coughing or breathing deep. Bryonia is especially a loosening remedy, changing a dry to a moist cough. A dry, spasmodic, wheezing cough, with rattling breathing, hoarseness, aphonia, croupy symptoms, is relieved by *bromine*. *Gelsemium* is valuable for convulsive and spasmodic coughs, of reflex origin, with excessive irritability of the respiratory centers: also in severe, dry cough of children. Suffocative coughs, with much

rattling of mucus in the bronchial tubes when breathing, which resist antimonium tart. will generally yield to *ipëcacuanha*. Children almost suffocate when coughing, and become purple in the face. It is also useful in obstinate winter coughs, with wheezing, nausea and vomiting. Moist cough, with expectoration of thick, bluish, lumpy mucus, or of tough, viscid mucus which can be drawn out in long strings, is relieved by *kali bichromicum*. Dry, spasmodic cough, especially at night, when lying down, better when sitting up, is relieved by *hyoscyamus*. Croupy cough; loose rattling of phlegm in the windpipe; cannot bear to be uncovered, as the least exposure to cold air excites the cough, by *calcium sulphide*; this remedy is also useful in chronic moist cough, due to organic disease. Dry cough at night, going off when sitting up in bed, indicates *pulsatilla*; the cough is loose in the morning, with yellowish or greenish expectoration, easily raised; sometimes attended with vomiting; dry, without expectoration at night. Chronic bronchial or laryngeal dry coughs with diarrhea, are frequently relieved by *sanguinaria*. Dry, spasmodic cough, from continual tickling sensation, by *lobelia*.

COUNTER-IRRITATION is a method of overcoming pain, inflammation, or other change in a part or organ by an effect produced on the skin in the immediate neighborhood or at a distance.

There are three stages or forms of counter-irritation. In the mildest form, rubefaction is produced; in the next, vesication; and in the most severe, pustulation, or local destruction of tissue. Mustard is the best rubefacient. As a vesicant, nothing answers so well as the liquor epispasticus. A liniment of croton oil or antimony may be used to produce pustulation. By the use of the actual cautery, setons, and issues, still more severe and protracted changes are produced.

COUP DE SOLEIL.—See SUN-STROKE.

COWPOX.—*Definition.*—An acute infectious vesicular disease of the cow, communicable to man, which has the effect of protecting from attacks of small-pox.

Symptoms.—If a puncture be made in the skin of a person who has not previously

been vaccinated, with a lancet, and the vaccine matter be inserted with care, after two days, during which nothing appreciable occurs, a papular elevation is produced. On the fifth or sixth day this becomes a pearl-colored vesicle of a round or oval form, depressed in the center and with its edges raised. On the eighth day the vesicle is more distended, but the depression in the center still remains. On the seventh or eighth day a red ring is formed round the vesicle, which may be two or three inches in diameter. The redness fades on pressure, but the area is harder and more tender than the surrounding skin. About the tenth day the redness begins to disappear, and the lymph in the vesicle is seen to become thick and purulent, while the umbilication is less marked. At the end of a fortnight a scab forms, which remains adherent till about the end of the third week, when it falls off, leaving in its place a somewhat circular depression slightly pitted. These pits correspond with the cells of the vesicles. The cicatrix contracts somewhat, but otherwise, as a rule, remains for life.

Two or three days after the operation considerable itching of the part is experienced, and about the seventh or eighth day there is usually, especially in young children, some amount of constitutional disturbance, such as shivering, loss of appetite, and general *malaise*. At this period the temperature is somewhat slightly increased; sometimes also the axillary glands become enlarged.

Although this is the course of by far the majority of the cases of vaccination, some are from time to time found, which do not run through quite the same symptoms as described above. Thus, occasionally a rose rash (*roseola vaccinia*) makes its appearance between the third and eighteenth day after inoculation, commencing most often in the neighborhood of the irritation and extending over other parts of the body. This rash consists of very slightly raised spots of a red color, varying in size from a quarter of an inch to three or four inches in diameter. It lasts but a day or two, and is not followed by desquamation or deposit of pigment.

In *Variola vaccinia herpetica* a crop of vesicles appears on the third day after the operation, and is preceded by an attack of shivering. They soon burst; the fluid

which escapes irritates the adjoining skin, and an eczematous condition of the part is produced, the skin becoming hard and œdematous. Intense itching accompanies this outbreak, and the axillary glands often become enlarged.

In *Variola vaccinia bullosa* a bulla of various size, with a red edge, takes the place of the ordinary vesicle. It contains a clear liquid, which soon escapes, leaving a crust, which is shed without producing a scar, unless ulceration takes place, when the cicatrix is of considerable size.

In *Variola vaccinia furunculosa* red tubercles are found, which subsequently suppurate.

Occasionally erysipelas appears about the seventh to the tenth day round the vesicle, and spreads over the arm. It does not differ from ordinary erysipelas, and is accompanied by œdema, pain, and considerable constitutional disturbance. In some case the pustules, instead of drying up and forming scabs, burst, and ulceration takes place. The ulcers are attended by itching, pain, and constitutional disturbance. This condition rarely results from lymph which has passed through the human subject, but occurs more frequently after inoculation direct from the cow.

But one other variety has to be described—that in which perfect vesicles are never developed, but scabbing occurs after a little fluid has been formed. It may be well also to mention that revaccination produces vesicles the typical characters of which are less marked, appearing earlier and running a more rapid course than in primary vaccination.

Vaccino-syphilis will be noticed under SYPHILIS.

Prognosis.—A favorable result always follows vaccination, except in the rare case when erysipelas occurs among young children.

Treatment.—Vaccination requires but little treatment. The vesicles should be carefully protected from injury, and oil should be applied to allay the itching. On the eighth day, if the vesicles be much distended, a few punctures into them are useful to relieve tension. If there should be any tendency to retention of pus or ulceration beneath the scabs, they should be removed by a poultice, and the wound treated according to the rules for ulcers. If the erythema be great, or if erysipelas occur, the arm should be kept

in a sling and lotio plumbi applied to the part.

Finally, it should be borne in mind that lymph should never be taken, for the purpose of vaccination, from any but a perfect vesicle, with a proper areola, in the person of a healthy child vaccinated for the first time.

MALCOLM MORRIS.

CONDYLOMATA.—*Causes*.—Mostly syphilis, gonorrhea, and dirt.

Pathology.—Papilliform, but sarcomatous or made of soft connective tissue in structure; non-recurrent; infectious.

Seat.—About anus, foreskin, prepuce, and mucous membrane of mouth.

Treatment.—Touch with argent. nit.; zinc oxide, calomel, copper sulphate; cleanliness, dryness; wear prepuce back.

CRAMP.—A painful tonic spasm, especially liable to attack the muscles of the calf, occurring more often during the night than the day. It seldom lasts very long, but the pain is agonizing. Putting the extensor muscles into action, or grasping the thigh firmly, is the best means of relieving it. Some cause of irritation affecting the stomach or intestines will occasionally be found. It is met with in the subjects of chronic nephritis, and is also often an indication of a neurotic tendency. Not infrequently it is the forerunner of epilepsy.

Symptomatic Indications.—*Chamomilla* or *cuprum*.

CRANIOTABES.—An atrophy of the cranial bones occurring in infancy. The term is not, however, applied to a uniform thinning of any cranial bone. Shallow conical pits are seen at the necropsy, the wide part of the cone being on the inner surface. The pit is not smooth on the inside, but granular, and on the outer surface and around the margin may be seen a worm-eaten appearance, due to the presence of more or less osteophytic overgrowth. Possibly the bone is primarily the seat of a rarefying osteitis, and the softened bone atrophies from within from the combined effect of the weight of the brain and the counter-pressure or resistance of the pillow on which the child rolls its head. The seat of election of craniotabetic pits is the posterior inferior region of the parietal bone, but the superior part of the

occipital bone, the temporal bones, the upper surface of the orbital plates of the frontal, and very rarely the upper parts of the frontals and parietals, may be affected. During life careful palpation and pressure may be needed to discover the wasted spots, as the pitting starts from within, and until it has nearly reached the external lamina pressure cannot indent the bone, and the so-called "parchment-crackling," is not obtained. The number of atrophic areas varies much in different cases. Mere marasmus is held not to cause this affection, but the writer cannot assent to this view; it is probable that rickets and syphilis are causative, but the relative influence of each factor must always be difficult to estimate. Frontal bossing is often more evident in those cases in which rachitic changes are present in the other parts of the skeleton, and when there are rachitic nervous symptoms. Craniotabetic spots are often associated with the soft vascular stage of Parrot's bosses—an argument in favor of the pathology (of the pits) above given. Some observers, however, hold that there is a mere chemico-physical change in the bone, not a recognizable rarefying osteitis. Craniotabetic pits may be due to a premature formation of the markings of the convolutions on the inner face of the calvaria; they certainly almost invariably occupy the early formed convolution-impressions. The atrophic areas are seldom present at birth, but are common during the first months of life; they are less often seen after the tenth month, and are still more rare after sixteen months. That they are in some way associated with the rapid growth and development of the brain appears certain. Craniotabes is a purely physical condition, entailing, as a rule, no risk to life, and causing no symptoms. Signs of rickets may be detected, and also those of syphilis; sometimes one, sometimes the other, disease preponderates.

ANGEL MONEY.

CRETINISM, ENDEMIC.—Endemic cretinism is met with in various parts of the world, but is most common in the valleys of Switzerland, Savoy, Piedmont, and the Tyrol; it does not occur in Great Britain. The prominent features are a varying degree of idiocy, with arrested development, the subjects of the disease seldom reaching 5 feet

in height. In a considerable proportion of the cases there is an enlargement of the thyroid gland. In places where cretinism is endemic, goiter is also endemic, and to a much greater degree; and it has been observed that when a family migrates to such a neighborhood, some members of it will speedily become goitrous, but no cretins will appear among them for two or three generations. Children may become cretinoid if taken to live in one of these districts during the early period of development. The only constant factor known about these districts is that the soil is damp, and that it contains a large amount of magnesian limestone. Certain changes at the base of the skull, especially the premature ossification of the bones entering into its formation, have been regarded by Virchow as the cause of cretinism, but it would seem more probable that both these and the goiter own some further cause, and that, in some way not yet understood, the nature of the soil plays an important part in the causation of the disease. Removal to a more healthy district is the only measure available; it will at any rate prevent the children subsequently born from being cretins.

CRETINISM, SPORADIC.—A congenital deficiency of intellect occurring with stunted development and other peculiarities.

Sporadic cretins may be easily recognized by their low stature—they are seldom more than 3 feet high, often less; by their large, flat-topped heads, pale, earthy complexions, and spade-like hands and feet. The hair is coarse, dry, and scanty, the skin rough and scurfy; the hands, feet, and eyelids are often puffy, and the extremities cold. The bridge of the nose is generally depressed, the mouth large, with thick lips and a large semi-protruding tongue. As a rule, the isthmus of the thyroid appears to be wanting, and the rings of the trachea can easily be felt. Very often soft pads, consisting of fat, can be perceived in the superclavicular spaces on either side. Development proceeds slowly: the anterior fontanelle may not be closed until the fifth year, or even later; dentition is delayed, and the teeth are apt to decay early; the long bones are stumpy and enlarged at their ends, and the hands and feet peculiarly square, with short

fingers and toes; puberty is delayed. Cretins change very little as they grow older, and it is almost impossible to form even a guess at their age. The intelligence is very imperfect; it is seldom that they can even speak. As a rule they are good-tempered. Certain changes at the base of the skull have been found, but not the premature synostosis regarded by Virchow as the cause of endemic cretinism. The thyroid has been found to be absent on post-mortem examination. The analogy between this condition and myxœdema is most striking; the two diseases would appear to differ only in that one is congenital and the other a disease of adult life. Sporadic cretinism has no relation with goiter, and is not hereditary. Cases have occurred where the mother has borne many children previously, and where she has borne few. Intoxication of the parents at the time of coitus has been suggested as a possible cause. It is equally common in the two sexes. The *treatment* would be the same as for other forms of idiocy in children.

CRISIS.—Febrile affections which end abruptly are said to terminate by crisis. The best example is acute pneumonia, in which disease the temperature, in uncomplicated cases, usually falls suddenly on or about the seventh day. Diseases which commence suddenly have a tendency to end in a similar manner, while those in which the onset is gradual rarely terminate by crisis; the temperature chart in typhoid fever, for instance, hardly ever shows a well-marked "crisis." The belief that a critical evacuation may carry off fever is no longer entertained.

CROUP.—Croup is a non-infectious inflammation of the mucous membrane of the trachea, occurring in children, differing from other inflammations in like tissue in the presence of plastic exudation of a fibrino-albuminous material, which rapidly coagulates upon the mucous membrane of the epiglottis, glottis, larynx, or trachea, and sometimes over all of these points; indicated by accelerated, difficult, wheezing, or shrill respiration; short, dry, constant, barking cough; voice altered by hoarseness, with spasm of the interior laryngeal muscles, and pain and constriction above the sternum, frequently followed, toward the

close of the disease, by expectoration of a membranous albuminous substance, or even of a cylindrical cast of some portion of the breathing tube. The disease occurs in children, and may terminate fatally either in suffocation or exhaustion of the vital powers. Thus the most remarkable pathological phenomena of croup are to be observed in the exudative process which attends the inflammation in the windpipe, and the formation of a false membrane, almost peculiar to children, but sometimes seen in adults. The disease derives its importance from the tendency of the inflammation to attach itself to the opening of the glottis. In childhood the trachea is the chief seat of the inflammation; and when the larynx and the fauces are involved, they are so secondarily, and to a less degree. The croupous exudation rapidly coagulates when it is thrown out upon the free surface of a mucous membrane, involving in its lesion the epithelium only, so that when the croup-membrane is detached, the epithelium is reproduced. No loss of substance occurs in the mucous membrane itself and no scar remains after the membrane is removed or disappears. On the other hand, the diphtheritic process is characterized by the production of a similar fibrino-albuminous and rapidly coagulable exudation; but differs from croup in the exudation forming not merely upon the surface of the mucous membrane, but within its substance. It infiltrates the mucous and submucous tissue, and this interstitial exudation, as well as the swollen elements of tissue, exerts a pressure upon the blood vessels which results in sloughing (diphtheritic) of a portion of the inflamed mucous membrane. A diphtheritic eschar is the result, and on its separation there is a loss of substance and a consequent cicatrix. Every now and then discussions arise as to whether or not croup exists as distinct from diphtheria; and the essential qualities of the two diseases are often in dispute. Anyone who has seen much of croup in children can have no difficulty in recognizing it as a disease very different from diphtheria in its attack, its course, and its results. A transition from croup to diphtheria is, however, not unfrequent when the malady forms part of, or occurs during the course of such acute infectious diseases as measles, smallpox, typhus, scarlet-fever, or during an epidemic of diphtheria.

Croup may be ushered in by sore throat, catarrhal symptoms, or a short dry cough, and may occur without the general health being sensibly impaired. The attack commonly takes place during the night; the sleep of the child, which was perhaps more or less agitated, being interrupted by fits of hoarse coughing. These become more frequent, the respiration more difficult, and marked by a peculiar wheezing, which has been described as like the sound of an inspiration forcibly made with a piece of muslin before the mouth, or like the sound of air passing through a brazen tube. The little patient also feels a sense of restriction about the throat, as shown by carrying the hand often to it, grasping the larynx, or passing its fingers into its mouth, as if to pull away something which obstructs the passage.

By the end of the second or third day, sometimes sooner, the tongue becomes white, the heat of the body increased, the pulse frequent, the face flushed, and the countenance distressed. From this point the disease now rapidly advances, and the croupy sound, comparable to the noise which a fowl makes when caught in the hand, attains its height.

Diagnosis is generally between croup and the different forms of sore throat, as scarlet fever, measles, diphtheria, bronchitis, chronic laryngeal and tracheal inflammation, and whooping-cough; and the differential symptoms of each of these from croup must be studied by comparing the definitions, symptoms, and course of each of these diseases, as well as scarlet fever, measles, diphtheria, and whooping-cough. In diphtheria there is a specific fever, and the lesion spreads from above downward, or may commence in the larynx. In croup the lesion commences in the trachea, and spreads upward. Acute laryngitis is a disease of adult life, and croup is a disease of childhood.

Treatment.—Every case of croup demands the most active, efficient, and energetic treatment. When the exudation extends to the larynx, the course of the disease in children is so rapid and so fatal that the measures for its suppression must be early. Bleeding, and especially local bleeding, should be employed, and in most cases to a considerable extent. Two to twelve leeches, according to the age of the patient, should be applied over

the larynx, and the bleeding should be encouraged by the applications of a linseed poultice to the throat. As soon as some relief is obtained, a blister should be applied along the lateral aspect of the neck on each side, and not over the trachea. Emetics effect large evacuations, and favor the resolution of the inflammation; while the effort of vomiting may be the means of detaching and of expelling the false membrane, should it have formed. If relief does not ensue on the action of the emetic, two, three, or four grains of calomel, with two or three grains of James' powder, are to be given every two or three hours; and a dose of castor oil occasionally, till the full effect of the calomel as a purgative is obtained. Green fecal stools, like chopped spinach, are characteristic results of these medicines. Expectorant medicines, ipecacuanha and seneca, should be given with the mercurials, and to be continued after them. Five-grain doses of iodide of potassium every two hours and of chlorate of potassa, have been used with benefit; and the use of a vapor bath from 75° to 80° Fahr. is not to be neglected.

The medical treatment of croup is so frequently unsuccessful that tracheotomy is called for as the means of prolonging life, and as affording an additional chance of the patient's recovery. The evidence also is daily accumulating which shows that tracheotomy, as a remedy for croup, ought to be resorted to much oftener than it has hitherto been, and that at a much earlier period in the disease—not as a last resource when death from asphyxia appears imminent, and after treatment of the most depressing kind. In country districts, indeed, the performance of tracheotomy in a case of croup is almost imperatively called for in the majority of cases, if some symptoms of amelioration do not follow the steady use of bleeding, emetics, the warm bath, and calomel purgation, pursued for twelve or sixteen hours.

WILLIAM AITKEN.

Symptomatic Indications.—*Aconite* is the principal remedy, particularly in the first stage, with predominant febrile symptoms, the child is hot, restless, and cries, when attempting to swallow, from soreness and pain in the throat, hard breathing during expiration but not during inspiration. *Antimonium tart.* is also use-

ful in early stage; the child has bluish, cold face, covered with cold perspiration, the chest expands with great difficulty. Also in advanced stages; threatened paralysis of the pneumogastric nerve, rattling in the trachea and chest as if they were full of mucus, but none is expectorated. *Iodine* is valuable in membranous croup, after the acute stage, the voice is deep, rough, and hoarse; the cough, dry, short, and hacking, with great difficulty of breathing. Soreness and pain in throat and chest, the child grasps at the parts with the hands. *Kali bichrom.* is also valuable in true membranous croup; the disease commences gradually, with slight dyspnœa, and hoarse, croupy cough; as it progresses, the dyspnœa increases; the air, passing through the trachea, sounds as though it were passing through a metallic tube. Violent wheezing and rattling in the trachea, audible at a distance. *Bromine* for great oppression and difficulty of breathing; the child gasps for air. Spasm of the larynx, causing suffocation. Dry, hoarse, spasmodic cough, with wheezing, rattling respiration, impeding speech. *Spongia* is more valuable in non-membranous croup, with slow, loud, wheezing, and sawing respiration, or suffocative fits, with inability to breathe except with head bent backward. Rough, crowing, barking cough; stridulous respiratory sounds during inspiration. *Spongia* follows well after *aconite*; *calcium sulphide* after *spongia*. Loose, rattling, choking cough; the air passages seem clogged with mucus. Violent fits of coughing, as if the child would choke or vomit; the child cannot bear to be uncovered, and coughs when any part of the body gets cold. Great drowsiness and profuse sweat. *Sanguinaria* prevents extension, recurrence, and predisposition; is also valuable for sequelæ.

CROUP, SPASMODIC.—See LARYNGISMUS STRIDULUS.

CUPPING is a mode of drawing blood to the skin with a view to relieve internal inflammation or congestion. A cupping glass is a small bell-shaped glass capable of holding 3 or 4 ounces; the air in this having been rarefied by heat (preferably by setting alight a drop of methylated spirit placed in it), the glass is applied to the skin, taking care to avoid a bony prominence. As the glass cools, the skin

will be forcibly drawn into it, and will at the same time become congested. The cup should be left on for a time varying from ten minutes to half an hour, according to the object desired, and then removed; this constitutes *dry cupping*. In *wet cupping*, previous to the application of the cup, the skin is cut in about a dozen places by means of a specially devised instrument with that number of little blades, arranged in two parallel rows close together, and constructed so as to cut to any depth that may be considered best. The cupping glass, when warmed as before and applied over this area, rapidly becomes filled with blood, and in this way several ounces of blood can be speedily abstracted. The number of cups to be applied in either form of cupping will depend upon the nature of the case.

Dry cupping is chiefly employed in inflammatory affections of the bronchi, lungs, or kidneys. The applications of wet cupping will be found under VENESECTION.

CUT-THROAT.—Usually suicidal.

Position.—Generally opposite larynx, which it of course opens, unless the wound be superficial.

Dangers.—(A, immediate) 1, hemorrhage; 2, suffocation by blood clot; 3, suffocation by a displaced solid structure; 4, entrance of air into a divided vein. (B, secondary) 1, exhaustion; 2, erysipelas; 3, abscess; 4, some form of blood-poisoning; 5, bronchitis or pneumonia; 6, secondary hemorrhage, especially such as might be provoked by the patient tearing the wound open afresh. (C, remote) 1, cicatricial stenosis; 2, fistula.

Prognosis.—When a large vessel is wounded, death is usually almost immediate. In other cases the prognosis would be hopeful, but for the unfavorable state of body and mind usually coexisting in suicides.

Treatment.—1, Arrest hemorrhage; tie bleeding vessels; 2, extract clots from air-passages; 3, if the injured parts cannot be brought into apposition without sutures, and if these sutures will not interfere at all with drainage, use them. In most cases sutures are not necessary; place a bandage round the head and another round the chest, and connect these in such a manner as to hold the chin down toward the chest; 4, in cases where the injury is such as to seriously

obstruct breathing through larynx, perform tracheotomy; 5, dress the wound with a mass of antiseptic gauze (of course, this is not meant to keep the wound aseptic); 6, the patient must be diligently fed, and if, from wound of the esophagus or damage to the larynx, swallowing is impossible or difficult, a tube must be passed down the gullet and food passed through it. Be sure not to pass this tube into the trachea by mistake, a blunder easily made; 7, see that the nursing is diligent, energetic, and vigilant.

C. B. KEETLEY.

CYNANCHE MALIGNA. — See DIPHTHERIA.

CYNANCHE PAROTIDEA. — See MUMPS.

CYANOSIS is the blue livid tint which the skin presents in certain diseases. It is due to the presence in the capillary vessels of insufficiently oxygenated blood, but never to the admixture of arterial and venous blood. It is met with in cases of congenital malformation of the heart, in long-standing heart or lung disease, in suffocation, and locally when an important vein is obstructed or compressed.

CYSTITIS.—See BLADDER, DISEASES OF.

CYSTOCELE is the descent of the bladder, pushing before it the anterior vaginal wall through the vulval orifice. It is usually the first stage of uterine proidentia; for the ordinary course of that affection is that the descending anterior vaginal wall drags after it the uterus, and the uterus the posterior vaginal wall. The anterior vaginal wall descends first, because it is the least supported part of the pelvic floor,

The *causes* of cystocele are allied to those of displacements in general: viz., deficiency of muscular tone, which is generally a result of lowered nervous energy, and overstrain of muscular and fibrous structures, leading to their stretching or rupture. Such a condition of the muscular and fibrous structures of the pelvis is a frequent result of parturition, and the nervous and muscular tone is often lowered by the mental, emotional, and physical strain of lactation

and the care of young children. Hence cystocele is, in the majority of cases, a sequela of child-bearing. Cystocele, however, occasionally occurs in women who have not borne children. It is most often met with among those whose employment involves physical strain, and comparatively seldom in the well-to-do.

The *symptoms* are a feeling of weight, "bearing-down," and aching in the back, lower abdomen, and thighs. The call to micturate occurs with undue frequency. The patient can feel a protrusion between the labia and, if it be large, she may find that she cannot empty the bladder until she has pressed this up. All the symptoms disappear when the patient is recumbent, and are aggravated by violent or prolonged exertion.

Diagnosis.—A swelling covered by mucous membrane can be seen presenting at the vulva and separating the labia. On vaginal examination this is found to be the anterior vaginal wall. A much curved sound, passed into the urethra with its concavity backward, is felt to pass into this swelling.

Treatment.—If the symptoms be very slight, they may be relieved by medicines which restore depressed nervous tone, such as quinine and strychnine. If these fail, local treatment will be needed. If the vaginal orifice be not much dilated, a vaginal pessary will afford relief. The best for this purpose is Hewitt's "cradle" pessary. The patient can be taught to take it out and replace it herself. A ring of watch-spring covered with india-rubber, or one of the varieties of Hodge's pessary, is also useful. These instruments the patient can remove, but cannot replace, because she cannot, except by accident, get its posterior arch behind the cervix. If one of these pessaries be used, it should be removed, the parts examined, and the pessary cleaned and replaced at least once in three months. While wearing it the patient should syringe the vagina with warm water night and morning; otherwise, especially if an india-rubber instrument be used, an offensive discharge may result. If the vaginal orifice be much dilated, no vaginal pessary will be retained. The choice then lies between a pessary supported by bands attached to a waist-belt—one of the many forms of cup and stem pessary—and an operation to contract the vagina. Such an operation

should only be done in patients who have ceased bearing children. In some cases it will, without further treatment, remove the symptoms, but this only happens in the minority of cases. In most, however, perfect the result seem to be a few weeks after the operation, the downward pressure of the anterior vaginal wall again dilates the artificially narrowed vaginal orifice, and the old state of things is reproduced. But the narrowing of the vaginal orifice will enable the patient to wear a vaginal pessary and so do without the waist-belt and straps. A properly adjusted vaginal pessary does not itself press into the vaginal orifice, and will prevent the anterior vaginal wall from doing so. More than this cannot be promised with certainty as the result of operation.

G. E. HERMAN.

CYSTS, OVARIAN.—See ABDOMINAL TUMORS.

DEATH, MODES OF.—Failure of the heart or of the respiratory mechanism is always the ultimate cause of death, although in many cases the brain, pons, or medulla is the part primarily affected, the respiratory or cardiac center being subsequently paralyzed, death then occurring from *coma*. When the failure of vital power is very gradual it may not be possible to determine whether death commenced at the heart or lungs; for example, in cancer affecting the alimentary canal, in cases of persistent diarrhea or vomiting, and in other wasting disorders. Death occurring in this manner is said to be due to *asthenia*. But in the majority of instances it can be readily determined whether death commenced at the heart or lungs, the former being the more common. *Syncope* is the term used to denote death from cardiac failure. It may be absolutely sudden, occurring either in ventricular systole or diastole, and due either to spasm or paralysis of the heart; in the one case the cavities are found empty; in the other, full of blood. Disease of the heart, such as fatty or fibroid degeneration, or of the coronary arteries, valves, or aorta, are the chief causes of sudden death under this head. In this group may also be included sudden death from violent mental emotion, from drinking cold water when heated, from a sudden blow

in the epigastrium, or severe injury to any part of the body: *i. e.*, from *shock*, however caused. In other cases the heart failure is more gradual, and is shown by faintness, giddiness, nausea, pallor, coldness, sweating, and dimness of sight; the pulse becomes rapid, feeble, and is finally extinguished, insensibility supervenes, and the heart's action ceases; the cavities of the heart will be found relaxed and more or less full of blood. Another form is death from loss of blood, as betrayed by extreme pallor, fainting, and delirium. After death the heart will be found contracted. In death from *collapse*, the heart sounds become feeble, the features sunken, but there are no subjective symptoms and no loss of consciousness; eventually, death is sudden. Death commencing at the lungs is from *asphyxia*. It may be sudden, owing to paralysis of the respiratory center in the medulla, as in the case of certain brain diseases, especially those involving the base of the brain; or from the effect of certain poisons on the medulla, or from plugging of a branch of the pulmonary artery. The respiratory center may be gradually paralyzed in various ways by occlusion of the trachea or larynx, or from deficiency of oxygen in the respired air. In all cases of asphyxia the lungs and right side of the heart will be found engorged and the left side empty.

JOHN ABERCROMBIE.

DELIRIUM TREMENS.—See ALCOHOLISM.

DELUSION.—Delusions are false beliefs which affect the actions and manner of life, which appear incredible to persons in the same condition of life as the person who expresses them, which are not recognized on an appeal to reason, and which are the result of an abnormal condition of the brain. They must be distinguished from hallucinations, which are sensations in the absence of external stimuli, and illusions, which are false perceptions of actual objects. Delusions may be systematized or unsystematized. The former are of serious prognostic import, and are best seen in cases of chronic insanity. Three chief varieties may be mentioned: (1) of imaginary greatness, (2) of secret agencies and persecution, (3) of suspicion. Systematized delusions are compatible *inter se*,

generally incompatible with the laws of nature, and nearly always originate in sense-perversions. Unsystematized delusions, such as the fleeting delusions of general paralysis or mania *a potu*, occur in most cases of insanity, are of every conceivable variety, have little relation *inter se*, are generally perversions of possible or even actual facts, frequently do not depend upon disorders of the senses, and are the external expression of abnormal brain action or mere mental confusion.

G. T. REVINGTON.

DEMENTIA.—This term is used to designate acquired mental weakness, as distinguished from amentia or congenital weak-mindedness.

Symptoms.—The prominent characteristics of dementia are loss of reasoning power and of the faculties of attention and origination, weakening of the powers of observation, imagination, memory, and volition, scantiness of the association of ideas, feebleness of the emotions, limited reaction to environment, partial loss of self-control, self-respect, and of regard for the decencies of life, and finally loss of the dominant human feelings: affection, hope, and ambition.

The only difficulty of *diagnosis* is the distinction between the temporary form of dementia, or secondary stupor as it is well called, which follows acute attacks, and is curable, and the incurable secondary dementia.

No *prognostic* characteristics can be as yet pointed out; each case must be judged separately, and apparently hopeless cases will occasionally recover, while cases with every favorable symptom end in dementia.

Varieties and Aetiology.—Dementia has been well described as "the goal of all the insanities," and to get a complete grasp of this subject the reader must refer to the articles on the various diseases mentioned below.

The following varieties are usually described: (1) Primary, (2) secondary, (3) senile, (4) organic, (5) alcoholic.

(1) *Primary dementia* is a misnomer, and cases which fall under this head in current literature will here be treated with melancholia and the insanity of stupor.

(2) *Secondary, sequential, or terminal dementia.*—This is the most typical form,

and nearly always occurs after an acute attack, more frequently after mania than melancholia, and is the result of disease attacking a brain which is just attaining its highest development, and occurs, therefore, chiefly in the insanity of adolescence from eighteen to twenty-five years of age. The dementia which results from acute attacks after the age of twenty-five is usually complicated with delusional or maniacal symptoms. The duration of the attack and the intensity of the symptoms have only a slight, if any, influence in determining the occurrence of dementia after the acute attack. Heredity is the great factor, and, the further knowledge advances, the more firmly is the opinion held that original brain constitution determines the progress of disease toward either recovery or dementia, whether that brain constitution be due to obvious heredity, to reversion, or be apparently adventitious. The characteristic features of secondary dementia, in addition to the general symptoms of dementia previously described, are the absence of motor symptoms, such as we find in congenital weak-mindedness or in general paralysis, the excellence of the bodily health as a rule, the capabilities of useful employment and the stationary character of the mental symptoms, which often remain unchanged for twenty or thirty years.

(3) *Senile dementia*.—The insanities of the senile period will be treated separately. Their most striking characteristics are the marked tendency to end in weak-mindedness, the complication of the dementia by maniacal or melancholic symptoms, the marked eroticism, and the filthy habits.

(4) *Organic dementia* differs chiefly from the senile form in the causation, and includes all of weak-mindedness resulting from gross brain lesions, such as apoplexies, softenings, and tumors. Post-apoplectic dementia is the commonest form, and is generally a mild type of weak-mindedness.

(5) *Alcoholic dementia*.—This form presents no special features distinguishing it from other forms of dementia, and is treated under the head of INSANITY, ALCOHOLIC.

Pathology.—The morbid anatomy of dementia should be separated from the morbid anatomy of all chronic insanity. The general brain atrophy, the compensatory thickening of the brain membranes,

and the excess of fluid in the meshes of the pia mater, the cellular degeneration, and the increase of neuroglia are common to all, and are probably more the result of long-continued disuse than the cause of the dementia. It is possible that dementia is the result of a lowering of function—that is to say, of changes as yet unrecognizable by our histological methods.

Treatment.—While secondary dementia will remain the typical form, all insanity tends to end in dementia. Every insanity is, in fact, a potential dementia, and, as been well said, “the cardinal problem of psychiatry is to avert this tendency;” and when we consider that 40 per cent. of all fresh cases of insanity actually end in dementia, and that two-thirds of the total number of the insane are demented, we see what an important problem this is. The term dementia should be limited to the established and incurable forms, and treatment directed to the temporary dementia, better termed the secondary stupor, which supervenes on the cessation of the acute symptoms. The cardinal principles of this treatment should be attention to the bodily health, abundance of food, and employment in the open air, with, in some cases, the use of tonics, the cold shower-bath in summer, the Russian douche, electricity to the head, and possibly massage, and most emphatically the avoidance of narcotics.

G. T. REVINGTON.

Symptomatic Indications.—When the dementia follows acute insanity *helleborus* will often do valuable service, especially when the disease is attended with stupor and indifference. When attended with complete stupidity, the patient sitting silent and indifferent, resort may be had to *calcium sulphide*. Dementia in young persons, from masturbation, will frequently yield to *anacardium* or *phosphoric acid*. Amorous frenzy with intense erethism of the sexual organs to *cantharis*. When associated with melancholia *conium* is a useful remedy.

DEMULCENTS are substances which are administered for their soothing effect on mucous membranes. Their action is probably mechanical. They are white of egg, starch, glycerine, gelatine, gum, honey, linseed tea, linseed, almond and olive oils.

DENGUE.—*Natural History.*—A continued fever, or febricula, characterized by sudden severe frontal headache, and by severe pains in the limbs, small joints, and in the trunk; and sometimes by an eruption resembling that of measles. The disease is more peculiar to the East and West Indies and America; but has been seen in Spain and other European countries. The attack of dengue is sudden—almost to a minute. The patient may go to bed, apparently quite well, and wake up about two or three in the morning with a hot skin—so hot that in a few hours the temperature in the axilla ranges from 99° to 103° Fahr., a pulse varying from 78 to 108, and a countenance indicative of utter helplessness and prostration. The fever is peculiar in the numerous daily remissions and exacerbations. Very often the first symptom is pain in the head, back, limbs, and small joints (which swell), with a feeling of faintness, giddiness, and weariness, so that the desire to lie down is overpowering. From the peculiar affection of the joints, the fever has been described as “arthritic.” There may be a tendency to shiver, and in some epidemics distinct rigors, with hysterical symptoms in women and also in men, and convulsions in children. The average duration of this first febrile stage is about forty-eight hours (extremes, twelve hours to three or four days), when the symptoms begin gradually to subside and a period of remission, of two to three days, occurs. During this period, general debility and muscular pains predominate, but without fever. On the fourth day there is generally a slight return of fever: and on the fifth or sixth day an exanthematous eruption appears, more like erysipelas than the eruption either of measles or scarlet fever. The color, however, is not so intense, and spreads over the whole body in forty-eight hours. The eruption is always most marked on the palms of the hands and soles of the feet; and, beginning on the head and face, passes downward.

When the eruption reaches its maximum, painful swellings of the lymphatic glands of the neck and occiput, axilla and groin, are common, and sometimes also of the testicles. According to Dr. Christie of Zanzibar, the occipital glands invariably swell. With the swelling of lymphatics, the mucous membrane of the mouth, nose, and throat becomes impli-

cated—varying from mere redness to an extensive aphthous eruption, with considerable tumefaction of the lips and nose, conjoined with excessive pain—the mucous membrane becoming raw. The condition of the tongue varies greatly—generally it is coated, and with large papillæ. On the seventh or eighth day desquamation commences, and the acute stage terminates. The victims of dengue are to be commiserated for the horrible and agonizing pains peculiar to the disease; but they are also to be reassured by the fact that the disease is of a non-fatal nature. The recurrence of the excruciating pains in the limbs, at a period long after subsidence of the fever, ought to be in remembrance of any prognosis as to the probable duration of the illness. Swellings of the lymphatic glands of the neck, axilla, and groin, occur in many cases.

Diagnosis.—This disease may be confounded with rheumatism, or scarlet fever, or erysipelas.

Treatment.—Purgation is generally called for at the outset only, and is not to be continued.

Rhubarb, soda, and calumba, or colocynth, or those variously combined, are the most efficient remedies—to be followed by doses of quinine of five to ten grains.

When the febrile symptoms subside, iodide of potassium, in four or five grain doses, has a very beneficial effect.

Belladonna, in the form of tincture, in medium doses, repeated every hour, is of great service in subduing the pain. The effect of this remedy requires to be watched.

WILLIAM AITKIN.

Symptomatic Indications.—In the early stage *aconite* and *bryonia* are the main remedies, with *ipecacuanha* to relieve vomiting and *arsenicum* for the diarrhea. If the disturbance of the stomach prove troublesome *colocynth* or *nux vomica* may be given with good results. Hemorrhagic conditions may require *arsenicum*, *secale*, or *cinchona*. Renal hemorrhage, *cantharides*, *belladonna*, or *arsenicum*.

DENTITION.—Any symptoms of illness occurring in an infant at or a little over six months of age should suggest the possibility of teething being the cause, and applies also to somewhat older infants who have already cut some teeth, but not

all. The troubles to which dentition may give rise are most varied. A febrile condition, fretfulness, disturbed sleep, convulsions, cough, or diarrhea are the most common. A child is apt to present the same symptoms with each tooth. If the gum be swollen, hot, and tender, and of a dark color, it is highly probable that a tooth is causing irritation, and lancing the gum in such a condition will often give relief, but, unless the tooth be nearly through, it is worse than useless to lance the gum, and some authorities are of opinion that the same may be said of the operation under any circumstances.

Symptomatic Indications.—The most generally useful remedy is *gelsemium*, particularly when there are threatened convulsions from nervous irritation. Cerebral irritation with congestion to the head, child is drowsy or comatose with moaning and starting during sleep, points to *belladonna*. *Aconite* is useful when febrile symptoms are present. *Chamomilla* for the diarrhea induced by teething; the child is restless and fretful; is quiet only when being carried. *Calcarea carb.* or *calcarea phos.* is valuable when the cutting is slow and painful, with disturbance of digestion.

DEODORANTS. — See DISINFECTANTION.

DEPLETION is the means whereby engorged blood vessels are relieved of some of their contents. It is of two kinds, either general or local; of the former, venesection and purging are the most efficacious, the production of vomiting or sweating being less useful measures; while blood-letting by means of leeches, cupping, or scarification constitutes the local measures of depletion.

DERMATITIS is a convenient generic term used to designate an ill-defined and extensive group of symptomatic inflammations of the skin characterized clinically by redness, heat, swelling, and pain, terminating in resolution, suppuration, gangrene, or chronic dermatitis. The distinction between dermatitis, erythema, and eczema is a purely arbitrary one, based rather on causal than on clinical or anatomical differences. Thus, in all, the essential process is an erythema, the further progress and development of which depend upon the duration, intensity, and quality of the

exciting causes and the physiological vitality or idiosyncrasy of the individual. The various grades of severity comprise the formation of erythematous patches, papules, vesicles, pustules, bullæ, and the occurrence of hemorrhage and gangrene.

J. J. PRINGLE.

DERMATITIS GANGRÆNOSA (*Sphaceloderma*) may be primary or secondary to other skin diseases. The primary form occurs most frequently in adults as the expression of special constitutional depravity, and is symmetrical in its distribution. The lesions are at first reddish or purplish erythematous spots, usually on the trunk and extremities, which vesicate, rapidly become gangrenous, and slough; they are attended by fever and constitutional disturbance. Spontaneous recovery generally ensues after a more or less prolonged period, each spot leaving a scar, but relapse is frequent. The condition presents many points of affinity with Raynaud's disease, diabetic gangrene, acute bed-sore, and to a form of gangrenous rash which sometimes accompanies acute cerebro-spinal meningitis.

It is closely simulated by the feigned or artificial skin disease produced by hysterical subjects or malingerers. These are situated on the front of the chest, or more easily accessible portion of the limbs, generally on the left side, and are produced by scratching with the nails, the pressure of coins, or the application of caustic substances. They rapidly recover when the patient is carefully watched and the ulcers are protected by simple dressings.

The secondary form is most common in strumous and syphilitic children, and may succeed any antecedent pustular skin disease: *e. g.*, eczema, impetigo, vaccinia, and especially varicella (*V. gangrænosa*). The gangrenous patches may be numerous and extensive, accompanied by very high temperature, and death may rapidly ensue, or a series of minute pustules, each of which sloughs and leaves a scar, may appear in crops, and prolong the disease for an indefinite period. There is considerable presumptive evidence that the condition depends upon the presence of a specific microorganism.

Occasionally the lesions are very trifling, but itching may be a troublesome symp-

tom (*e. g.*, in varicella prurigo of Hutchinson).

In adults a similar ulcerative gangrenous action may affect spots of psoriasis and lichen ruber.

Treatment.—(1) *Constitutional.*—All tonic remedies are indicated, especially quinine and sulpho-carbolates, cod-liver oil being of special value in children. In many cases affecting adults opium proves invaluable.

(2) *Local.*—Any soothing ointments may be applied, the oleates of bismuth and zinc being perhaps the most generally useful. Dilute ammoniated mercury ointment is sometimes efficacious in children.

J. J. PRINGLE.

DERMATITIS PAPILLOMATOSA CAPILLARIA—See ACNE.

DERMATITIS VENENATA is the result of the contact of irritating substances with the skin. The condition is common, as a chronic one, in many trades which necessitate the handling of noxious matters, or even the immersion of the hands and arms—the parts most frequently affected—in water. Grocers, bakers, bricklayers, colormen, flax-spinners, French polishers, potmen, and laundresses may be particularly instanced. A form of dermatitis (tar acne, *acne picealis*), which involves chiefly the extensor surfaces of the limbs is common in fiber-dressers, who work with paraffin, and in persons otherwise brought in contact with preparations or vapors of tar or its congeners (creosote, benzine, oil of cade, impure vaseline), in which the inflammation and blocking of the sebaceous follicles by dark comedones are prominent features. Aniline dyes employed to impart gaudy coloring to cheap flannel underclothing, acids, bichromate of potash, alkalies, and arsenical preparations are all frequent causes of dermatitis. Many substances employed medicinally act in a similar manner: *e. g.*, those used as counter-irritants (croton oil, cantharides, savin, tartar emetic, mezereon, turpentine, mustard); or as caustics (nitrate of silver, chloride of zinc); and occasionally carbolic acid, arnica, chrysarobin, and mercurial ointments. A very severe form of acute general dermatitis is common in America, due to contact with, or even proximity to, different varieties of the botanical genus *Rhus* (poisonous sumach, poison ivy),

the immediate causative agent being an exceedingly volatile acid which they contain.

Treatment must in every case be directed to the cause. Soothing local applications alone are seldom efficacious. Protection of the exposed parts: *e. g.*, by india-rubber gloves—is always advantageous, but to secure permanent recovery it is often necessary for the patient to change his occupation.

J. J. PRINGLE.

DESQUAMATION is the process of shedding the skin seen during recovery from certain ailments. After scarlet fever the skin peels off in layers, and such a peeling in any person is always strongly suggestive of a recent attack of that malady. After measles there is often a branny desquamation.

DIABETES INSIPIDUS.—A disease of which the leading symptoms are great thirst and the excessive secretion of urine free from sugar and of low specific gravity.

Symptoms.—The disease often commences suddenly after the occurrence of some injury or nervous shock. It may, however, be gradual in its onset, and it has been known to be congenital. The first symptom complained of is an excessive secretion of urine, though thirst very quickly ensues.

The urine is passed in large and sometimes in almost incredible quantities; 30, 40, and 50 pints a day are recorded. It is pale, almost colorless, and clear; its specific gravity ranges from that of water to a few points above this. The percentage of solid matters in the urine is greatly lowered, but the daily total excretion is in most cases increased. The urea is usually increased in amount; in some cases the phosphates and in other cases the chlorides have been excreted in excessive proportion, but ordinarily the normal ratio of the different solid matters remains undisturbed, and but very rarely is albumen or any other foreign substance found.

Thirst is intense, and sometimes unquenchable. The tongue and mouth are in nearly all cases dry, but in a few instances an excessive secretion of saliva has been observed. The appetite is, as a rule, not increased, as in the case in diabetes mellitus; but it may in rare instances be voracious. The skin is dry and harsh,

but boils, carbuncles, and pruritus are not observed.

In severe cases the general health is always affected. The patient emaciates greatly, becomes weak and languid, and complains of epigastric and other pains; the nervous system is disturbed, insomnia, irritability of temper, and mental feebleness being symptoms of common occurrence. In other instances, again, the general health remains good, and the patient is only troubled by the thirst and frequency of micturition.

The *course* of the disease is variable. Complete recovery may take place, but does so in a small proportion of cases only. More commonly, a stationary condition is reached, and the patient may then, in the absence of complications, live for years. On the other hand, the disease may gradually cause exhaustion, with failure of the heart and general œdema, and from this, or from the super-vention of phthisis or pneumonia, the patient dies. Some cases, especially those due to traumatism, are very rapid in their progress toward death or recovery; others may last for many years. The occurrence of an acute febrile disorder frequently suspends, or for a time diminishes, the intensity of the affection.

Diagnosis.—The main symptoms are usually so pronounced as to render the diagnosis easy. It is necessary, however, to distinguish the disease from symptomatic and temporary polyuria, such as may follow excessive potations or the exhibition of diuretic drugs, and may also occur in hysteria and in convalescence from acute fevers. In this condition the thirst and emaciation of diabetes insipidus are absent.

Prognosis is in most instances unfavorable. Its immediate gravity depends upon the extent to which the general health is affected, and the presence or absence of complications. The nutrition is least disturbed in those cases which arise after cerebral injuries, mental emotion, and acute febrile attacks, and in those which are congenital or occur in the very young without apparent cause. When phthisis or pneumonia has set in, and when the disorder is secondary to cerebral tumor or meningitis, the prognosis is necessarily grave.

Pathology and morbid anatomy.—The disease shows a special association

with lesions of the nervous system. One case has been recorded of diabetes insipidus associated with malignant disease of the solar plexus.

Unless the disease be a result of a gross lesion of the nervous system, the morbid anatomy of the disorder reveals only lesions which are secondary to the excessive flow of urine and the marasmus. Thus, the kidneys have been found dilated and sacculated; in other cases they were enlarged and congested; and, again, they have contained multiple abscesses. Pneumonic or tubercular lesion of the lungs is frequently found, and may be the determining cause of death.

The proximate cause of the constant diuresis is a persistent dilatation of the blood vessels of the kidneys. This, however, is itself a secondary condition, and is undoubtedly brought about through the vasomotor system of nerves. The disease, therefore, can be caused by a lesion of the vasomotor nerves in any part of their course: in the sympathetic system, in the spinal cord, in their center in the fourth ventricle, or in the higher cerebral mechanism which communicates with the vasomotor center. The relation of gross nervous lesions to the disease is thus easily explained. Where such lesions are absent, we must assume that a functional disorder of the vasomotor system exists, giving rise to the constant renal congestion. Bernard found that puncture of a certain spot in the floor of the fourth ventricle caused a copious secretion of urine which contained neither sugar nor albumen. Fatty degeneration of the nervous tissues in the floor of the fourth ventricle, and tumors in this situation, have occasionally caused the disease.

Ætiology.—Males are more often attacked than females. The disease may be congenital, but the largest number of cases commence between the ages of five and thirty years. A well-marked hereditary tendency to the disorder has been sometimes observed. A syphilitic history has been noted occasionally. Injury, and especially an injury to the head, exposure to cold, drinking cold fluids while heated, and an alcoholic debauch have been the most frequent determining causes of the disease. In a comparatively large proportion of cases the affection has ensued upon an acute febrile attack, while muscular effort and

mental emotion have preceded a certain number of cases.

Treatment.—To limit the potations has no effect upon the disease, but greatly increases the distress of the patient. Valerian in large doses, given either as the powder or as the valerianate of zinc, has been apparently efficacious in some instances. Ergot also is highly spoken of. Nitrate of potash, nitro-muriatic acid, iodide of potassium, strychnine and pilocarpine have all been tried, and occasionally with success. Opium, while diminishing somewhat the thirst and diuresis, greatly aggravates the general discomfort. The constant current applied with one pole over the upper part of the spinal cord and the other over the loins or epigastrium has been used with success in a few cases. Attempts must be made to maintain the general health by tonics and nutritious food. The dryness of the skin can be relieved by warm baths, and the epigastric pain by warm and sedative fomentations.

ROBERT MAGUIRE.

Symptomatic Indications.—*Apocynum cann.* has been successful in some cases where the disease was attended with great debility; with sinking feeling at the pit of the stomach. *Squills* has also been used with success for excessive flow of pale, watery urine. *Jaborandi* lessens the quantity of urine.

DIABETES MELLITUS.—A disease marked by more or less persistent glycosuria, polyuria, thirst, debility, and emaciation, with a tendency to a fatal issue.

Nevertheless, this, the type of diabetes mellitus, is united to simple glycosuria, in which, although sugar is present in the urine, there is no serious or even observable departure from a state of health, by cases in which the patients, though in feeble health, are not conspicuously emaciated, but are distressed, rather than seriously endangered, by a diminished severity of the symptoms characteristic of the more grave disorder. See GLYCOSURIA.

Symptoms.—The onset of the disease is generally insidious. The patient's attention is only after some time directed to his state by experiencing great weakness or thirst, or possibly by frequent calls to urinate. Slowly the diabetic condition becomes more pronounced, the

appetite is voracious, yet emaciation proceeds apace, the thirst is insatiable, the tongue becomes glazed, the skin dry and harsh, and an anxious and suffering appearance is impressed on the countenance. The urine still increases in quantity, its specific gravity rises, and the sugar contained in it is greater in amount. Occasionally the onset of the disease is sudden and its progress rapid, and in rare cases the symptoms may attain to a high degree of severity in a few weeks. Unless the disease be checked, the patient becomes still weaker, the circulation fails, and dropsy of the legs appears; finally, he dies from exhaustion, aided possibly by one of the complications which may arise at any stage.

The *urine* is greatly increased in quantity. The actual amount passed daily may vary from 5 to 6 pints in very mild cases, to as much as 25 to 30 pints when the disease is severe. In the same patient, too, the amount of urine passed is variable. In the earlier stages of the disease the quantity is not greatly increased, and as death approaches the excessive amount previously excreted is diminished. Similarly, too, less urine is passed when appropriate dietary rules are observed, and during an intercurrent febrile attack the total daily amount of urine may not exceed the normal. The quantity of urine is proportionate to the amount of fluid imbibed. Cases are exceptionally met with in which throughout the disease no very excessive amount of urine is passed.

Conditions similar to those just mentioned will also influence the percentage of sugar found in the urine, and during intercurrent febrile attacks the sugar has been observed to disappear completely. The amount of sugar is increased after meals, and markedly after the use of saccharine or amylaceous foods, while it is diminished by fasting. In mild cases, and in the earlier stages of severe cases, the sugar may be caused to disappear by abstention from sugar and starch in the diet; but in the later stages, and in all severe cases, its presence is persistent, though in diminished amount, in spite of a purely animal diet. The quantity of sugar is usually from 2 to 5 per cent., but may reach as high as 12 per cent. The total daily excretion of sugar ranges from 15 to 25 ounces, and it has been known to exceed 1000 grams.

(=2 lbs.). The diabetic sugar gives the reactions of glucose, but levulose and inosite have also been found occasionally in small quantities. The specific gravity of the urine is increased; "it usually fluctuates a few degrees above or below 1040; it may rise to 1055 or 1060, or sink to 1015" (Sir Wm. Roberts).

The other constituents of the urine are increased as to their total daily excretion, though their percentage in the urine is diminished. Urea has been shown to be greatly increased. Uric acid may be deposited in reddish crystals, especially in the earlier stages of the disease. In some cases the phosphates of the urine are greatly in excess, and sugar may or may not be simultaneously present. Yet all the symptoms of diabetes mellitus are found, and it has been proposed to term such cases "phosphatic diabetes." The urine is usually very pale in color when passed in excessive amounts, but of normal color when the quantity is nearer the healthy standard. The spores and filaments of the yeast plant speedily develop in it when it is exposed to the air, and may form a whitish sediment. The reaction is faintly acid. Diabetic urine very often has a sweetish smell, resembling that of ripe apples. This is due to the presence of diacetic ether, which may be a product of β -oxybutyric acid, also found in such urine, and may in turn give rise to the presence of acetone (acetonuria). Diacetic ether causes the so-called ferric chloride reaction of diabetic urine—viz., a purple red coloration when liq. ferri. perchlor. is added to the urine in excess.

Thirst is one of the earliest symptoms of diabetes; in most cases it is excessive, and may be almost unquenchable. The cause of the thirst is probably the presence of sugar in the blood, which needs large supplies of water to maintain it in solution and aid its transmission through the kidneys. The distress of the patient is greatly aggravated by any attempt to limit the quantity of fluid, but the excessive amount of fluid imbibed seems to increase metabolism, and so hastens the wasting of the body. It is to be noted that some patients complain but little of thirst, even though considerable quantities of sugar are passed; but the urine in such cases is seldom greatly increased in quantity.

An inordinate appetite is a frequent

symptom of diabetes, but is more often absent than the sensation of thirst. Not infrequently in the course of the disease total disgust for food, or at least for such food as can be permitted, is experienced. The tongue is dry, red, and glazed, sometimes coated; the gums are prone to swell and bleed easily, and the teeth may become carious and drop out. In the later stages, aphthous stomatitis is common. The saliva has often an acid reaction from the development of lactic acid. Digestive disturbances of various kinds are common, slight vomiting, flatulence, uneasy or even painful sensations at the epigastrium being frequently experienced. The bowels are as a rule confined, but toward the end of the disease obstinate diarrhea may arise, and is to be regarded as a most unfavorable sign.

In the typical form of diabetes mellitus, *emaciation* is very pronounced, and rapid in its progress. All the tissues participate in the marasmus, the fatty constituents of the body being the first to disappear. The wasting persists in spite of the consumption of enormous quantities of food. Although much of the wasting is due to the profound changes in metabolism going on in the body, yet it is markedly controlled by the amount of fluid passing through the system, as indicated by the polyuria. When, under suitable treatment, the amount of urine is diminished until it nearly approaches the normal, the patient may not only cease to emaciate, but may even gain flesh. The pulse and respiration rates are usually normal, and, provided that no complications exist, the body temperature is usually below the normal. The sweet smell (acetone odor), mentioned above as present in the urine, is often perceived in the breath, and may be disagreeably intense. The skin, as a rule, is dry and harsh, but, on the other hand, abundant perspiration may be present throughout the course of the disease. The subcutaneous tissues are not infrequently oedematous. In the later stages of diabetes, the mental faculties fail to a pronounced degree. Not only are the mental processes carried on slowly, but there is great disinclination for mental exertion, and the temper becomes peculiarly irritable. Morally, too, a defect is noticeable, and patients, who in a state of health were notably truthful, will

practice lying and deceit on the smallest provocation. The sexual powers tend to become abolished.

The symptoms described are those of the typical and most usual form of the disease. But cases are frequently met with which, while presenting individual symptoms of diabetes mellitus, do not show the complete picture described above. Thus, it is common to find that patients florid in complexion, and stout or even obese in habit, will pass large quantities of urine containing a considerable amount of sugar, and will complain of thirst. In such cases there may be a tendency to heart failure, and digestive disturbances are usually prominent. Yet no other symptoms of diabetes are observable, and emaciation may never ensue. A history of gout is to be obtained in many such cases, and copious deposits of uric acid may be found in the urine at times. This form of diabetes is prone to occur in the aged or middle-aged rather than in younger persons, who more often manifest the disease in its typical form.

Complications.—The complications of diabetes are numerous. The most frequent and serious are those which affect the lungs. That which is most usually met with is a chronic or subacute caseous pneumonia of tubercular origin. This begins by insidious infiltration of the apex, as is the custom with tubercular affections under other conditions, or may commence with ordinary pneumonic symptoms. It leads very rapidly to breaking down and excavation of the lung. Simple or non-tubercular pneumonia is also met with, and may be croupous or catarrhal in character. As a rule, it is acute in its course, but has been known to be chronic. All these inflammations of the lung in diabetes show a notable tendency to proceed to gangrene. It is a peculiar characteristic, however, of diabetic gangrene of the lungs that the sputum and the breath have rarely the intensely fetid odor which they present when no diabetes is present.

Numerous affections of the skin and underlying tissues are prone to occur in the course of the disease. Of these, boils and carbuncles are the most frequent, and of common occurrence in diabetic patients. Eczema and intolerable itching of the skin may torment the patient. These conditions occur in all parts of the body, but are most marked over the genital organs, and are especially frequent in

patients of the female sex. Indeed, not infrequently the occurrence of pruritus, accompanied or not by an eczematous condition of the labia, is the first symptom of diabetes to attract the notice of the patient. Psoriasis and pemphigus may also be mentioned as rare complications of diabetes. Gangrene of the toes or of even greater portions of the lower extremities is not of uncommon occurrence, and usually resembles in character the dry gangrene found in old persons; its cause is, in most cases, obscure, but an obstruction of the arteries leading to the gangrenous part has been occasionally observed, and is probably due to sclerosis of the vessels.

Albuminuria is a common complication of diabetes, and may be due to a variety of conditions. It may result from a chronic irritation of the kidneys, set up by the passage of saccharine urine through the glands. This leads in time to a sclerotic condition, with overgrowth of fibrous tissue, or to a chronic inflammation and fatty degeneration of these organs. In either case the complication has scarcely any influence upon the course of diabetes, and adds but little to the gravity of the prognosis. The same may be said when albuminuria, as occasionally happens, is the result of high pressure in the renal pelvis and tubes owing to the difficulty experienced in the transmission of the large quantity of urine into a hypertrophied and often distended bladder. But in certain conditions albuminuria is a grave phenomenon. It may be due to heart failure, and it may, again, accompany and even precede the most dangerous complication which can attack the diabetic—the so-called diabetic coma. When due to these causes, albuminuria is frequently the precursor of a fatal termination. Among minor complications which attack the urinary system may be mentioned pyelo-nephritis, cystitis, urethritis, and, in the male, balanitis.

The cardiac failure so often observed in diabetes may be chronic in its progress, and apparently only a part of the general bodily weakness. The pulse becomes slow and feeble, and œdema of the limbs is prone to occur. It may, however, be acute in its onset and extreme in degree, and may give rise to most alarming symptoms, which are sometimes considered as constituting one variety of diabetic coma. Endocarditis has been observed in a few instances. In the digestive system, the

only complication of importance is obstinate diarrhea, which occurs sometimes as a late and often fatal trouble.

Defects of sight, as opacity of the lens or cataract are common. This occurs as a late symptom, and is generally considered an unfavorable indication as to the future duration of the case. It is of rapid course, and quickly affects both eyes. The cataract is generally of the soft variety. It is generally regarded as degenerative in nature, and as an indication of the low state of vitality of the tissues, other evidences of which condition are gangrene of the limbs. Operations for cataract in diabetes are seldom successful. Weakness of vision is also a common complaint among the sufferers from this disease. It is perhaps most frequently the result of a weakness of the muscles of the eyeball, which interferes with accommodation. Such weakness may, in some cases, lead to actual paralysis of one or more muscles, with strabismus and diplopia. Yet true amblyopia is of frequent occurrence, and in rare instances total blindness may ensue. Lesions have been observed, but they are not invariable, which explains the loss of sight, but it must suffice here to merely enumerate them—optic neuritis, retinitis, retinal hemorrhages, retinal atrophy, and cloudiness of the vitreous. Iritis and keratitis sometimes occur.

Recently it has been observed that in many cases of diabetes the knee-jerk is wanting. This is a sign of a severe and late phase of the disease, and its pathology is as yet obscure. It may be due to a peripheral neuritis, or to a generally depressed state of the spinal centers. Neuralgia affecting various nerves is extremely common in diabetic patients. Sciatica is thus a frequent symptom. On the other hand, however, diminution of sensibility is not unusual. Paralysis may affect individual groups of muscles, or may assume the form of hemiplegia.

But the most important and formidable complication which can affect the diabetic patient is **coma**. This is more common in young patients and in a comparatively early stage of the disorder, but those cases in which it appears are invariably severe. Often no exciting cause of this condition can be detected. Excessive muscular exercise, a mental shock, and the sudden assumption of an anti-diabetic diet have appeared to have a causal influence in bringing about the attack. The

symptoms present themselves in different groupings. Most frequently, the patient complains for a little while of headache, epigastric uneasiness, nausea, or even vomiting. Then great restlessness and an anxious appearance are observed, which are soon followed by delirium and gradually deepening coma. A peculiar characteristic of the comatose state is an extreme dyspnœa affecting both phases of respiration, and styled by Kussmaul "air-hunger." There is no cyanosis, and no cause for the dyspnœa is revealed by physical examination of the chest. The muscles may twitch, but true convulsions are of very rare occurrence. The pulse is quick and feeble; the temperature is low. The pupils are usually, but not invariably, dilated. The urine is generally diminished in quantity and contains less sugar immediately before the attack than has been the rule in the preceding stages of the case. Albuminuria is an invariable accompaniment and frequent precursor of the comatose state. The urine presents, in a marked degree, the sweet apple-like odor already described, and also gives the ferric chloride reaction. Moreover, when distilled after acidulation, acetone can be detected in the distillate by its usual tests, preferably by the addition first of liquor potassæ and then of a solution of iodine and iodide of potassium, when a precipitate of iodoform is produced. The breath also has the same odor, and has been shown to yield the same reaction of acetone when similar tests are applied.

In another form of diabetic coma the dyspnœa is not so marked, but there is drowsiness followed by gradually increasing coma. This condition is sometimes called the "apoplectic" form.

In a third class of these cases wild excitement is the more prominent symptom, and the condition may be mistaken for one of acute alcoholism. There may be, as additional sources of fallacy, a staggering gait and incoherence of speech. Soon, however, as in the preceding forms, drowsiness and coma supervene.

There is a fourth class of cases which is erroneously, but yet generally, included among the comatose forms, but is really the result of acute failure of the heart. Suddenly faintness is experienced, the pulse becomes rapid and feeble, pallor of the face and coldness of the skin are observed, and consciousness fails. In these cases the peculiar dyspnœa is wanting.

All these forms of so-called diabetic coma are extremely dangerous to life, and recovery from them is of rare occurrence.

Morbid anatomy.—No lesion has as yet been found in the bodies of diabetic patients which throws any light upon the nature of the disease. The liver has in the earlier stages been found enlarged and congested; in the later stages somewhat diminished in size and hardened. Microscopically, the liver cells may be quite normal, or may present minor digressions from the normal state. Glycogen has been demonstrated in their interior. The interstitial tissue is, in the late stages, increased in amount. The pancreas has been found hardened and atrophied. Spots of softening in various parts of the nervous system are not uncommon. Sometimes, too, a gross lesion of the brain in the neighborhood of the fourth ventricle, such as a tumor or hemorrhage, may be found. In such a case the lesion has probably been the cause of the diabetic condition. In the kidneys of a patient dying from diabetic coma the cells of the convoluted tubes show the changes of coagulative necrosis. The cells are swollen, pale, and hyaline; they do not take staining fluids readily, and their nuclei are scarcely apparent.

The blood in diabetes is charged with sugar, and similarly sugar is found in all the fluids of the body. After death from diabetic coma, the blood has been found to be pale, more fluid than usual and to contain fat. Also, it gives off the peculiar sweet smell already mentioned, and on analysis has been found by various observers to contain acetone, di-acetic acid, di-acetic ether or β -oxybutyric acid. Probably the three first-mentioned bodies are products of decomposition of the fourth. Finally, the lesions due to complications are found in addition to those already described.

Etiology and pathology.—Diabetes is more common in males than in females, and more frequently attacks young adults and children than those more advanced in years. The milder form of diabetes is found for the most part in persons of middle age, and especially in those of obese habit. A gouty diathesis also favors the development of this form. An hereditary tendency to diabetes is frequently observed. Diabetes is more common in country districts than in towns. Per-

sons of a neurotic temperament are found to be specially liable to the disease. Jews have been found to furnish a much larger proportion of patients than other races. Malaria, syphilis, and pregnancy have been noted as predisposing causes. The exciting cause is frequently obscure. Exposure to cold, mental shock, injuries of the brain or peripheric nerves, and severe bodily exercise have preceded the outbreak of symptoms in some cases. Organic diseases of the brain, such as tumor, softening, and hemorrhage, especially when affecting the region of the fourth ventricle, are occasionally observed to be associated with polyuria and sometimes with glycosuria and other diabetic symptoms. The excessive use of starchy and saccharine foods, and the abuse of alcohol, will cause glycosuria and sometimes the more severe symptoms of diabetes, but such cases are generally easy of control.

The liver has for one of its functions the transformation of certain of the food stuffs into glycogen, a starchy material easily convertible into sugar by the action of ferments. The sugar absorbed from the alimentary canal is stopped by the liver, changed into glycogen, and so, at any rate for a time, prevented from reaching the circulation. Bernard believed that during healthy life the liver glycogen was being continually converted into sugar, and in this form carried off into the circulation to be used for the needs of the economy. In disease, however, the hepatic glycogen is converted in greatly increased quantities. This excessive conversion of glycogen is believed to be due to a greatly increased flow of blood through the liver, whereby an excess of sugar is carried off, and a greater than normal quantity of arterialized blood is brought to that organ, such blood having been shown to possess great power of converting glycogen into sugar. In slight cases of diabetes, therefore, it is possible that, the liver having lost the power of transforming sugar into glycogen, the sugar passes on into the blood and is excreted by the kidneys, while, in more severe cases, dilatation of the vessels of the liver, brought about by means of the vaso-motor system of nerves, leads to a greater supply of arterial blood to that organ, the result being an increased formation of sugar. The connection of glycosuria with diseases of the nervous system and with experimental puncture of

the floor of the fourth ventricle is thus explained.

But the important and extended observations of Seegen have thrown new light upon the liver function. He confirms Bernard's view that sugar is continually being formed in the liver during health and poured out into the circulation. He also shows that amylaceous and saccharine foods are converted in the liver into glycogen. But he concludes that the glycogen of the liver takes no part in the sugar formation; that, in fact, the liver during life is constantly forming sugar out of the peptones absorbed from the alimentary canal. Diabetes is, according to this view, in its severe forms due to an increase of the destructive power of the liver upon proteids, a fact which goes far to explain the ravenous appetite and emaciation of diabetic patients; in its milder forms the liver function of converting sugar into glycogen is in abeyance, and the sugar obtains access to the general circulation in quantities too large for the organism to deal with.

Recent observations of Dr. Mitchell Bruce are of great importance, and tend to support Seegen's views. He concluded, from observations upon a marked case of diabetes, that (1) the diabetes was not due to mere transportation of sugar from the intestine, for, on removal of all saccharine and amylaceous materials from the diet, the patient still excreted 4000 grains of sugar a day, and that therefore the liver formed the sugar from nitrogenous materials. (2) Dr. Bruce observed that the glycosuria was controlled by morphine, but less so when the morphine was introduced subcutaneously than when given by the mouth, the conclusion being that the glycosuria was not due to a diminished destruction of sugar in the system, but to an increased influx of sugar into the blood. (3) He came to the conclusion that the excessive glycogenesis took place in the liver and not in the muscles and other viscera, because the administration of morphine reduced the sugar excretion, when it was introduced into the stomach and absorbed by the portal vein, even though the quantity used was insufficient to affect the nervous system, whereas a larger dose, sufficient to affect the nervous system profoundly, when administered subcutaneously had but little effect upon the sugar excretion. (4) Dr. Bruce's final conclusion is that the seat of the disor-

dered process, whatever may be its nature, is in the liver.

The pathology of diabetic coma is obscure. It is generally believed to be due to a poison which circulates in the blood, but the nature of the poison is a matter of dispute. Other theories which have been held are that fat embolism in various parts would account for the condition. Fat has been demonstrated in the blood, and fatty embolisms found in the lungs of patients who died of diabetic coma. Yet this does not explain the whole symptomatology. Similarly, the opinion that heart failure is the cause of diabetic coma, while true of certain cases, will not apply to all.

Course.—The progress of diabetes is essentially gradual in the majority of cases. The typical cases last from one to three years, yet sometimes the disease is most rapid in its progress. Sometimes, too, after a sudden onset and rapid course for a short time, the symptoms abate in severity, and then assume the chronic course, which commonly characterizes the disorder. While, as a rule, the disease steadily progresses toward the fatal end, cases occasionally happen in which intermissions are observed after the symptoms have been sufficiently marked and constant to remove all doubt as to the nature of the disease, but the more severe symptoms soon recur. Although recovery may occur in the milder forms of diabetes, the majority of well-marked cases die, the end being usually hastened by the presence of one or other of the complications and seldom due to simple exhaustion from the original disease.

Diagnosis is rarely difficult, nevertheless, it must be remembered that every case of glycosuria is not necessarily one of diabetes. Before the diagnosis can be considered as established it must be ascertained that the glycosuria is not a temporary condition only, that the urine contains more than a mere trace of sugar, and that some of the constitutional symptoms of diabetes are present.

Prognosis.—If the glycosuria occur in a patient of middle age, or at a later period of life; if there be a history of gout; if the patient be obese; and if the thirst, polyuria, and other constitutional symptoms of diabetes be but slight, the prognosis is favorable. On the other hand, those cases in which emaciation is marked and rapid in its advance, and the

constitutional symptoms are severe, only admit of an unfavorable opinion as to their issue. The results of treatment give an indication as to the further progress of the case, for when, on the assumption of an animal diet, the sugar disappears from the urine or becomes greatly diminished in quantity, and the polyuria lessens, it is probable that the case is not of a severe type, or is at least in an early stage. When, however, after all starchy and saccharine food-stuffs have been withdrawn, there is but little amelioration of the condition of the patient, the prognosis is very gloomy. The younger the patient the less likely is he to recover. Those cases, too, in which some definite cause of the diabetes can be traced are more favorable than those in which the cause is obscure, provided, obviously, that the ascertained cause is not an organic lesion of the nervous system fatal in itself. The presence of the various complications above enumerated increases the fatal tendency of the disease. Attention may, however, be called to what has already been said as to the varying influence of albuminuria upon the progress of the diabetes according to the condition which gives rise to it. So few cases of diabetic coma have been known to recover that a fatal prognosis must almost necessarily be given when this complication presents itself.

Treatment.—The first effort of the physician must be directed to limiting the supplies from which the body may obtain or manufacture sugar. In the milder cases this will suffice to cure the disorder; and in all but the very severe forms it will mitigate the symptoms and diminish the distress. Strict directions must, therefore, in all cases be given to the patients to eschew those food-stuffs which contain sugar or starch. Nearly all animal foods, fish, meat, and fowl, may be permitted to the patient. Liver, however, is to be forbidden on account of the large amount of glycogen and sugar it contains, and similarly all mollusks are to be avoided, since the greater portion of their bodies is made up of liver. Cheese, butter, oil, including cod-liver oil, and eggs may be partaken of freely. Cream also may be allowed. Milk, if partaken of sparingly, does no harm. Soups if not thickened with flour, and jellies if not sweetened with sugar, may be allowed. Is is among the

vegetable foods, however, that the greatest care is necessary in order to avoid those which contain starch and sugar. Bread forms such a large portion of an ordinary diet that its deprivation is one of the most severe hardships which must be inflicted on the diabetic. Yet it must be forbidden entirely. Several substitutes have been suggested. Freshly made gluten bread is very generally used by diabetics. But much of the gluten bread sold contains a considerable quantity of starch, so that care must be taken as to the quality. Gluten flour, too, may be used as a thickening for soups. Bran cakes are another substitute for bread, and have the merit of being less expensive than the gluten preparations. The patient sometimes becomes disgusted with all these preparations, and it is then advisable to allow a small quantity of bread which has been toasted almost to a cinder. Sugar, of course, is to be forbidden, and with it, honey. Glycerine in small quantities may be used as a sweetening agent, or the tabloids of saccharine recently introduced, although saccharine has not been of so much use in diabetes as was expected. The patient, after its use, frequently complains of everything tasting sweet. Moreover, the diabetic does not crave for sugar as he does for bread, and soon become indifferent to its absence. Flour preparations, such as macaroni and vermicelli, potatoes, rice, sago, tapioca, arrowroot, peas, beans, carrots, beetroot, and parsnips, must be forbidden. Green vegetables, such as spinach, greens, turnip tops, lettuce, and watercress, may be eaten. Others, too, which contain a little sugar, such as asparagus, cauliflower, and cabbage, may be eaten if they have been previously boiled in a large quantity of water. Sweet fruits are to be avoided. Tea and coffee may be drunk, but no sugar must be added. Only a moderate quantity of alcohol can be permitted, and that must be taken in an unsweetened state. Sweet wines, liqueurs, and mild ales must be forbidden, but the patient may drink sparingly of bitter ale, dry sherry, claret, and whisky.

The patient must be clad warmly, so as to avoid all chills. Thirst may be allayed by acid drinks, the dilute phosphoric acid being specially useful for this purpose.

Opium is of value in diabetes, not merely for its anodyne effect, but for an

actual curative influence upon the disease. Dr. Mitchell Bruce has shown that the best method of administering it is in the form of morphine, and by the mouth rather than subcutaneously. Dr. Pavy considers codeia to be preferable, as it disturbs the digestion to a less degree than does the more powerful alkaloid. It is notable that diabetic patients exhibit a great tolerance of opium and its alkaloids.

Salicylate of soda has been found of use by many physicians. During its administration, thirst and general discomfort have been alleviated, though no other positive effect on the disease has been apparent. A warning may be here given that the ferric-chloride test of the urine mentioned above cannot be used if the patient be taking salicylate of soda.

The general health must be maintained by tonics, such as quinine, strychnine, iron, and cod-liver oil. Distressing symptoms should be treated on general principles as they arise. The bowels must be maintained in a state of daily activity by mild aperients or by small doses of the purgative mineral waters. Sir William Roberts recommends for the relief of the craving for food, and for the uneasy sinking sensation at the epigastrium, a pill containing 2 or 3 grains of asafetida. Concerning other drugs which have been recommended, such as the bromides, arsenic in different combinations, belladonna, iodoform, lactic acid, and peroxide of hydrogen, it can only be said that the majority who have tried them have found them useless.

In diabetic coma treatment is of scarcely any avail. When preliminary symptoms are observed, smart purgation is recommended as a possible means of warding off the attack. During the attack good results have been recorded from transfusion of blood and from the injection of saline solutions into the blood vessels.

A residence for a time at certain spas has been found of service in diabetes, and especially in those cases which are associated with a gouty diathesis. Carlsbad and Vichy are those most visited.

ROBERT MAGUIRE.

Symptomatic Indications.—The remedy from which the best results have been attained in this disease is *sizygium jambolanum*, which causes the urine to diminish in quantity, and the sugar to

disappear. *Phosphoric acid* has also been successfully used, especially when the disease was the result of nervous derangement. *Uranium nit.* is recommended for cases originating in dyspepsia or assimilative derangement. *Arsenicum* may also be useful when the disease is due to faulty assimilation.

DIAPHORETICS are remedies which increase perspiration. They act in several ways—some by augmenting the flow of blood through the skin, others by direct stimulation of its afferent thermic nerves. Warm baths, the Turkish bath, extra clothing, and alcohol act in one or other or both of these ways. Hot drinks stimulate the efferent nerves reflexly. Nicotine, opium, chloral, ether, chloroform, and alcohol act directly on the sweat center. Pilocarpine acts especially on the peripheral nerves at their terminations in the sweat glands. Salines—*e.g.*, citrate and acetate of ammonium—probably stimulate the secreting cells of the sweat glands; while the mode of action of antimony, ipecacuanha, senega, and guaiacum is quite unknown. Substances which cause very profuse sweating are called sudorifics.

DIARRHEA, ACUTE, FROM INGESTA.—Acute diarrhea is the most prominent symptom of illness produced by eating articles of food which are undergoing certain peculiar processes probably allied to putrefaction. Milk, ham, pork, pies, veal, fish, and sausages have been known to produce severe illness. The ætiology and pathology of the affection vary much in different cases. Clinically, two classes may be formed—(a) in which the symptoms come on very soon (half an hour to a few hours) after taking the food, and are probably due to the presence in it of a chemical poison; (b) in which the symptoms set in after an interval of twenty or thirty hours or even several days. In the first class of cases the diarrhea is profuse, watery, dark, and offensive. It is preceded by vomiting and acute abdominal pain, and accompanied by chilliness, a feeble pulse, subnormal temperature, great prostration, and sometimes by hallucinations. The tongue is furred; headache is not a prominent symptom. The amount of collapse is in proportion to the severity of the diarrhea. In fatal cases, which

are rare, death is due either to collapse or to the occurrence of complications. The chief signs observed after death have been gastro-enteric catarrh and congestion of the lungs, spleen, and kidneys.

In the second class of cases, where the interval between ingestion and the onset of symptoms is longer, the diarrhea has the same characters, but is less easily controlled. Headache is a prominent and early symptom, vomiting is less marked, the tongue is thickly coated, but the tip and edges are red, the pulse is hurried, the diarrhea is accompanied by great pain, and quickly produces prostration and cold sweats. Death may occur in this stage, but it is rare, the patient generally passing into a condition of reaction, during which there is marked fever. Pneumonia is common, and parenchymatous nephritis may occur. Cases of this class are apparently due to infection by bacilli, which are also pathogenetic to dogs and other animals.

Treatment.—The diarrhea is, as a rule, comparatively easily controlled, a dose of castor oil, followed by a mixture containing bismuth and opium, or opium with rhubarb and other carminatives, being generally sufficient to check it. For a week or more after the cessation of the attack the patient is liable to a relapse should he commit any indiscretion in diet. DAWSON WILLIAMS.

DIARRHEA, ACUTE SUMMER.—

This term is usually applied to acute attacks of profuse watery diarrhea. Some of the cases are examples of diarrhea from ingesta; others depend on the same ætiological conditions as cholera infantum (*q.v.*). The onset is usually sudden, colic being rapidly followed by very numerous stools, which retain a feculent character. A sinking sensation at the epigastrium, chilliness and general depression are always present, and in weakly persons may cause severe prostration.

The *treatment* is best begun with a large dose of castor oil, with or without opium, if the case be seen early; at a later stage a mixture containing sulphuric acid, tincture of capsicum, and a small quantity of opium, or a mixture containing small doses of castor oil (m. x–xx) and opium, or one containing chalk and catechu, or aromatic chalk with rhubarb and compound tincture of cardamons is gen-

erally efficient. Abstention from solid food and milk, and in bad cases confinement to bed, are important measures in treatment. DAWSON WILLIAMS.

DIARRHEA, CHOLERAIC.—This term has been used in various senses: it has been limited to diarrhea occurring during the prevalence of cholera Asiatica, with which it has been supposed to have some premonitory or other relation. It has been extended to include every form of severe diarrhea of sudden onset not easily traceable to any recognized cause.

DIARRHEA, INFANTILE.—Various types may be distinguished as a matter of clinical convenience, but no hard-and-fast lines can be drawn.

Simple catarrhal diarrhea.—The infant is suddenly taken with griping, quickly followed by watery motions, containing at first some feculent matter and undigested curds. The amount of general disturbance varies, the child is restless, the tongue is generally furred, and there may be distinct pyrexia, which subsides as the flux is established. Vomiting is common, caused by associated gastric catarrh. Such attacks are traceable either to errors in diet, or to exposure to cold, and the first point in treatment is to administer a mild aperient, such as castor oil (3j), or rhubarb and soda (aa grs. v, with powdered cinnamon); the belly should be kept warm with a flannel binder or a layer of cotton-wool, and the milk should be freely diluted or withheld altogether, being replaced by weak veal-broth; most cases yield readily to this treatment, but recovery may perhaps be hastened by the administration, for a few days, of an antacid mixture (*e.g.*, sodium carbonate and dill-water). If the diarrhea continue, rhubarb and opium should be given (tinct. opii m. ss, spir. ammon. aromat., tinct. rhei, spir. chloroformi aa m. iij in dill or caraway water), or chalk and catechu. If the stools are frothy, the aromatic chalk powder should be given once or twice a day.

Acute inflammatory diarrhea as a term embraces the severer forms of simple catarrhal diarrhea and the very numerous cases of summer diarrhea which are closely allied to cholera infantum (*q.v.*) both in their ætiology and symptoms.

The attack commences with griping, often accompanied by vomiting; the stools at first contain curds and the skins of plums or scraps of other fruit which the child may have been allowed to swallow, but they quickly become watery, offensive, and either brown or green in color. In less serious cases, however, they may be pale and semi-solid. The general symptoms are severe; the temperature as a rule is raised, and may reach 106° or 107° F. in the rectum; the pulse is hurried and weak, the skin harsh and dry, the face sunken, the lips parched, and the tongue red, small, and rather dry. If, however, gastric catarrh be present, the tongue is furred, and vomiting is a prominent symptom.

The *diagnosis* from enteric fever is often difficult, and not always possible at first; the severity of the early diarrhea, and later the absence of enlargement of the spleen, assist in the diagnosis, which is confirmed by the early cessation of the symptoms in favorable cases. In protracted cases, the aspect of the child—drowsy, impassive, with rapid irregular pulse, pinched features, inelastic skin, and half closed eyes—somewhat resembles that seen in advanced tubercular meningitis, and to this condition the term “spurious hydrocephalus” has been applied. The depression of the fontanelle, the low or subnormal temperature, and the history of the illness, usually make the diagnosis clear.

Owing to the great exhaustion which is rapidly produced, especially in weakly children, a guarded *prognosis* must be given; unfavorable symptoms are continuance or marked increase of the pyrexia, early collapse, violent vomiting, and very frequent watery stools.

The *pathology* is not the same in all cases; in some the catarrh is excited by decomposing food, in others by exposure to cold, and in others again it is traceable to miasmatic influences (see CHOLERA INFANTUM). The catarrh is not uniform; it is most commonly seen in the jejunum, and in the ileum just above the cæcum, where shallow ulcers are often present. Occasionally minute patches of false membrane give the mucous membrane an appearance resembling that which would be produced by sprinkling it with bran.

The disease is most often seen in hand-fed infants, and in these the first step in

treatment is to entirely exclude milk from the diet, which should be restricted to veal or chicken broth, or whey and barley-water; koumiss in small doses is sometimes useful; the food must be given in small quantities. The belly must be kept warm by a covering of cotton-wool retained by a flannel binder, and the child nursed by a competent person in a well ventilated room. If the temperature continue high, recourse ought to be had to cool or tepid baths (about 70° F.), and administered with caution; when prostration comes on, stimulants must be given, good brandy being the best: warm mustard baths may be employed. At the onset it is advisable to give a dose of castor oil, and this may be followed by ipecacuanha and opium with a carminative (℞ Tinct. opii m. ss, tinct. zingiberis, vin. ipecac, aa m. ij, aquam ad 3 ss, every three or four hours). When the stools are green, dilute lactic acid may be added with advantage. In acute summer diarrhea the perchloride of mercury (gr. $\frac{1}{4}$), frequently repeated, is sometimes effective. Astringents are not of much use until the temperature has fallen to about 100° F.; the vegetable astringents are generally to be preferred, and either the extract of hæmatoxylon (grs. ij or iij), the extract of rhatany (grs. ij or iij), or the tincture of catechu (m. v to m. viij) may be combined with aromatic chalk and a minute dose of opium; in some cases aromatic sulphuric acid (m. iv) combined at first with opium is very useful.

Chronic inflammatory diarrhea is often observed as a sequel of an acute attack, but may arise insidiously, the wasted and anæmic condition of the child being the first thing to attract attention. The child will be found to be liable to frequent attacks of diarrhea, the stools being thin, foul, and of a dark brown color; sometimes they contain a peculiar green material like chopped spinach. In the intervals between these attacks three or four pale, copious, offensive, semi-solid stools are passed daily. The belly is distended by flatus, the appetite is capricious, being often voracious, but the general nutrition fails. To this condition the term “consumption of the bowels” is often applied, but a careful physical examination will usually distinguish it from tubercular disease. The intestines contain patches of chronic

catarrh; the mucous membrane is of a dark gray or dusky-red color; enlarged follicles project on the surface, and ulceration more or less extensive, but always superficial, commonly exists in the ileum.

The *prognosis* must always be guarded, especially among the children of the poor in large cities.

The most important points in *treatment* are food and clothing; milk, even diluted with lime-water and barley-water, can seldom be digested, and must be replaced by broths, whey, and barley-water, and good malted food made with whey. Children above one year generally do best on a diet mainly consisting of raw meat and thin bread and butter, or raw meat and jelly. Drugs are very uncertain in their action. During an exacerbation, if the stools are brown and offensive, phosphate of soda (grs. v to viij) with laudanum (m. ss) sometimes succeed; in other cases an aromatic mixture containing rhubarb and the above dose of laudanum will be of use. Pepsin (grs. iij) or papaine (Finkler), administered three or four times a day shortly after a meal, is most successful in many cases. In all cases, but especially in those associated with rickets, cod-liver oil in small doses should be cautiously tried, guarded at first by opium, and it is often surprising to note how soon it is well taken.

Lienteric diarrhea is a form of diarrhea not often observed in infants, but common in children over two years of age. Each meal is quickly followed by griping pains, which do not cease until a fluid motion, generally containing scraps of undigested food, is passed. It appears to arise from an undue irritability of the peristaltic apparatus, and is associated with chronic gastro-intestinal catarrh. In children it is best treated by attention to the clothing of the abdomen, and the administration of a mixture containing minute doses of arsenic, nux vomica, and opium; an alkaline carminative with a minute dose of opium may be given to an infant.

Dysenteric diarrhea, using this term to signify the symptoms produced by a catarrhal inflammation of the large intestine, is a very common disorder of children in temperate climates; it is sometimes incorrectly spoken of as dysentery. In its acute form the symptoms are tenesmus and colic followed by

severe straining at stool, the motions passed consisting largely of mucus, the fecal matter being often well formed; the lower part of the rectum is often prolapsed with each stool, and it may be difficult or impossible to return it. The general condition of the infant or child quickly deteriorates, owing to pain, irritability, and pyrexia, and the *prognosis* is grave if the prolapse and tenesmus be not quickly relieved. There is a general catarrh of the mucous membrane of the large intestine, and shallow ulcers, which are at first circular, but later become irregular, are commonly present. In chronic cases the general symptoms are those of ordinary chronic inflammatory catarrh, but the stools contain large quantities of slimy mucus, easily recognized; tenesmus is a prominent symptom, and prolapse of the rectum is common.

In the *treatment* of these cases in the acute stage, in addition to the general remedies above recommended, medication should be directed to the lower bowel. A small starch enema ($\frac{3}{4}$ ss) containing 3 or 4 minims of tincture of opium may be given twice a day, and a thick starch poultice applied over the prolapsed bowel. In the chronic stage astringent tonics by the mouth, and enemata containing catechu or rhatany injections are useful. Marked excess of mucus in the stools is an indication for small doses of castor oil guarded by opium.

DAWSON WILLIAMS.

Other useful remedies are nux vomica, particularly in cases caused by indigestion; frequent, scanty, watery evacuations, colic and tenesmus; specific for diarrhea of infants from disagreements of artificial foods; veratrum (veratrine), fever, headache, nausea, pain and tenderness in bowels, from cold; vomiting and purging of summer diarrhea. Mercury bichloride, slimy, bloody stools, with tormina and tenderness. Anemonine (pulsatilla), dyspeptic diarrhea, mucous discharges. Arsenic (or arseniate of strychnine), chronic, exhausting, offensive diarrhea. Arseniate of quinine, for malarial, periodic, dysenteric cases. Podophyllin, morning diarrhea, bilious condition; chronic with cutting pains. Ipecac (emeline), mucous diarrhea of children, grass-green stools, frequent vomiting. Colocynth, bilious watery diarrhea with violent spasmodic colic.

DICROTISM.—When a second beat of the pulse can be perceived by the finger, the pulse is said to be dicrotic. This second beat is almost always the great secondary wave which follows immediately upon the closure of the aortic valves, and is generally supposed to be a wave of recoil caused by this closure, and reinforced by an oscillation set up in the aorta. The conditions most favorable for the production of the dicrotic pulse are a left ventricle acting powerfully with a low state of arterial tension (See PULSE).

DIGITALIS, POISONING BY.—All parts of the plant are poisonous. Poisoning is more commonly the result of repeated doses than of a single large dose. The *symptoms* come on soon, vomiting being the chief; also purging and pain in the abdomen; thirst, noises in the head, suppression of urine, clammy sweats and dilated pupils are commonly observed, but the condition of the pulse is the point of chief importance. At first it is increased in frequency, but soon becomes slower, until ultimately the beats are much fewer than normal. Death often occurs suddenly from syncope.

Post-mortem appearances.—The right side of the heart may be distended, the left empty; the blood is generally dark and fluid; the stomach may be congested.

Treatment.—Vomiting should be encouraged by emetics, and the stomach-pump used. Stimulants and hot tea or coffee, or 20 grains of tannic acid in hot water, may be given frequently. Aconitia gr. $\frac{1}{120}$ has been recommended for hypodermic administration as an antidote. It is essential to keep the patient in a recumbent position until some time after all symptoms have passed off.

DIPHTHERIA.—An acute, infectious, and contagious disease, the chief characteristic of which is the development on the mucous membrane of the pharynx, nose, and larynx, and on abraded surfaces, of a fibrinous exudation or *false membrane*.

Symptoms.—The onset may be sudden, but is more often insidious, the period of incubation usually lasting from two to seven days. The first symptoms are a slight feeling of indisposition, headache, with some fever, stiffness of the neck, and tenderness about the angle of the jaw,

pain on swallowing, and a sore throat of a not very acute character. The mucous membrane of the soft palate and tonsils will be found reddened uniformly or in patches; soon a few whitish-gray spots are seen near the base of the uvula or on the tonsils. Gradually the spots coalesce to form patches, the patches run together, and at the same time become thicker. The whole of the soft palate and tonsils may thus be covered with a thick grayish or yellowish-white layer, which may envelop the uvula like a fingertip.

At first the exudation is not very adherent, but as it grows in thickness it becomes more firmly attached, so that when the whole membrane is formed it cannot be removed without some force, and leaves behind a raw and bleeding surface, on which it is speedily reproduced; if left to itself it gradually gets loose and comes away. The membrane is more closely adherent to the tonsils than to the palate. Sometimes no definite membrane can be seen, the parts being simply swollen, and of a dull grayish color. The membrane often extends into the cavity of the nose; indeed, it is rare not to have some nasal discharge. Epistaxis is of occasional occurrence, and may in rare cases prove a source of danger or even be the cause of death. The disease may also spread along the eustachian tube, causing otitis, or along the lachrymal duct, and set up conjunctivitis. The so-called diphtheritic ophthalmia, however, has nothing in common with diphtheria, being simply a chronic membranous inflammation of the conjunctiva. The membrane may either spread to the larynx or the disease may attack that part primarily. It may be surmised that the larynx is affected when hoarseness, stridulous breathing, dyspnoea, aphonia, and recession of the chest walls make their appearance. If possible a laryngoscopic examination should be made, but this cannot always be done in the case of young patients, and it is not advisable to persist should the patient struggle much. The younger the patient the more likely is the larynx to be the part primarily attacked; such, indeed, is the rule in infants under two years.

At an early period of the disease the glands in the neck become enlarged, the gland at the bifurcation of the carotid, a little behind and below the jaw, being the

first affected; the neighboring glands and peri-glandular tissues subsequently suffer, and a considerable swelling of the whole side of the neck may result; the enlarged glands are more or less tender.

The membrane gradually takes on a brownish tint, and the breath obtains a peculiar sweetish and very unpleasant but characteristic smell. There is not much fever, the temperature in some cases being scarcely raised, but it may reach 102° F. The pulse is generally increased in frequency and the heart's action weakened. In all cases of diphtheria the state of the pulse should be most carefully noted; sometimes it becomes extremely infrequent—a sign of bad omen. The bowels tend to be constipated: vomiting is rarely present, but is an unfavorable sign. Albuminuria will be found in a considerable proportion of the cases; the urine also often contains blood corpuscles and epithelial casts; general anasarca is, however, never observed, except when scarlet fever has preceded the diphtheria.

The duration of fatal cases is generally a week or ten days; recovery in a mild case will often be assured before the end of the first week. Twelve days would be a safe term of quarantine for a person who had been exposed to diphtheria; after an attack he should not be allowed to go among the healthy in less than three weeks from apparent convalescence. One attack affords no absolute protection against subsequent infection, although it rarely happens that an individual is twice the subject of the disease. It is safest to regard all forms of acute membranous inflammation as diphtheritic, and to treat them accordingly.

Sequelæ.—Certain phenomena referable to the nervous system are apt to follow an attack of diphtheria. They are loss of voluntary power, distributed over the whole body, most constant in the palatal muscles, and generally accompanied by anæsthesia of the soft palate; sometimes there is a certain amount of general anæsthesia. There may be loss of the knee jerks, and occasionally of the superficial reflexes. Loss of accommodation is an early symptom, and one almost pathognomonic; strabismus and ophthalmoplegia externa may also occur.

The speech is indistinct and nasal, fluids return through the nose, and the patient cannot drink without coughing

and choking. The degree of loss of power may vary from a mere slight debility to absolute helplessness. Sometimes the gait is decidedly ataxic. The pulse, especially in the early stages, is liable to be weak and irregular, and cough is often present. Paralysis of the muscles of the neck and of the intercostals or diaphragm is far from uncommon, and the involvement of the latter is of serious import, as, owing to the inability of the patient to fix his chest, the cough becomes feeble and ineffective. Paralytic sequelæ are rarely seen before the third week from the onset of the diphtheria or after the sixth week in children, but in adults they may appear much later; indeed, in children the whole affection seems to run a sub-acute course, in adults a chronic one.

The gravity of the complication will depend most on the implication of the chest walls; if these are affected, then a very little pulmonary catarrh will render recovery doubtful. The loss of the knee jerks and the paralysis of accommodation would appear to be the earliest symptoms, but an excessive knee jerk has sometimes preceded its disappearance. In a few cases some of the muscles have presented the reaction of degeneration, and this has persisted after convalescence was well established. In the majority of cases of diphtheritic paralysis recovery takes place, but the prognosis must be guarded. Albuminuria is sometimes found after an attack.

Diagnosis.—It is not always easy to distinguish between follicular tonsillitis and diphtheria, or to definitely exclude a diphtheritic element in some cases of tonsillitis. If the onset of the disease be sudden, the temperature high (103°–104° F.), the tonsils much enlarged and the membrane upon them in patches corresponding to the crypts, and if the enlarged cervical glands be tender, the case is probably one of follicular tonsillitis. The absence of membrane or of albuminuria is by no means inconsistent with diphtheria. The diagnosis of the laryngeal cases in the absence of any membrane on the fauces is often exceedingly difficult; even a sudden onset of symptoms in the middle of the night is not conclusive against diphtheria.

Prognosis.—The danger will, as a rule, be proportional to the youth of the patient. The extension of the membrane into the trachea and the medium-sized

bronchia, which may occur even after the performance of tracheotomy, is the complication most to be feared. Sloughing of the wound after tracheotomy is also not uncommonly a cause of death in diphtheria. Occasionally mediastinal emphysema occurs from the rupture of alveoli, or the air enters the thorax along the deep cervical fascia after tracheotomy. Cases in which the nose is much involved also frequently terminate fatally. The condition of the heart is of great importance in forming a prognosis. Vomiting is of bad augury, as also is the presence of a large quantity of albumen in the urine. Every complication adds to the danger, and even when the patient is safely through the diphtheria there are the great risks of subsequent paralysis. However mild the case may apparently be, the prognosis should be a guarded one.

Morbid anatomy and pathology.—In a recent case, on post-mortem examination, membrane may be found on both aspects of the soft palate and uvula, and in the larynx, but is rarely continuous from one spot to the other; also in the trachea and the bronchi; not, however, often beyond a second division of the tubes, but a thick muco-purulent secretion can be traced into the finer tubes. The lining membrane of the larynx, trachea, and bronchi will be found reddened beneath the membrane. The membrane is never so adherent in the air passages as in the fauces, probably owing to differences in the character of the two surfaces.

Membrane is occasionally found in the œsophagus, and more rarely in the stomach. The heart, especially in those cases which have proved fatal through syncope, may show granular degeneration analogous to that met with in enteric fever, in a few instances there has been endocarditis apparently of recent date. The kidneys in cases in which albuminuria was present show the changes of sub-acute parenchymatous nephritis. Certain changes have been found in the gray matter of the spinal cord and in the peripheral nerves, but the exact pathology of diphtheritic paralysis is still doubtful; the lesion must of necessity be slight, since recovery is usually complete; the fatal result is determined, not by the character, but by the situation of the lesion. The mildest attacks are perhaps the most apt to be followed by paralysis.

Ætiology.—Diphtheria is now almost universally regarded as primarily a local disease due to the presence of a specific germ and secondarily a constitutional disease, the constitutional disturbances being due to the absorption from the local focus of a chemical poison or toxin generated at the seat of infection by the bacilli diphtheriæ. The bacilli diphtheriæ were first described by Klebs in 1883 and were isolated by Loeffler the following year, and are known as the Klebs-Loeffler bacilli. The toxin generated by the bacilli may, and frequently does, affect distant organs, and cause, during the course of diphtheria, intercurrent diseases or complications, in this way seriously affecting the heart, the lungs, the kidneys, and the nervous system.

Treatment.—The treatment has three objects in view: destruction of the bacilli at the point of infection; neutralization of the absorbed toxin; combating the complications as they arise.

General.—1. The membrane should not be forcibly removed. Locally, ice is an excellent application; iodoform and carbolic acid may be applied to the fauces every four hours with great advantage, or solutions of carbolic acid (grs. ijss–3 j), tannic acid, or perchloride of iron may be applied with a brush. Good results have followed the use of the liq. hydrarg. perchlor. as a spray and throat wash. Spraying the throat with peroxide of hydrogen has given excellent results. The spray and powders have the advantage that in laryngeal cases the remedy, being to a certain extent inhaled, also reaches the larynx. When there is much swelling of the neck, nothing does so much good as ice compresses changed every two hours.

2. Internally, quinine, strychnine, perchloride of iron, and chlorate of potash are most in favor; the dose should be small, and the medicine given every three or four hours. The internal use of calomel in doses from 2 to 5 grains, every two or three hours until free catharsis is produced, has many advocates. It is all important, but a matter of considerable difficulty, to get the patient to take a sufficiency of nourishment. When there are any signs of cardiac failure, stimulants must be given freely.

The patient should be kept in bed and given a liberal supply of nourishment for at least a week or ten days after the

membrane has disappeared in order to diminish the risk of paralysis. In the treatment of diphtheritic paralysis absolute rest in bed and protection from the draughts are of the first importance; a liberal diet is equally necessary. If the palate be much involved, the patient should be fed through the mouth or nose by means of a tube.

JOHN ABERCROMBIE.

Mercury has been used with much success in diphtheria; the cyanide in the malignant form and the biniodide in the croupous form with much glandular swelling. Arsenic, in malignant cases, attended with prostration, typhoid symptoms, has also been successfully used. The bichromate of potash is also a remedy of much value, particularly when the membrane is thick, tenacious, of a yellow or yellowish-white color and firmly adherent; croupy cough and much swelling of the glands. For the sequelæ gelsemium is almost specific for paralysis of the smaller muscles, arseniate of strychnine for that of the larger.

The dosimetric treatment of diphtheria which was devised by Dr. Fontaine, who treated a large number of cases with a mortality of but two per cent., consists essentially in the saturation of the system with the sulphide of calcium. One granule of the sulphide of calcium every quarter of an hour, for infants; or two at a dose for young children, given with regularity and perseverance until a positive result is obtained, when the patient exhales sulphuretted hydrogen the medicine may be given once an hour for several hours; after which, the symptoms of sulphuric saturation having diminished, the former dosage may be resumed. The medicine thus given is well tolerated for two or three days. Spasms of the muscles of the glottis causing dyspnœa requires half a granule or a granule of hyoscyamine every half hour, regulating its administration by the state of the pupil, suspending it when the iris is well dilated. Adynamia may be treated with one granule of brucine. For children over three years of age arseniate of strychnine may be substituted for the brucine. The paralysis which follow the disease may be treated with two to six granules of the hypophosphates of strychnine daily, according to the age of the child. D'O. CASTRO.

The Treatment of Complications and

Sequelæ.—Under this heading we have such conditions as weak heart, bronchitis, pneumonia, albuminuria, paralysis. The treatment of these is the same as if these were the initial disease, with, perhaps, this difference, that the patient is already more or less exhausted by the diphtheria, and, in consequence, a more stimulating mode of treatment becomes necessary. Another condition which may arise during the course of diphtheria is partial stenosis of the larynx due to the formation of the membrane in that situation. Here the treatment will be either tracheotomy or intubation.

Following the plan of Roux, the diphtheria antitoxin is produced from the blood serum of the horse. This is drawn into sterilized vessels and preserved in small sterilized bottles, each of which is designed to contain a single dose. It is preserved by the addition of carbolic acid (Behring), camphor (Roux), or trikresol (Mulford). JOHN HERALD.

Antitoxin.—Under the antitoxin treatment the constitutional symptoms are lessened in severity, the spread of the membrane appears to be checked, and what has already formed is more quickly dissolved and removed. The explanation is found in the fact that, as the poison in the system is neutralized by the antitoxin, the various tissues of the body retain their vitality to a greater extent, and thus have a greater power to resist the invasion of the bacilli. The injection is always made into either groin, and I prefer to inject the full amount at one time, using a syringe which holds 1000 units. Usually within a few hours after the injection the temperature rises slightly—never more than 1° F. Frequently there appears around the point of injection a rash closely resembling that of scarlet fever, covering a circular space of 3 or 4 inches in diameter. The only inconvenience occasioned by it is a feeling of itchiness. In some cases this rash extends over the whole body, and then presents an appearance somewhat between that of scarlet fever and that of measles. I am of opinion that this rash is occasioned by some impurity in the antitoxin solution.

DISINFECTION (including *Disinfectants*; *Germicides*; *Antiseptics*; *Deodorants*).—The destruction of the contagium of infection.

Disease.	Isolation of the Patient until—	Quarantine, after Exposure to Infection, for—
Chicken pox . . .	Every scab has fallen off	Eighteen clear days.
Cholera	Convalescent	One week.
Diphtheria	Convalescence is completed (in any case for not less than three weeks), there being no longer any sore throat or discharge from throat, nose, eyes, or ears, and no albuminuria	Not less than ten days, if the throat be <i>quite</i> natural in appearance at the end of this time.
Enteric fever (Typhoid)	Apyrexia is established and all secretions are natural.	Not less than ten days.
Measles	Not less than three weeks have elapsed from the appearance of the rash, and all cough and desquamation have ceased	Sixteen days.
Mumps	Not less than four weeks have elapsed, and all glandular swellings have subsided	Twenty-four days.
Relapsing fever . .	Convalescence is completed	Twenty-four days.
Ringworm of body .	Cure is complete	Until careful and thorough examination has proved the absence of infection.
Ringworm of scalp .	Careful examination of the whole scalp shows a complete absence of diseased hairs and stumps	Until careful examination has shown complete absence of all signs of the presence of the fungus, followed by thorough application of an efficient "preventive" ointment or lotion.
Rötheln (German measles)	The end of second or third week, according to the severity of the attack	Sixteen days.
Scarlatina	The end of sixth week from the appearance of the rash, provided there be no longer any desquamation, albuminuria, or congestion of the fauces	Fourteen days.
Smallpox	Every scab has fallen off	Eighteen days.
Typhus	Convalescence is completed	Fourteen days.
Whooping cough . .	The end of the sixth week, if the peculiar paroxysmal cough and the whooping have ceased, or for a shorter period, if <i>all</i> cough have completely ceased	Twenty-one days at least.
Yellow fever . . .	Convalescent	Not less than fifteen days.

N. B.—Complete disinfection of person and of clothing must be carried out at the termination of the period of isolation or of quarantine.

A true *disinfectant* is an agent which destroys the contagium of infection; a *germicide* is a substance which, when added, in a certain proportion, to a culture of the particular microbe under observation, kills both it and its spores outright; the term is not synonymous with disinfectant, since there may be infectious poisons not due to the action of 'germs.'

Antiseptics are agents which arrest decomposition (*sepsis*); but (1) this arrest may occur only so long as the decomposable material is submitted to the inhibiting action of the antiseptic; or (2) the antiseptic employed may suffice to destroy the fully developed septic microbes without destroying the vitality of their spores.

Deodorants are more or less fragrant substances which mask the evil odors that commonly attend septic processes; but this is no guarantee that the actual poison which the bad smell served to indicate is destroyed.

In the order of their hygienic value, these substances would rank: (1) Deodorant—uncertain, dangerous, and delusive; (2) Antiseptic—locally useful so long as the action is maintained; (3) Germicide—valuable, and safe when the virus is microbic; (4) Disinfectant—certain and safe under all circumstances when used in the proper way.

Disinfectants can be classified in accordance with their mode of action, as: A. Oxidizing agents, including (1) those which oxidize directly, *e.g.*, ozone, potassic permanganate, etc., and (2) those which oxidize indirectly by the abstraction of hydrogen, *e.g.*, chlorine, chloride of lime, etc.; B. Deoxidizing agents, *e.g.*, carbolic acid, sulphurous acid gas, etc.; and C. Substances which destroy the pathogenic virus by some other form of physical action, *e.g.*, corrosive sublimate, heat, etc.

It is obvious that the members of groups A and B must not be used together, since their modes of action are chemically antagonistic; thus, carbolic acid may be employed in conjunction with the fumes of burning sulphur, but neither should be used with Condyl's fluid, chlorine gas, or sanitas.

The contagia of the various forms of infection vary greatly as regards their virulence and their power of resistance to destructive agencies; the spores of *bacil-*

lus anthracis and the virus of scarlatina are tenacious of vitality, while the infection of measles is short-lived and can be destroyed by free exposure to fresh air and bright sunshine.

As soon as an illness is proved, or even suspected, to be infectious, the patient should be isolated, preferably in a separate building, or, if this be impossible, in a room at the top of the house. Outside the door of this room a sheet moistened with some volatile disinfectant should be hung. No persons should enter the room save the nurse and the doctor, and any articles which must be removed during the illness (*e.g.*, crockery and soiled linen) should be previously immersed in a disinfecting solution. The sick room should be light and airy and should have an open fireplace. All superfluous furniture, together with curtains, carpet, and hangings, should be removed, and the room should be cleaned, aired, and warmed before it is occupied by the patient. The water-supply and the rain-water pipes should be looked to; drains, cisterns, and sinks must be examined, tested, and kept continuously disinfected. The sick room should be kept well ventilated.

But the treatment of a case of infectious illness is incomplete unless adequate measures be taken for the efficient disinfection of the patient and of his excreta; of the clothing, bedding, and furniture with which he has been in contact; and of the sick room itself.

For the disinfection of:

The person.—*The mouth* may be rinsed with a weak solution of Condyl's fluid (3 j to Oj), to which a little eau de Cologne may be added; or with a solution of peroxide of hydrogen, or boroglyceride (1 in 100). *The skin* in scarlatina may be daily anointed with carbolic oil (1 in 60), or with 1 part of sanitas oil to 20 of olive oil; in the later stages of desquamation a lanoline ointment containing 1 per cent. of carbolic acid is useful; it may be sponged with a tepid solution of sanitas or washed with carbolic soap (10 per cent.), sanitas soap, or lanoline-carbolic soap. When a disinfecting bath is given, care should be taken to thoroughly cleanse the nails, scalp, hair, and all the orifices of the body; after such a bath the patient should put on fresh, clean (disinfected) clothing. In diphtheria all wounds and abraded surface should be protected by smearing

them with carbolized vaseline (1 in 40), if they cannot be sealed with styptic collodion.

What may be termed prophylactic disinfection consists in the treatment of persons who have been exposed to infection with drugs which are supposed to destroy the infective virus as it enters the body, or to prevent its development; thus good results are claimed for the administration of small doses of arsenic and of the biniodide of mercury with potassic iodide, during the prevalence of scarlet fever epidemics. *Cabs* which have been used for the conveyance of infectious cases may be disinfected with chlorine or with sulphurous acid gas (*vide infra*).

The excreta. — *Fæces, urine, and sputa* should be received into vessels containing a teacupful of a solution of carbolic acid ($\frac{3}{4}$ iv to Oj of warm water), chloride of lime (1 lb. to Oj), sulphate of iron (green copperas) (1 lb. to Oj), chloralum or sanitas. Similar solutions should be used for flushing and disinfecting drains, sinks, water-closets, and for rinsing dirty utensils and crockery before washing them in hot water.

Clothing, furniture.—Every infected article which is useless or can be spared should be burnt. Carpets, curtains, bedding, other than linen, including blankets, mattresses, bolsters, pillows, and woolen clothing, should be exposed in a proper apparatus to heat. If dry air be employed, the exposure should be such that the center of the bulkiest articles is maintained at a temperature of not less than 220° F. for at least one hour. In disinfection by steam, a temperature of 212° F. for five minutes suffices. It would be useful to inclose a fragment of a fusible alloy, which melts at the minimum temperature desired, in a glass tube, and to place this in the center of the bulkiest article requiring disinfection (*e. g.*, a mattress). This could be withdrawn and examined when the process was completed, and the fusion of the alloy into a button would prove that the mattress had been exposed throughout its mass to the required temperature. Linen and cotton articles should be quickly rinsed in a solution of chloride of lime ($\frac{3}{4}$ j to Oj), then at once wrung out in clean water, and *boiled* at the wash. During the illness, clean soft rags should, as far as possible, be used instead of pocket-handkerchiefs and napkins, and burned directly they

are soiled. Furniture and floors should be washed with a tepid solution of carbolic acid, or chloride of lime, and then scrubbed with hot carbolic soap and water.

The sick room.—During the illness, the sheets suspended outside the door must be kept moist with solutions of carbolic acid or sanitas. The room may be sprayed with sanitas solution, several times a day. After the convalescent has left the room, and when the bedding and other infected articles have been removed, the room is to be disinfected by the use of chlorine or by the fumes of burning sulphur. When chlorine is to be used, all windows, doors, and other openings having been closed, and metal surfaces having been smeared with oil or vaseline, half a pint of hydrochloric acid is poured on to a quarter of a pound of manganese dioxide placed in a large dish elevated on a table in the center of the room. The room must remain closed for six hours before fresh air is readmitted and the walls and furniture washed. Chlorine bleaches, and this method is less convenient than the employment of sulphurous acid gas. In order to make efficient use of this latter agent, windows, ventilators, and fireplaces must be tightly closed, slips of paper pasted over cracks, and a sack of chaff or shavings stuffed up the chimney. It is important to see that enough sulphur is used: the proportion recommended is 1 lb. of sulphur to each 1000 cubic feet of space; the sulphur should be divided into two portions or more if the room be a very large or long one. The roll sulphur, previously broken into small lumps, is put into an iron or tin dish large enough to hold it all when melted; this dish is placed on a brick or otherwise supported in an iron pail or stout earthenware pan, and some water or sand is placed in the bottom of this pan, to receive any molten sulphur that may run over. The sulphur is most easily lighted by igniting alcohol previously poured over it. The door is then closed for from eight to twelve hours. At the end of this time the room may be cautiously entered, the windows opened, the fire lighted, and the walls and furniture washed with the dilute carbolic acid solution, or with hot water and carbolic soap.

If their disinfection cannot be otherwise insured, articles of clothing and

linen may be suspended on lines stretched across the room before the sulphur is ignited, but the sulphur fumes bleach vegetable dyes and, by forming sulphuric acid with the oxygen and moisture of the air, are apt to rot the fiber of substances exposed to their action for any length of time.

Should a case of infectious disease terminate fatally, the body should be washed with strong carbolic solution (1 in 20), and may also be sprinkled with carbolic powder; it should be buried with as little delay as possible.

It is a good rule in practice to regard every disinfectant as being poisonous. Visits to infectious cases should be made not oftener nor of longer duration than is necessary, and not when exhausted by fatigue. The hands, etc., should be thoroughly cleansed in a disinfectant and with soap and water when the visit is over, and every possible advantage should be taken of the disinfecting properties of fresh air. It is a good plan on entering the patient's house to put on, over the ordinary clothing, a large mackintosh, kept there for the purpose; this can be sponged over with a disinfectant on leaving the sick room.

Isolation and quarantine.—Isolation implies the continued separation of the infectious patient from the healthy until after he has ceased to be infectious: while quarantine means the segregation of *possibly* infected persons until after the period has elapsed at which they would (if infected) develop characteristic signs of the disease. The duration of this period will necessarily depend upon that of the incubation period of the particular disease to which they have been exposed; and, on its termination, thorough disinfection of the person and of all fomites, such as the clothing, should be carried out before such persons are again permitted to consort with the healthy.

If this disinfection be omitted, the mere quarantine affords practically no safeguard against the transmission and spread of infection, owing to the persistent vitality of the virus, which is especially notable in certain diseases: *e. g.*, scarlet fever. Hence, persons who have recently been in contact with a patient suffering from an infectious disease, or who have been exposed to the same source of infection, should be at

once separated from others and kept under observation "in quarantine," for at least a space of time corresponding to the full incubation period of the disease in question; if in good health at the end of this period, they may resume their usual relations to society, after thorough disinfection of their persons and clothing.

C. E. SHELLY.

DIPSOMANIA.—See ALCOHOLISM.

DISLOCATIONS.—1, Traumatic; 2, congenital; 3, spontaneous. In traumatic, the capsule is almost always ruptured.

Complicated dislocations.—In these there is either fracture, or wound of skin, or of large vessel, or of nerve, or several of these misfortunes.

Causes of dislocations.—1. External force which is (*a*) direct or (*b*) indirect. 2. Muscular action (*e. g.*, usual in dislocation of lower jaw).

Symptoms.—1. Altered form of joint. Compare two sides of body. 2. Line of direction of misplaced bone does not pass through the articular surface of the other bone. 3. Lengthening or shortening of limb. 4. Altered position of limb to trunk, *e. g.*, projection of elbow from side. 5. Abnormal distance between certain prominent points of skeleton, *e. g.*, between internal condyle and olecranon. 6. Ecchymosis (rarely distinct at first, sometimes absent). 7. Pain. 8. Inability to move the limb. Manual examination must finally settle the question in most cases, showing the articular cavity empty and the head of the bone at some other point. Anæsthesia may be necessary for a diagnosis, because of soft parts being so swollen and tender. A soft crepitation sometimes, caused by rubbing head of bone on torn capsular ligaments and tendons, partly from the compression of firm coagula.

Diagnosis.—1. From dislocated articular fracture. Easily made by an attempt at reduction. The latter is easily reduced, but returns at once; 2, from contusion and sprain. Examine carefully; 3, from relaxation of the capsule in paralyzed limbs. Here consider the history, and make a careful local examination.

Capsular opening is of variable size. Escaped head of bone does not always remain immediately opposite it. Occa-

sional spontaneous reduction by muscular action.

Mechanical obstructions to reduction.—1. Contraction of muscles. Head of bone may be caught between two contracted muscles. 2. (A far more frequent obstacle), a small capsular opening, or its occlusion by the entrance of the soft parts. 3. Certain tensions of the capsular or strengthening ligaments.

Reduction.—Easiest immediately after the injury. Later, anæsthesia often required. Maneuvers depend on joint affected. Usually, the assistants make the motions while the surgeon himself manipulates the head of bone. Much depends on correct anatomical knowledge. Multiplying pulleys, Bloxam's dislocation tourniquet; these things now only used under anæsthetics; when they involve the application of straps round the chest, they make anæsthesia more dangerous. If too great violence is used: 1, patient may collapse; 2, limb may mortify from the pressure; 3, great vessels or nerves may be ruptured; 4, rupture of other soft parts, as skin or muscles; 5, fracture of bone; 6, limb may be torn off. These accidents occur mostly in attempting to reduce old dislocations. The results of pressure best prevented by fastening the straps over a wet bandage previously applied from below upward. Nerves and muscles are most liable to rupture when adherent to deep cicatrices.

After-treatment.—Reduce synovial inflammation, which always ensues, by moist bandages and cold compresses. Passive motion; in shoulder, not for a fortnight; in elbow and hip, earlier. Too early motion may cause:

Habitual Dislocation.—When a joint has been several times dislocated it becomes extremely liable to dislocation.

Treatment.—Long rest of the joint.

Irreducible Dislocation.—Restore the movements as far as possible by passive and active exercise, otherwise the muscles atrophy. The anatomical changes are as follows: the extravasation is reabsorbed; the capsule folds together and atrophies; the soft parts about the misplaced head become infiltrated with plastic lymph, and transform to cicatricial, firm connected tissue, which partly ossifies; the cartilage metamorphoses into connected tissues and adheres to the neighboring parts; the surrounding muscles suffer

considerably from molecular disintegration and fatty metamorphosis.

How long dislocations are reducible.—Depends on joint. Ball and socket much longer than hinge-joints. Shoulder may be reduced after years. Hip, after two or three months, very difficult. Tenotomy has been employed, but not very successfully; for the chief obstacle is the firm adhesion of the head of the bone in its new position. Is reduction of such old dislocations desirable? Often preferable to let patient simply exercise limb well in its new position. Breaking up adhesions about the head of the bone by rotating it forcibly may facilitate this. Pressure on brachial plexus may require excision of head of humerus.

Complicated Dislocations.—1. With fracture. Always attend to this, and apply an apparatus till it has united, changing it and putting the joint in a new position, say every ten days, to prevent stiffness. 2. With compound fracture. Resect joint, or try to save it, using some thoroughly antiseptic method. If there is considerable crushing and tearing of the soft parts amputation may be required.

Congenital Dislocations.—Distinguish from those caused during parturition. Occur in most of the joints of the extremity, but especially in the hip. Head of bone above and behind acetabulum. Generally readily replaced. Peculiar wabbling gait. If the dislocation is one-sided, patient, lying on the back, turns the foot inward. Acetabulum is too shallow, and in adults filled with fat. Ligamentum teres, if it exists, is abnormally long. Head of femur too small. Articular cartilage usually completely formed. Capsule very large and relaxed. Cure mostly impossible.

Causes.—Perhaps excessive quantity of fluid in joint, at very early period of uterine life. Perhaps also extreme adduction in uterine life.

Result.—In course of time, spinal curvature.

Treatment.—It has been recommended that the thigh should be kept for a very long time in a position of abduction.

Dislocation of Ankle.—Four directions: outward, inward, backward, forward.

Outward.—Accompanied by fracture of fibula above outer malleolus and rupture of deltoid ligament, or fracture of inner malleolus. Same thing as "Pott's

Fracture." Foot turned outward. Depression over fracture of fibula.

Treatment.—Dupuytren's splint (to inner side), or ordinary leg-splints. Keep foot well in, and sole at right angles to leg.

2. *Inward.*—Accompanied by fracture of inner malleolus. Treat on same principle as Pott's Fracture, only keeping foot well out.

3 and 4. Dislocations backward and forward may be distinguished from fracture of leg bones by relation of malleoli to tarsal bones. After reduction, apply starched bandages and mill-board, or some other firm apparatus.

Compound Dislocation of Ankle Joint.—Requires amputation if tibial arteries be injured, or other important parts be much damaged. Otherwise, remove small fragments; clean, set, and dress. Primary excision of the joint occasionally advisable. Ankylosis pretty certain. Use antiseptic dressing.

Dislocation of Astragalus.—If simple, must be either backward or forward. Latter has an inclination either outward or inward. Dislocation directly outward or inward is always complicated with fracture of leg bones. Dislocation forward most common. Complete or incomplete. Prominence of head of bone beneath skin in front of ankle. Malleolus of side toward which the bone is inclined projects. Danger of skin sloughing from pressure.

Treatment.—Flex knee to relax gastrocnemii; extend foot and push astragalus into its place. This is tolerably easy in partial dislocation; but complete dislocation may require anæsthesia and a division of tendo Achillis. Dislocation backward is very rare and difficult to reduce.

Compound Dislocation.—Except in the most favorable cases, reduction is not to be tried. The question lies between excision and amputation. Decide and treat on general principles. In simple irreducible dislocation, primary excision is not advisable. The bone may remain harmless in its new place.

Dislocation of Separate Carpal Bones, especially of os magnum, can be reduced by pressure, and generally require, for some time, apparatus to prevent recurrence.

Dislocation of Clavicle.—At the sternal end, three varieties, viz.: 1, forward; 2, backward; 3, upward. Forward most

common; others very rare. The deformity is in each case so manifest that diagnosis is palpable. In dislocation backward end of clavicle presses on trachea, esophagus, and great vessels of neck.

Treatment.—Extend shoulders backward, and bandage to a splint applied to the back with a pad between splint and spine. Difficulty of keeping bone in its place. Truss to press on head of bone displaced forward. At the acromial end, dislocation almost always upward, but sometimes below acromion, or even below coracoid process. Reduction easy by pulling shoulders backward. Here also difficult to keep bone in its place. Gutta-percha or leather shoulder-cap, with a pad over end of clavicle. Bandage in a line parallel to upper arm, over shoulder and elbow. Then bandage arm to side.

Dislocation of Coccyx may result from falls or during parturition. Reduce with the assistance of a finger in the rectum.

Dislocation of the Elbow:

1. Complete dislocation of radius and ulna: 1, backward; 2, forward. In the former there may be fracture of the coronoid process; in the latter, fracture of the olecranon; 3, inward; 4, outward. The latter two are rarely complete.

2. Ulna alone: backward only.

3. Radius alone: 1, forward; 2, backward; 3, outward; 4, partial forward.

4. Ulna backward with radius forward.

Injuries of elbow often obscured by great swelling. Following excellent directions, as to the points to be noticed in an injury to the elbow, are from Holmes (abbreviated): 1. Is there transverse fracture of humerus? 2. Longitudinal or partial fracture of lower end of humerus, *e. g.*, of condyles? 3. Distance between olecranon and internal condyles? 4. Fracture of olecranon? 5. Are motion and position of head of radius normal? 6. Do axes of radius and ulna correspond in direction?

Dislocation of both bones backward: Prominence of olecranon; distance between it and internal condyle increased. Prominence of lower end of humerus below fold of skin at front of elbow-joint. (In fracture of lower end of humerus, the prominence of the upper fragments is above that fold.) Fracture of coronoid process causes increased mobility as well as crepitus.

Dislocation of both bones forward: Arm is lengthened, and olecranon, unless broken off, is on a level with condyles.

Dislocation of ulna backward: Head of radius can be felt normal; but olecranon is too far back from internal condyle.

Dislocation of radius forward (most common of the three modes): Elbow somewhat flexed, and midway between pronation and supination. Further flexion, as well as supination, very limited; head of radius can be felt displaced. After reduction, very liable to recur, because orbicular ligament is ruptured. Not uncommon in childhood.

Dislocation of radius backward: Head of bone can be felt behind external condyle.

Dislocation outward recognized by manipulation.

Reduction of dislocations of elbow.—Can often be effected by merely pressing the bones into position. Sometimes extension, and even anæsthesia, required. Dislocations two months old have been



FIG. 1.—Reduction of Backward Dislocation of Elbow over the Knee.

reduced, after breaking down adhesions by forcible flexion and extension. In dislocation of the radius, extend from the hand. Bending elbow across knee a useful method of reduction.

Compound dislocations.—Amputation seldom necessary.

Dislocation of Fingers.—Are not common, and may be reduced by extension. Amputation should never be done for compound dislocation, unless the finger be hopelessly crushed.

Dislocation of Hip.—Four chief directions: 1, backward and upward on dorsum ilii; 2, backward into sciatic notch; 3, downward into obturator foramen; 4, inward on pubes. Other varieties, *e. g.*, into perineum, are very rare. First form is most frequent.

Causes.—The backward dislocations take place when a person is in a stooping position, and either falls heavily on his feet, or is struck by a heavy weight falling on his back. Dislocation into the thyroid foramen is caused by sudden and violent abduction, and dislocation on the pubes by sudden and violent extension of the limb, especially if coincident with a blow on the back of the thigh.

Anatomy.—The anterior part of the capsule, including Y-ligament of Bigelow, remains wholly or partially unruptured in all ordinary dislocations, and thus limits the position of the bone, interferes with reduction by extension, and can be utilized in reduction by manipulation. The obturator internus is a strong tendinous muscle; and backward dislocations are on the dorsum ilii, or toward the sciatic notch, according as they escape from the acetabulum above or below that muscle respectively. In the lower dislocation, the head of the bone is superficial to the obturator internus. Fracture of the acetabulum not uncommon, especially in dorsal dislocations.

Symptoms.—1. Dislocation on dorsum ilii. Hip looks widened. Peculiar position of limb; rotation inward; slight flexion of both hip and knee; axis of thigh intersects lower third of sound thigh; ball of great toe rests on instep or ankle of other foot; heel raised. Abduction and external rotation impossible; stiffness and immobility under chloroform; head of bone makes a prominence in its new position; trochanter is above a line between ant. sup. spine of ilium and tuberosity of ischium (Nélaton's line). Shortening, one, two, even three inches. 2. Dislocation in sciatic notch.—Symptoms like those of dorsum ilii dislocation, only less marked. Axis of thigh across opposite knee; ball of toe on ball of other great toe. Shortening, half to one inch. 3. Dislocation into thyroid foramen.—Body bends forward; foot points slightly outward; a hollowness takes the place of the trochanter. Lengthening two inches. Head of femur perhaps discoverable in its new position. 4. Dislocation on pubes.—

In this and the other rarer forms of upward dislocation, head of bone can be felt in its high position; flattening of hip; abduction and eversion. Shortening, one inch.

Diagnosis.—Of dislocation on dorsum ilii from impacted fracture of neck of femur with inversion. Under anæsthetics, the former shows immobility, the latter mobility. In the former the trochanter is behind, in the latter it tends to lie below the ant. sup. spine of ilium.

Treatment.—Each kind of hip dislocation can be reduced in two ways, viz., extension and manipulation. Extension method is partly based on the idea that muscular contraction is the chief difficulty. But it is not so. The main resistance proceeds from strong ligaments, and sometimes from too small a hole in the capsule. Hence the advantage of manipulation. Dislocation on dorsum ilii.—1. Extension. Apply pulleys just above condyles of femur, and extend knee across lower third of opposite thigh; fix pelvis with perineal band. 2. Manipulation.—Place patient on back, and give anæsthetic completely; grasp knee and foot; flex well both knee and hip, adduct thigh, ro-



FIG. 2.—Reduction of Dislocation of Hip.

tate outward, and suddenly bring down the limb into a straight line with body. If this fail, try again and again, or rotate inward instead of outward. Dislocation toward sciatic notch.—1. Extension. Place patient on sound side; apply perineal band and pulleys; flex limb, and draw it across opposite thigh. 2. Manipulation. Same proceedings as in dislocation on dorsum ilii. Dislocation into thyroid foramen.—1. Extension. A pelvic band pulls pelvis toward sound side. A perineal band, working beneath it, is connected with pulleys which extend

upward and outward from the injured hip. The surgeon grasps the ankle of the dislocated limb, and dragging inward, thus prises the femur into the acetabulum. Instead of the pelvic and perineal bands, the bed-post may be placed in the patient's fork, and used as a fulcrum. 2. Manipulation. Flex hip, abduct slightly, rotate strongly inward, abduct, and straighten. Dislocation on pubes.—1. Extension. Extend limb, well abducted, downward and backward. At same time, pull head of bone outward by a towel round thigh just beneath groin. 2. Manipulation. Pull strongly on thigh in line of axis of femur, at same time bending it on the abdomen; rotate inward, and bring down into a line with body: or employ same maneuvers as in thyroid dislocation.

Old dislocations.—Reduction is tolerably safe to attempt up to two months. Afterward, danger of inflammation of joint, or fracture of femur.

Dislocation with fracture of femur.—Try to push head of bone into place, or let bone unite, and then, in sixth week, attempt reduction.

Dislocation of Lower Jaw.—Usually bilateral. *Causes.*—Direct violence, or overextension in gaping.

Symptoms.—Bilateral.—Mouth widely open and cannot be shut; saliva dribbles; speech and deglutition almost impossible; depressions where condyles ought to be; prominences behind and beneath malar bones. Unilateral.—Symptoms less marked; chin inclines toward sound side; depression in front of ear only on side dislocated.

Mechanism.—Two views. One that it is caused by the coronoid process locking against the malar bones. The second merely attributes it to excessive muscular action.

Prognosis.—If left unreduced, a certain amount of motion returns, and the teeth can be made to nearly, if not quite, meet.

Treatment.—Firstly, disengage condyle by pressing downward with thumbs, guarded by a towel, in mouth behind last molar teeth. Secondly, push chin backward and upward. Congenital dislocation is generally accompanied by other signs of imperfect development. Subluxation is a kind of "catching" of the jaw which the patient can easily remedy for himself. It occurs in young people of relaxed fiber.

Treatment.—Tonics and time.

Dislocation of Knee.—Five kinds : forward, backward, inward, outward, and dislocation of semilunar cartilage, called “subluxation.” The first four are unmistakable, from the obvious deformity. The lateral dislocations are most common and not complete. One or other condyle slips over to the opposite half of the tibial surface. Dislocation of the tibia forward is dangerous from pressure on popliteal vessels by femur. Subluxation is marked by sudden and severe pain attacking joint, which then remains semi-flexed.

Treatment.—Extend and rotate slightly. Compound dislocation, except in favorable cases, requires amputation. Subluxation is reduced by flexion, followed, when the patient is off his guard, by sudden extension, combined with slight rotation. While manipulating, press firmly with one thumb on any tender spot.

Dislocation of Metacarpal Bones.—Rare, obvious, and easily reduced by extension.

Dislocation of Metatarsus, if compound, may require amputation.

Dislocation of Patella.—Four kinds : outward (most common), inward, edgewise, and upward.

Causes.—A blow on the edge of the patella, or sudden muscular action.

Signs, etc.—1, Outward (most common) : patella rests on outer side of external condyle, generally with outer edge raised. 2, Inward : most rare, almost unknown. 3, Edgewise : either inner or outer edge of patella is twisted into intercondyloid space, the bone standing on its edge. 4, Upward : Ligamentum patellæ is always ruptured. Quadriceps extensor pulls patella upward.

Treatment.—In first two varieties flex thigh on abdomen : press outer or inner edge of patella, according as dislocation is outward or inward. The outer edge is thus raised and the bone freed, the quadriceps at once pulling it into position. Case 3 often presents great difficulties. Anæsthesia.

Manipulation.—Manipulation combined with bending leg and rotating it on axis of tibia. Forcible flexion. Sudden and violent extension made by patient himself. The cause of the difficulty said to be wedging of the superior angle of the bone in the intercondyloid space. Shun any divisions of tendons or ligaments. If dislocation be

irreducible, wait, watch, and act according to the course taken by nature. 4, Upward dislocation ; treat like fractured patella.

Dislocation of Lower Angle of Scapula.—Query as to pathology. Slipping of latissimus dorsi or paralysis of serratus magnus. On latter supposition use strychnine endermically, Erichsen ; electricity ; orthopedic appliances.

Dislocation of Shoulder Joint.—Five kinds : 1, Downward, subcoracoid ; 2, downward, subglenoid ; 3, inward, semi-clavicular ; 4, backward, subspinous ; 5, upward. Subcoracoid is far the most common, subspinous very rare.

Causes.—Predisposing : The natural shallowness and free movements of the joint, previous dislocation, male sex, old age. Exciting : Falls on shoulder, elbow, or hand ; muscular action. To produce the dislocation backward, the elbow has to be directed across chest when falling, or else twisted inward.

Signs.—Six common signs : 1, Flattening of the shoulder ; 2, hollow under acromion ; 3, apparent projection of this process, with tension of the deltoid ; 4, presence of head of bone in an abnormal situation ; 5, rigidity ; 6, pain in shoulder. These resolve themselves into three simply : 1, Head of bone is evidently absent from its place beneath acromion ; 2, it is present elsewhere ; 3, there are such signs as are common to dislocation of all joints, viz., stiffness, pain.

1. *Subcoracoid.*—Head of bone under or slightly internal to coracoid process. To feel it, raise the elbow. Elbow projects from side. Slight lengthening, real or apparent, of upper arm ; rarely slight shortening. Stiffness : movement only possible antero-posteriorly.

2. *Subglenoid.*—Much like subcoracoid, but head of bone more distinctly felt in axilla, elbow projects more, and there is lengthening, one inch. Marked symptoms of pressure on axillary vessels and nerves.

3. *Subclavicular.*—An extreme degree of “subcoracoid.” Prominence of head of bone beneath clavicle. Elbow projects backward and outward.

4. *Subspinous.*—Head of bone felt beneath spine of scapula. Elbow outward and forward.

5. *Upward.*—Always complicated with fracture of acromion or coracoid. Consequently, injury and swelling likely

to be severe. Shortening, crepitus, and deformity.

Anatomy.—In the first three forms the inner and lower part of the capsule is torn, and, if the displacement be great, either the great tuberosity of the humerus, or else some of the muscles



FIG. 3.—First Method—Heel in Axilla.

attached to it (supra and infra spinatus and teres minor), have to give way. In subglenoid, the subscapularis also goes. In subspinous, also, the subscapularis is torn. In subspinous, head of bone lies between subscapularis and teres

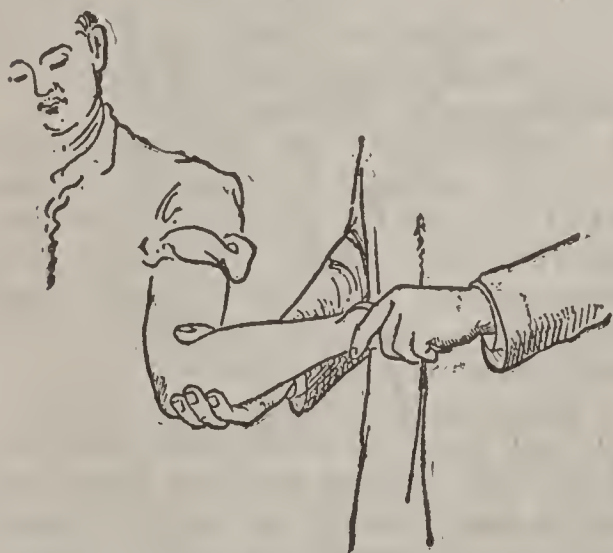


FIG. 4.—Kocher's Method—First Part, External Rotation of Humerus.

minor; in subglenoid between subscapularis and long head of triceps; in subclavicular, on second and third ribs.

Diagnosis.—1. From fracture of neck of humerus. This fracture is never caused by anything but direct violence. Then there are the general differences between fracture and dislocation. Both

injuries may occur together. 2. From mere paralysis of deltoid. Then, although there is flattening, still head of bone is easily felt in glenoid cavity.

Treatment.—By heel in axilla; by manipulation; by pulleys; by knee in axilla; by air-pad in axilla; by extension upward. *Heel in axilla.*—Patient lies on back. Surgeon sits with unbooted heel in injured axilla. Extension made either by himself or by assistants or pulleys. Anæsthesia. Slight rotation of limb facilitates. Neither anæsthetics nor assistants necessary in most cases.

Manipulation.—Bring arm with a sweep round in front of chest and face, then rotate inward while bringing the arm down to the side again. This should be done by one hand of the surgeon, while with the other he tries to press the head of the humerus into its place. Anæsthesia helps. *Pulleys.*—Anæsthesia.

Caution: danger of rupturing nerves, axillary artery, etc. Forearm has been torn off. First apply a wet bandage to the arm, then put on a clove hitch over the bandage, above the elbow. Extension should be slow and patient. Counter-extension by a jack towel, or by surgeon's heel or knee. *Knee in axilla.*—Patients sits on a chair. Surgeon places one foot on chair and the knee in axilla. He then seizes the arm, extends a short time, and, lastly, steadying the shoulder with left hand, uses the knee as a fulcrum



FIG. 5.—Kocher's Method—Second Part, Raising the Arm, Internal Rotation and Circumduction.

on which to lift humerus into its place. Or, the surgeon can place his back against a door-post and have extension

made through the doorway by assistants, while he steadies the shoulders with both hands. Mr. Cock placed an air-pad in the axilla and bound the elbow firmly to the side. In three days the dislocation was found to be reduced. All other attempts had previously failed. Extension upward can also be made with the heel against the shoulder, or extension outward with counter-extension from opposite wrist. Skey has shown that, owing to the great mobility of the scapula, the real direction of the extending force is much the same, whatever it may be apparently.

Compound Dislocation of Shoulder.—Rarity. Question of resection uncertain. Antiseptic treatment. *Complications.*—With fracture of neck of humerus attempt reduction by manipulation, then treat fracture. If reduction impossible, put up fracture, and in sixth week (when union has taken place) again attempt reduction. If rupture of axillary artery occur, reduce dislocation first and then tie both ends.

Dislocation of Thumb (Metacarpophalangeal Joint).—Almost always backward. *Signs.*—Thumb is bent back. Head of metacarpal can be felt projecting on palmar aspect, and base of first phalanx on dorsal aspect. Main obstacle to reduction is engagement of neck of metacarpal between two heads of flexor brevis pollicis, as in a button-hole.

Treatment.—The efforts are directed to disengage from flexor brevis pollicis; bend the metacarpal joint of the thumb well into the palm of the hand, thus relaxing the muscle; now press the first phalanx of the thumb well backward, *i. e.*, hyperextend it; at the same time pull the thumb downward, *i. e.*, toward the tips of the fingers; lastly, flex the thumb (every joint) into the palm; if this fails the pulley may be tried. Anæsthesia; subcutaneous division of one or both heads of flexor brevis or lateral ligaments; passing a blunt hook through a small incision and hooking tendons of flexor brevis over head of metacarpal bone. After reduction, keep thumb bent toward palm for a day or two.

Dislocation of Wrist.—Extremely rare; readily reduced.

Diagnosis.—From Colles's fracture; in fracture the styloid processes go with the hand; in dislocation, they approach too near the finger-clefts.

C. B. KEETLEY.

DISSECTION WOUNDS.—Under this head we notice the lymphatic and cellular inflammations and blood poisoning produced by absorption of animal poison from dead bodies. Bodies lately dead much more dangerous than those which have been long dead; bodies dead from erysipelas, peritonitis, puerperal and typhoid fevers, especially dangerous. Peritoneal fluid particularly poisonous after death from peritonitis. Not necessary that there should be a skin wound. Poison absorbable through hair follicles or through unbroken skin.

Signs and prognosis.—Three grades of severity. In the first the symptoms, except slight fever for a few days, are trivial and almost confined to the limb poisoned; in the second, there is either severe cellulitis in the limb, or abscesses form in parts of the body beyond the limb, or both these troubles may be present. This grade is liable to pass into chronic pyæmia. The third grade is marked by violent and sudden symptoms of septicæmia and often terminates fatally in two or three days. The point of inoculation usually looks angry and purulent, and presents either a vesicle, a pustule, or a scab; it is painful; the lymphatics extending from it to the nearest glands are reddened, tender, and sometimes surrounded by inflamed and even suppurating cellular tissue (phlegmonous erysipelas), these glands are tender and enlarged, and abscesses tend to form around them. Chills, rise of temperature, and other feverish symptoms come on within twenty-four hours. Symptoms such as these are common to almost every case, but the further course is variable. In the third grade of cases, within forty-eight hours, to quote Mr. Callender, "the patient, flushed, anxious, restless, even delirious, is in a hopeless condition, with prostration and rapid sinking." In the second grade there may be extensive cellulitis or the formation of numerous abscesses near glands; but so long as the disease is subacute or chronic, and provided actual pyæmia does not occur, the prognosis is very hopeful. In these cases the spirits are usually very low. In the first grade, recovery takes place in a week or two or even in a few days.

Treatment.—If, while dissecting, the hand should be wounded, grasp it so as to check the return of venous blood,

wash it, suck the wound, permit to bleed freely, and let a stream of cold water flow over it. If afterward signs of local poisoning appear, give the limb complete rest, and the patient a country holiday, with instructions to avoid any kind of exertion, for excitement of the circulation appears to drive poison from the wound inward. Cauterize the wound; a warm bath for the limb; generous diet; fresh air; tonics; purgatives; rest in bed for the severe cases; to properly rest a limb, splints are necessary; mill-board and starch apparatus; poultices. Open abscesses as they form.

Symptomatic Indications.—*Arsenicum* is nearly specific for dissecting wounds when attended with rapid prostration, burning pain, typhoid symptoms. *Aconite* is valuable for inflammation of absorbents in poisoned or dissection wounds; it may be advantageously replaced by *belladonna* when the injured part is much swollen and very painful, general congestion with headache. *Apis mel.* is useful when the injured part is œdematous, with stinging and burning pains, throbbing pain extending along the limb.

DISSEMINATED SCLEROSIS
(Multiple Sclerosis: Insular Sclerosis).—A disease characterized by the formation of patches of sclerosis in many parts of the cerebro-spinal system.

Symptoms.—The onset is gradual. Generally the first symptom to appear is weakness of both legs, the arms being after a time similarly affected. There is no affection of sensation, or of the sphincters. After some months attacks of transient diplopia occur, followed by amblyopia and subsequently by nystagmus. *Amblyopia* remains as a permanent symptom, but it very rarely ends in complete blindness. The optic disks are as a rule unaffected, but in some cases atrophy follows. In a typical case the chief symptoms are the peculiar speech, nystagmus, tremors on voluntary movement, general weakness of the limbs, with some rigidity of the legs and increase of the tendon reflexes.

The *speech* is very characteristic: it is slow, and each syllable is pronounced with difficulty and after a slight pause, giving it what is termed a "scanning" character. In some cases this is so marked that each syllable is blurred out

with much effort in an explosive manner, so that the speech becomes unintelligible. Occasionally this condition is associated with tremors of the lips.

The *tremors* occur *only* on voluntary movement. When lying down the patient is quite quiet, but, on being told to touch his nose with the fore-finger, the arm begins to tremble, and this increases as the finger approaches the point to be touched, but the movement is *not* increased by closing the eyes. Making the patient raise a tumbler of water to the lips is a common test for this condition. In walking, the leg is brought forward tremulously, sometimes causing the whole body to shake, then the foot which is on the ground trembles while the other is brought forward, but there is no throwing about of the legs, or stamping with the heels, as in locomotor ataxia. Shaking of the head, when it is raised off the pillow, occurs in some cases, and tremor of the tongue when it is protruded.

Nystagmus of the eyes is a very constant symptom; it is conjugate, and becomes obvious when the patient looks laterally or up or down. The quick oscillating movements of both eyes which constitute this symptom occur in the direction toward which the patient is looking. In extreme cases nystagmus occurs if the patient be merely told to fix his eyes on an object in front of him, but in the early stages of the disease it is not observed when the eyes are at rest.

Besides the above-mentioned symptoms, three-fourths of the patients suffer from *vertigo*, which may be either subjective or objective in character.

Mental changes are present in many cases, and sufferers from the disease are very emotional and, in the advanced stage, attacks of dementia are not uncommon. The expression of the face is described as being stolid, vague, and uncertain, but this is not sufficiently marked in recent cases to be characteristic.

In the limbs, especially the legs, there is progressive weakness, but no paralysis of any particular movement; the legs tend to become rigid.

The *knee-jerks* (patellar tendon reflex) are increased, and *ankle clonus* is usually present.

Sensibility is usually not affected at all, and the sphincters not until late in the disease.

As unusual and late symptoms, Charcot

mentions atrophy of groups of muscles of the limbs, bulbar paralysis, apoplectiform seizures, associated with acceleration of the pulse and a rapid rise of temperature.

Three stages of the disease are described:

(1) From the commencement till the patient has to take to his bed.

(2) When he is confined to bed, but the organic functions are intact.

(3) When the organic functions are affected.

In the last stage the sphincters become involved, diarrhea sets in, followed by general emaciation, the formation of bed-sores, dementia, and death.

Diagnosis has to be made from paralysis agitans, in which disease the tremors occur while the patient is at rest and diminish on voluntary movement. In general paralysis of the insane the tremors are usually finer and nystagmus is absent, but the diagnosis from general paralysis is sometimes impossible, as the two diseases may be combined. In tabes dorsalis the inco-ordination is increased by closing the eyes. Chorea could hardly be mistaken for this disease, as the movements in the former occur irrespective of voluntary movement.

The *prognosis* is grave; the disease lasts many years, the age of forty appearing to be the limit of life in disseminated sclerosis.

Morbid anatomy.—The lesions appear as grayish or semi-gelatinous yellow patches, varying in size from a pin's head to that of a pea, or they may even be still larger. They are found in the cerebrum, especially the internal parts, in the pons Varolii, cerebellum, medulla, and in the spinal cord, where they occur in both the white and the gray matter.

On *microscopic examination*, the patches are found to consist of an overgrowth of the fibrous tissue (neuroglia) of the part. If a large patch occur in the lateral or posterior columns of the spinal cord, secondary descending or ascending sclerosis, respectively, ensues, and is marked by the occurrence of the symptoms characteristic of these degenerations.

Ætiology.—The disease distinctly pertains to youth and early adult life, the most common age being between twenty-five and thirty years. It may begin as early as fifteen, and is rare after thirty. In this respect it differs much from paral-

ysis agitans, which is rare before the age of forty. Females are much more often attacked than males, the proportion being 25 to 9. Exposure to wet and cold and excessive mental grief and anxiety seem to be the most potent factors in the ætiology of the disease, but in many cases no adequate cause can be discovered.

Treatment has hitherto failed to arrest the disease. Strychnine and nitrate of silver have seemed in some cases to diminish the tremors, but for a time only. The strength of the patient should be maintained by good food and the administration of tonics. A trial may be given to the hypophosphites. No marked benefit has resulted from the use of phosphorus, arsenic, or belladonna.

C. E. BEEVOR.

Symptomatic Indications.—*Gelsemium* is useful in the early stage of the disease; where there is spinal weakness from exhaustion; confusion of the head; paresis of the tongue and glottis; muscles feel bruised and will not obey the will. *Phosphorus* is valuable when the disease is the result of sexual excesses, or when in connection with inflammatory disease of the vertebræ. Indicating symptoms are burning pain in the spine; dyspnoea and cough; numbness and insensibility of the extremities. In severe cases, *mercurius sol.* is an important remedy. The bladder, rectum, and lower extremities are paralyzed, with occasional jerks through the paralyzed parts; violent pain in the spine, worse from motion, great restlessness and sleeplessness; insensibility of the skin. *Physostigma* is useful in tremors of young persons from emotional or physical disturbances; staggering gait as if drunk; a feeling of weakness, as though paralyzed, passes downward from occiput through back to lower limbs, which feel as if asleep. *Sulphur* is frequently useful to arouse the vital reaction when other remedies fail to act. *Veratrum*, for painful paralytic weakness of the upper and lower limbs; the patient is scarcely able to drag them; tingling in the fingers; painful jerking in limbs.

DOSE of remedies named in *Symptomatic Indications*:

Aconite.—One-tenth to one-one-thousandth minim of tincture. Repetition of the dose may be every one, two, or four hours.

Ammonium carbonicum.—One-hundredth to one-tenth grain, every one, two, or four hours.

Antimonium crudum.—One-hundredth grain, every one, two, or four hours.

Antimonium tartaricum.—One-thousandth to one-hundredth grain, repeated every one, two, or four hours.

Apis mellifica.—In cutaneous affections, one-thousandth to one-hundredth minim, every one, two, or four hours.

Apocynum cannabinum.—One to five minims of the tincture.

Arnica montana.—One-tenth to one minim of the tincture, every one, two, or three hours.

Argentum nitricum.—One-hundredth grain, every one, two, or four hours.

Arsenicum album.—One-thousandth grain, repeated every one, two, or three hours.

Aurum metallicum.—One-thousandth of a grain, every two, three, or four hours.

Baptisia tinctoria.—One minim of the tincture, every one, two, or four hours.

Baryta carbonica.—One-hundredth of a grain, every one, two, or four hours.

Belladonna.—One-tenth of a minim to one minim of the tincture, every one, two, or three hours.

Benzoic acid.—One-hundredth of a grain, every one, two, or three hours.

Borax.—One-tenth of a grain, every one, two, or four hours.

Bryonia alba.—One-hundredth to one-tenth of a minim of the tincture, every one, two, or three hours.

Cactus grandiflorus.—One-hundredth to one minim, every one, two, or three hours.

Calcarea carbonica.—One-hundredth grain, every two or four hours.

Calcarea phosphorica.—One grain three times a day.

Calcarea silicia.—One-thousandth grain, three times daily.

Calcium sulphide.—One-thousandth to one-tenth grain, every one, two, or four hours.

Calendula.—One minim of the tincture, every one, two, or four hours. Externally, 10 to 15 minims in two ounces of water.

Camphor.—One minim of tincture, frequently repeated.

Cannabis sativa.—One minim of the tincture, frequently repeated.

Cantharis.—One-thousandth to one-hundredth minim of the tincture, every one or two hours. For external use, 10 to 15 minims in two ounces of water.

Capsicum.—Five to ten minims of the tincture, before meals.

Carbo vegetabilis.—One-hundredth grain, every two or four hours.

Caulophyllum.—One-tenth minim, every one, two, or three hours.

Causticum.—One-hundredth minim, every two or four hours.

Chamomilla.—One minim of the tincture, every one, two, or three hours.

Cinchona.—One minim of the tincture, repeated every one, two, or three hours.

Cimicifuga.—In melancholia, insomnia, delirium tremens, mania, cerebrospinal meningitis, headache, neuralgia, chorea, one-hundredth to one minim of the tincture, every one, two, or three hours.

Cocculus indicus.—One minim of the tincture, every one, two, or three hours.

Colchicum autumnale.—One minim of the tincture, every one, two, or three hours.

Conium.—One-tenth minim of the tincture, every one, two, or three hours.

Corallium.—One-thousandth grain, every one, two, or three hours.

Crocus sativa.—One minim of the tincture, every one, two, or three hours.

Cuprum.—One-hundredth grain, every one, two, or three hours.

Digitalis.—One minim of the tincture, every one, two, or three hours.

Dioscorea.—One minim of the tincture, every one or two hours.

Dulcamara.—One-tenth minim of the tincture, every one, two, or three hours.

Eupatorium.—One minim of the tincture, every one, two, or three hours.

Euphrasia.—One minim of the tincture, every one, two, or three hours.

Ferrum.—One-hundredth to one-tenth grain, every one, two, or four hours.

Gelsemium.—One minim of the tincture, every one, two, or three hours.

Glonoin.—One-hundredth minim, every one, two, or three hours.

Graphites.—One-hundredth grain, every two or four hours.

Hamamelis.—One-hundredth to one-tenth minim, every one, two, or three hours.

Helleborus.—One minim of the tincture, every one, two, or three hours.

Hydrastis.—One minim of the tincture, every two or three hours.

Hydrocyanic acid.—One-hundredth minim, every one, two, or four hours.

Hyoscyamus.—One-hundredth minim, every one, two, or three hours.

Ignatia amara.—One-hundredth minim of the tincture, every one, two, or three hours.

Iodine.—One-hundredth grain, every three or four hours.

Iris versicolor.—One minim of the tincture, every one, two, or three hours.

Ipecacuanha.—One-hundredth to one-tenth grain, every one, two, or three hours.

Kali bichromicum.—One-hundredth grain, every one, two, or three hours.

Kali carbonicum.—One-hundredth grain, every one, two, or three hours.

Lachesis.—One-thousandth minim, every one, two, or four hours.

Leptandra.—One minim of the tincture, every one, two, or three hours.

Lobelia.—One-tenth to one minim of the tincture, every one, two, or three hours.

Lycopodium.—One-thousandth grain, every two or four hours.

Mercurius cyanide.—One-thousandth grain, every one, two, or four hours.

Mercurius corrosivus.—One-thousandth grain, every one, two, or three hours.

Mercurius solubilis.—One-thousandth of a grain, every one, two, or three hours.

Natrum muriaticum.—One-thousandth of a grain, every two or four hours.

Nux vomica.—One minim of the tincture, every one, two, or three hours.

Opium.—One-thousandth of a grain, every one, two, or three hours.

Phosphorus.—One-thousandth of a grain, every one, two, or three hours.

Phosphoric acid.—One-tenth of a grain, every one, two, or three hours.

Physostigma.—One-thousandth of a grain, every one, two, or four hours.

Podophyllum.—One-hundredth of a grain, every one, two, or three hours.

Pulsatilla.—One minim of the tincture, every one, two, or three hours.

Rheum.—One-hundredth minim, every one, two, or three hours.

Rhus toxicodendron.—One-hundredth minim of the tincture, every one, two, or three hours.

Ruta graveolens.—One-hundredth

minim of the tincture, every one, two, or three hours.

Sabina.—One-hundredth minim, every one, two, or three hours.

Sanguinaria.—One-tenth minim of the tincture, every one, two, or three hours.

Secale cornutum.—One-hundredth minim of the tincture, every one, two, or three hours.

Sepia.—One-thousandth grain, every two or four hours.

Sizygium jambolanum.—One-tenth minim of the tincture, three times a day.

Silicea.—One-thousandth grain, every two or four hours.

Spigelia.—One-hundredth minim of the tincture, every one, two, or three hours.

Spongia.—One-hundredth grain, every one, two, or three hours.

Stramonium.—One-hundredth minim of the tincture, every one, two, or three hours.

Sulphur.—One-thousandth of a grain, two or three times a day.

Thuja.—One-hundredth minim of the tincture, every two, three, or four hours.

Veratrum album.—One-tenth minim, every one, two, or three hours.

Veratrum viride.—One-hundredth to one-tenth minim, every one, two, or three hours.

Viburnum opulus.—One minim of the tincture, every one, two, or three hours.

Other remedies mentioned may be given in doses of one-thousandth grain of the drug, or one-thousandth minim of the tincture. These remedies of the strength here given are prepared in tablet and granular form by Wyeth & Co., Wm. R. Warner & Co.

DOSIMETRY.—Dosimetric Method.

—**Alkaloidal Therapeutics**.—The dosimetric method of medication, signifying literally a method of exact or measured doses, followed upon the discovery of the alkaloids or active principles of plants and was founded about a quarter of a century ago by Professor Burggraefe of Brussels, in conjunction with Ch. Chanteaud of Paris, who prepared the alkaloids in granular form, in fractional doses. In the words of its founder: "Dosimetry places medicine in the great conclave of positive sciences, and gives to therapeutics a rigidly determined object and method." It is the art of appro-

priating remedies to the nature and progress of diseases, to their symptoms, and to individual idiosyncrasies. It makes use, not of the complex formulæ of the official pharmacopœia, but of the simple principles which modern chemistry puts at our disposal, notably of the alkaloids and of those metallic salts and metal-loids whose pharmaco-dynamic action can be put in evidence by direct experiment.

The dosimetric method takes everything, however trifling, into consideration, such as the medical constitution, the individual constitution, the hereditary condition, the age and sex, and the mode of life, the treatment being modified according to varying conditions in each case. Dosimetry, therefore, never follows rigid and unchanging routine. It recognizes the fact that a medicine which is suitable for one individual is not so good for another. It is a therapeutic method based upon physiology and clinical experience; and has for its principal application the employment of the alkaloids in broken doses, exactly measured. It substitutes certainty for uncertainty, fixedness for variability, exactness for vagueness. It is in this respect that the dosimetric method, substituting certainty for uncertainty by employing the active principles, the alkaloids, the resinoids, the glucosides, etc., of a fixed composition, instead of the vegetable preparations of unknown power, places therapeutics upon a scientific basis.

So also by the use of the active principles, fixed, unchanging, invariable, and whose therapeutic action can be predicted with absolute certainty, the dosimetric method substitutes fixedness for variability, and the physician is enabled to prescribe his remedies with confidence, knowing exactly what their therapeutic effect will be.

The essential character common to all the dosimetric medicines are: Chemical purity: The substances which enter into their composition are always identically the same and always chemically pure. Exact dosage: each granule represents a ponderable unit, always the same, in such manner that the physician may know to a certainty the quantity of the medicine or medicines taken by the patient. Besides this, the unit is the same for all the medicines of the same series, so that each granule is clearly defined,

not only with regard to itself but with regard to others, and all the successive doses may be easily compared one with another, and with the first dose with mathematical precision. Unalterability: The preparation and granulation of the remedy secures its absolute preservation. Definiteness: The definiteness of their action is such that alkaloid in granular form and employed according to teachings of dosimetric therapeutics, never goes beyond its physiological action, because it does not accumulate in the system, and when it is administered in small—although sufficient—doses to obtain in each case only the sure and determinate effect, the physician may, in observing the development of its therapeutic action, suspend or moderate the administration; in a word, govern it according as the effect he desires to obtain is produced. When the evil is abated and all danger has passed he may discontinue it and the action ceases; as, for example: in a high fever, temperature 104° to 106° F., we prescribe aconitine, alone, or associated with veratrine or digitaline, one granule of each, every quarter of an hour; but as the fever decreases, the temperature falls, the skin becomes moist, the urine free and abundant, the circulation moderates, and the nervous super-excitation calmed, we diminish the dose of the defervescent alkaloids, giving only every hour, then every two or three hours, until the fever is completely vanquished; taking care during all the course of the malady to proportion the remedy according to the intensity of the disease and the persistency of the symptoms. A few granules of hyoscyamine in many cases take the place of the catheter in urinary difficulties; the large doses of opium and the hypodermatic use of morphine may be well replaced by the alkaloidal medicaments. Pneumonia requires prompt aid. Experience has shown that aconitine, veratrine, digitaline, and strychnine do wonders here. Apoplexy and the various kinds of convulsions, as well as the congestions, require prompt recognition and active treatment by the defervescent alkaloids and arseniate of strychnine, and often the sedatives, as hydrochlorate of morphine, hyoscyamine and gelsemine, atropine sulphate, etc. Aconitine when there is fever and acute congestion, veratrine for the same, but for the sthenic variety, digitaline with them when the heart

is feeble and laboring; cactenin when there is hemorrhage; in short, in all cases of oppression. When there is depression, strychnine sulphate or the arseniate of strychnine must be given at short intervals until relief is obtained. Atropine for great central congestion, teething and whooping cough fits, 1-1000 grain every thirty to sixty minutes.

Strychnine or brucine, 1-1000 grain every half-hour or hour until relief is obtained. Arsenite of copper is useful for anæmic children with head symptoms—those that utter a cry during the attack and are stupid between attacks, more especially when there are thin discharges from the bowels and of an involuntary character. Arsenic, cicutine, and atropine in convulsions from injury; if from worms, cicutine, santonine, jalapire, calomel, and juglandin. If from fright, hyoscyamine, strychnine, morphine hydrochlor., gelsemine, aconitine, atropine. One or more granules of each of the selected remedies as the nature of the case indicates.

In incipient brain affections, gelsemine in doses of $\frac{1}{67}$ gr. every half-hour for two or more times until better, then less frequently until out of danger. General measures, as baths with mustard (90° F.) cold to the head, etc. The spasms of robust children are generally reflex; of delicate ones, probably from the brain. The first require hyoscyamine, purgatives, and baths.

The fundamental laws of dosimetry may be stated to be: To jugulate all maladies at the beginning—intermittent, remittent, and continuous fevers. In the treatment of disease to distinguish two elements—the dominant and the variant. The first deals with the cause of the evil; the second with its effects or symptoms. The treatment, as far as possible, should be addressed to the vital or dynamic period of the disease. The thermometer should be used to ascertain the vital conditions. At the commencement of all affections there is not, properly speaking, any disease,—simply a state of deranged vitality,—a non-physiologic state, when inequilibrium exists between innervation and nutrition—between decomposition and recomposition. The dynamic action of a medicine is a doctrine, an idea proceeding directly from rational physiologic action; its end or effect has been proved over and over again.

Dosimetric remedies.—Alkaloids and fixed principles (Ch. Chanteaud, Paris; E. Fougere & Co., New York):

Granules containing $\frac{1}{800}$ gr.: Stophantine.

Containing $\frac{1}{268}$ gr.: Atropine, daturine (stramonium), hyoscyamine.

Containing $\frac{1}{134}$ gr.: Aconitine, arseniate of strychnine, brucine (nux vomica), cicutine, cocaine, colchicine, colocynthis, gelsemine, lobeline, picROTOXINE (coccus indicus), sulphate of atropine, sulphate of calabarine, sulphate of strychnine, valerianate of atropine, veratrine (veratrum album).

Containing $\frac{1}{67}$ gr.: Agaricine, anemone (pulsatilla), arsenious acid, benzoic acid, apomorphine, arbutine (gaustheria) arseniate of caffeine, arseniate of iron, arseniate of quinine, arseniate of soda, asparagine, bin-iodide of mercury, bromhydrate of cicutine, bromhydrate of morphine, bryonine, caffeine, calomel, citrate of caffeine, codeine, cotoine, cubebine, cyanide of zinc, cyclamine, digitaline, elaterine, emetine, euomymine (wahou), Gregory salt, guaranine, hydrastine or berberine, hydrochlorate of cocaine, hydrochlorate of morphine, hydroferrocyanate of quinine, iodhydrate of morphine, iodoform, iridine, jalapine, juglandine, kousseine, leptandrine, lycopine, narceine, nitrate of pilocarpine, phosphide of zinc, piperine (pepper), quassine, scillitine, tannate of cannabine, tannate of pelletierine, valerianate of caffeine.

Containing $\frac{1}{6}$ gr.: Benzoate of ammonia, benzoate of lithia, benzoate of soda, bromated camphor, bromhydrate of quinine, carbonate of lithia, croton-chloral, diastase, emetine (ipecacuanha), ergotine, helenine, hypophosphite of lime, kermes, lactate of iron, pepsine, phosphate of iron, podophyllin, protoiodide of mercury, salicylate of lithia, salicylate of quinine, salicylate of soda, salicylic acid, santonine, sub-nitrate of bismuth, sulphate of quinine, sulphate of sparteine, sulphide of calcium, tannic acid, valerianate of iron, valerianate of quinine, valerianate of zinc.

These remedies being in most cases the active principles of the remedies named under the head of the symptomatic indications may be prescribed upon the same indications.

A cardinal principle of dosimetric practice may be said to be to acute diseases, acute treatment; to chronic diseases a

chronic treatment; that is to say, in the case of acute disease the treatment must be active, the remedy being given according to the severity of disease and the resistance of the patient, sufficiently often, every quarter, half, or hour, to obtain the desired effect.

DROPSY, GENERAL.—Dropsy is only a symptom or pathological condition, though often a very important one, associated with certain general or local diseases. It consists in an accumulation of serous fluid, which has escaped from the blood vessels, either in the subcutaneous or submucous cellular tissue, in serous cavities, or in the cellular tissue of certain organs; or it may occupy all these parts at the same time. Dropsy of the subcutaneous cellular tissue, if at all extensive, is named anasarca; if localized, œdema; hydrothorax signifies accumulation in the pleuræ; hydropericardium, in the pericardium; ascites, in the peritoneum; hydrocephalus, in the ventricles of the brain or arachnoid cavity; dropsy of organs is termed œdema, *e. g.*, œdema of the lungs. When dropsy involves both the subcutaneous cellular tissue and serous cavities, it is said to be general.

Certain morbid conditions which are known as spurious dropsies, but which really have no pathological relation to dropsy, include ovarian dropsy, which is a cystic disease of the ovary; accumulations of fluid in the interior of hollow organs, as the result of obstruction at an orifice or of inflammation, such as dropsy of the uterus (hydrometria), or of the gall-bladder; certain serous effusions consequent upon inflammation, *e. g.*, hydrocele, and acute œdema of the glottis; dropsy of the kidney (hydro-nephrosis), which is either due to cystic disease, or, more frequently, to obstruction of the ureter and consequent accumulation of urine and products of inflammation within the pelvis of the kidney, which gradually destroy this organ.

Ætiology.—A dropsical accumulation is the immediate result either of excessive flow of fluid out of the vessels; of deficient absorption; or of both combined; in short, the balance between exhalation and absorption is in some way disturbed. This derangement may be due to the following pathological conditions:

1. Overdistention of the vessels in the

different forms of congestion, but especially that dependent upon mechanical interference with the return of blood through the veins, is one of the most common causes of dropsy, which is then due both to an excessive escape of fluid from the vessels and to their diminished power of absorption. Obstruction to the circulation on the right side of the heart thus causes more or less general dropsy, beginning in the feet and ankles and extending upward, which may also follow serious impediment in the lungs. Obstruction on the left side of the heart leads to œdema of the lungs, because the pulmonary vessels are then distended. Any local obstacle may originate limited dropsy. Thus interference with the portal circulation is followed by ascites; a clot in the principal vein of the arm or leg, or external pressure upon it, will give rise to œdema of the corresponding extremity. Hydrocephalus is chiefly the result of pressure upon the small veins returning the blood from the ventricles of the brain. Gravitation necessarily influences much the seat of the congestive form of dropsy, and may itself induce it under certain conditions. Active congestion does not give rise to any great amount of dropsy, as a rule, but it often causes local œdema.

2. A feeble and relaxed state of the vessels and tissues, in consequence of which the former readily yield and allow transudation of fluid, often aids in the production of dropsy. The œdema of the feet and ankles which is met with in many cases of general debility is partly due to this cause, being assisted by the weakened cardiac action, which induces mechanical congestion.

3. An unhealthy condition of the blood may occasion dropsy, especially if this fluid is very watery, deficient in albumen, or impregnated with certain morbid materials, such as urea. Under these circumstances its liquid portion more readily transudes through the walls of the vessels. This cause often aids materially in the production of all forms of dropsy, but it is most important in connection with the anæmic and renal varieties.

4. It is highly probable that a deficient power of absorption on the part of the lymphatic vessels assists in giving rise to dropsy in some instances. Possibly this may exercise an influence in many cases of cardiac dropsy, the chief lymph-ducts

being unable to empty themselves into the distended veins.

Such being the immediate pathological conditions which explain the occurrence of dropsy, and which are often more or less combined, its more obvious causes may be thus summed up :

1. Any cardiac disease that interferes with the circulation of the blood, and leads to overflowing of the veins and capillaries. The most important are affections of certain of the orifices and valves of the heart ; dilatation of its cavities ; and degenerations of its walls, with consequent weak action. The heart may also be displaced or pressed upon by morbid conditions external to it.

2. Affections of the lungs impeding the circulation. When acute bronchitis complicates extensive emphysema, considerable dropsy may follow. Pulmonary affections also not uncommonly aggravate cardiac dropsy.

3. Diseases of the kidneys attended with deficient elimination of water and urea, but allowing the escape of albumen in the urine. As a consequence the blood is impoverished and impure, and the vessels are overdistended. Scarlatina demands special mention in this connection as a cause of dropsy, as this symptom then generally depends upon acute renal inflammation.

4. Disease of the liver or any other morbid condition causing obstruction to the portal circulation. This is a local variety of dropsy, resulting from mechanical congestion.

5. Exposure to cold and wet, or anything occasioning a chill. This cause is generally supposed to act by driving the blood inward, and inducing active congestion, the resulting dropsy being named active or febrile. It chiefly acts, however, by checking elimination by the skin, and at the same time giving rise to congestion of the kidneys, these organs being consequently unable to perform their functions properly ; hence the vessels become overloaded, and the fluid portion of the blood transudes.

6. Any local obstacle in connection with a particular vein. Local dropsy is not uncommonly due to this cause, resulting from the pressure of a pregnant uterus, ovarian and other tumors, or aneurisms ; as well as from inflammation of veins, varicose veins, and thrombosis.

7. Gravitation of the blood into de-

pendent parts. Prolonged standing may of itself lead to dropsy, especially if the blood is watery, and the tissues are wanting in tone.

8. Causes which impoverish the blood. Dropsy may be induced by a want of proper diet, especially if combined with other unfavorable hygienic conditions ; hemorrhage or excessive discharges, either natural or morbid ; and various acute or chronic diseases, such as fevers, especially malarial, phthisis, cancer, splenic disease, scurvy, purpura, and other lowering affections.

9. Certain conditions leading to active congestion. Dropsy occasionally follows the rapid disappearance of chronic skin diseases, or the sudden suppression of habitual discharges, and is then believed to result from active congestion. This may also be due to the irritation of some morbid deposit, such as tubercle or cancer ; and it accounts for the œdema often observed in the neighborhood of inflamed parts.

Anatomical characters.—The seat and extent of dropsy, as well as the quantity of fluid accumulated, vary considerably in different cases. Dropsical fluid presents the following characters : It is almost always thin and watery ; either quite colorless or light yellow as a rule, but sometimes tinged by the coloring matter of the blood or of bile ; clear and transparent, or rarely opalescent ; usually varying in its specific gravity from 1008 to 1012 or 1014. Its reaction is generally alkaline, but occasionally neutral or slightly acid. Chemically it is allied to the serum of the blood, consisting of water holding in solution albumen, alkaline, and earthy salts, especially chlorides and extractive matters, but the proportion of these ingredients varies much in different parts and in different cases, especially the amount of albumen, and the composition is never identical with that of blood serum, the proportion of solids being much less. Fat, especially cholesterin, fibrin, or pigments is sometimes present, and urea may be found in one special form, viz., in renal dropsy.

Symptoms and course.—As a rule dropsy comes on more or less gradually, but sometimes its progress is extremely rapid, and it may extend over the whole body in a few hours. It usually appears first and is most abundant in dependent parts, especially such as are distant from

the heart; in those which are exposed; or in regions where there is much loose cellular tissue. It is liable to vary with position, being necessarily influenced by gravitation.

The objective signs of anasarca or œdema are swelling of the affected part, and superficial pitting on pressure, the skin being generally pale, but sometimes congested. The degree of enlargement varies much; it may be so great as to cause the skin to assume a tense, shining aspect, or even to burst or slough. The vitality of dropsical tissues is impaired, and hence they are very liable to erysipelatous and other forms of low inflammation, either spontaneously or from slight irritation. When fluid accumulates within serous cavities, it may or may not produce evident enlargement, but its presence can be made out in most cases by certain "physical signs," to be hereafter described. The subjective symptoms accompanying dropsy of external parts are more or less discomfort or uneasiness, and a feeling of tightness or stiffness, but no actual pain or tenderness is experienced. An accumulation of dropsical fluid interferes mechanically with organs, and may thus cause most serious disturbance of their functions. In certain parts it may lead to a rapidly fatal issue, as, for instance, when there is œdema in the neighborhood of the glottis.

The general symptoms will necessarily vary according to the cause of the dropsy. If it is at all considerable in amount, the normal secretions are as a rule deficient in quantity.

Diagnosis is usually not difficult, but the chief point in diagnosis is to make out its cause. In order to ascertain this, it is necessary to inquire into the history of the patient; to observe what other symptoms are present, both local and general; and to examine carefully those organs, diseases of which are known to occasion dropsy. Much help may be derived from a consideration of certain facts with regard to this particular symptom, viz.:

1. *Its place of origin, seat, and extent.*—Cardiac or pulmonary dropsy begins in both feet and ankles and extends upward, ultimately becoming more or less general. Ascites only follows after the circulation through the liver has been for some time obstructed. Renal dropsy frequently starts in the face and upper part of the body, especially about the eye-

lids, where there is much loose cellular tissue, and in the hands, because they are exposed. It may rapidly spread over all the body, and involve all the serous cavities, though not usually to a great extent. Hepatic dropsy is confined to the peritoneal cavity at first, because the portal system is alone interfered with. The abdomen may become considerably distended before any dropsy is observed elsewhere, but in most cases after awhile anasarca of the legs sets in, in consequence of the pressure exercised by the fluid upon the vena cava inferior. Anasarca of the legs and ascites may appear simultaneously, should there be any pressure upon the inferior cava just before it passes through the diaphragm. Anæmia never causes much dropsy; it is always limited to the subcutaneous tissues; and is usually only seen about the feet and ankles, or in the loose tissue of the eyelids. Local dropsy, as, for instance, œdema of one leg or arm, always indicates some local obstructive cause. Rarely the superior cava is pressed upon, and dropsy of the upper part of the body is one of the consequences.

2. *Its rate and mode of progress.*—Cardiac dropsy is generally slow and gradual in its progress, liable for a time to some variation according to position, but ultimately this does not influence it much. It may increase rather quickly in consequence of some acute pulmonary complication. Renal dropsy, if acute, may be extremely rapid in its course, in some cases producing enormous enlargement of the whole body and obliterating the features in a few hours. This is the only form of dropsy in which such a mode of progress is observed; may also disappear in the same rapid manner. Hepatic dropsy usually progresses slowly and steadily. That of anæmia comes and goes easily, being often present about the feet in the evenings, but disappearing with a night's rest, while the eyelids are puffy in the mornings.

3. *The appearance of a dropsical part* may assist the diagnosis. Thus, in some cases of renal disease, the skin presents a very peculiar dull, white, pasty aspect. In cardiac dropsy signs of venous congestion are often present, the skin being shining and tense.

4. *Characters of the fluid.*—That of renal dropsy is of a very low specific

gravity, containing only a small quantity of albumen, and urea can in some instances be detected in it.

5. *The effects of treatment.*—The dropsy of anæmia is easily got rid of; the renal form can frequently be removed for a time or permanently by appropriate treatment; it is difficult to bring about absorption of cardiac dropsy, as a rule, if it is at all considerable in amount, and it is liable to return speedily.

Prognosis.—The chief questions with which the prognosis of dropsy is concerned are its immediate danger to life; the probability of curing it permanently; and its temporary removal or alleviation. Caution should be exercised in giving an opinion, especially an unfavorable one, for cases which seem quite hopeless sometimes improve in a remarkable manner. The main data upon which the prognosis is founded, are: 1. The cause of the dropsy, and the possibility of removing such cause, special attention being directed to those organs which are so frequently accountable for this symptom. 2. Its seat; dropsy of some structures, *e.g.*, œdema of the larynx or lungs, being immediately dangerous to life; while in other parts it is very difficult to get rid of. 3. Its extent over the body, and the quantity of fluid accumulated. 4. Its duration and progress, acute and rapidly-spreading dropsy being highly dangerous, but at the same time often more easily dispelled than that which is chronic and steadily progressive. 5. The possibility of adopting appropriate treatment, and the effects resulting therefrom. This applies particularly to those active measures which have for their object the absorption of the fluid; much depending upon the strength of the patient and his ability to undergo the requisite treatment, as well as upon the state of those organs which are directly acted upon. 6. The condition of dropsical parts; there being more danger if their nutrition is obviously impaired, or if they are the seat of any form of low inflammation.

Treatment.—The objects to be kept in view in the treatment of dropsy are: 1. Its removal. 2. The prevention of its recurrence. 3. The prevention, as far as possible, of its injurious effects, if the fluid cannot be removed. The particulars of treatment must necessarily be governed by the cause of the dropsy and

the condition of the several organs, but there are certain general principles which need attention.

1. *Removal of the cause.*—As illustration, the relief of any pressure or constriction affecting a vein; or of an attack of acute bronchitis in cases of cardiac disease, which may seriously aggravate dropsy to this cause. It is highly important to attend specially to any organ a morbid condition of which is keeping up dropsy, and to try to cure the disease, or to render the organ capable of performing its functions, so far as this is possible.

2. *Attention to rest, position, and regulated pressure.*—Far too little heed is usually paid to the influence of rest and position in the treatment of dropsy. The part affected should, if necessary, be maintained continuously, and for a long time, in an elevated position. Much benefit may often be obtained by keeping the legs, if they are the seat of anasarca, on a level higher than the body; or by raising an œdematous scrotum by means of a pillow of cotton-wool placed underneath. Pressure is also very valuable in many cases if carefully and properly applied.

3. *Promotion of absorption of the fluid.*—This indication is carried out by employing diaphoretics, saline and watery purgatives or diuretics, so as to promote free secretion by the skin, intestines, or kidneys respectively, and thus to remove some of the watery portion of the blood.

The only diaphoretic that is of much practical value in the treatment of dropsy is some form of bath which promotes perspiration, such as the warm, vapor, hot air, or Turkish bath. Either of these may be used as frequently as circumstances require; and local baths may be employed with much advantage if the patient cannot sustain general baths. It is in the treatment of renal dropsy that they are most valuable, and especially of acute cases. An occasional bath is also useful in preventing this form of dropsy. Diaphoretic medicines are often given, such as ipecacuanha, antimony, spirits of niter, liquor ammoniæ acetatis, or citrate of potash, but they afford little or no assistance from their diaphoretic action in the removal of dropsy. Jaborandi might prove serviceable in some cases.

Watery purgatives are frequently highly efficient in relieving dropsy, but care must be exercised in their administration, as they tend to weaken a patient. The most important are extract of elaterium (gr. $\frac{1}{8}$ gradually increased to gr. $\frac{1}{2}$); jalap (℥j to 3j); and cream of tartar (3j to 3ij); the last two form a very effective combination. They may be given two or three times a week, or oftener if required. Other purgatives are employed, such as gamboge, veratrum, podophyllin, calomel, or croton oil, but these are much less admissible ordinarily, though they are occasionally serviceable.

Diuretics are most beneficial in some forms of dropsy. Those usually given are the nitrate, acetate, or citrate of potash or soda in full doses, freely diluted; cream of tartar in small doses; spirits of niter; infusion or tincture of digitalis, or the powdered leaf made up into pills with other ingredients; squill in the form of tincture or pills; spirits or infusion of juniper; infusion of fresh broom tops; or oil of turpentine. The balsam and resin of copaiba have been found efficacious in the treatment of some cases of ascites. The following pill will sometimes produce a good effect in relieving dropsy, given about every other night: R. Ext. elaterii, gr. $\frac{1}{8}$ to gr. $\frac{1}{2}$; pulv. scillæ, gr. $\frac{1}{2}$ to gr. j; pulv. digitalis, gr. $\frac{1}{2}$ to gr. j; ext. hyoscyami, gr. $1\frac{1}{2}$. M. fiat pil. Digitalis is also used as an external application, poultices of the leaves being placed over the abdomen, or the powder rubbed in, or fomentations of its infusion being employed. Gin or whisky freely diluted undoubtedly acts as an efficient diuretic in the treatment of some cases of dropsy.

4. *Removal of the fluid by operation* includes: 1. Paracentesis or tapping of serous cavities, especially to be adopted in certain cases of ascites. 2. Acupuncture or scarification of the skin, or the introduction of small canulæ into the subcutaneous cellular tissue, in cases of anasarca. It is generally quite sufficient to make several superficial punctures with an angular needle in dependent parts, repeating them as often as may be required, and taking care that the punctured spots are not inflamed by urine or other sources of irritation. Dr. Southey has, however, introduced a really useful and efficient mode of treatment which is applicable to

many cases of anasarca, namely, the introduction through the skin of small canulæ by means of a trocar, these being left in after the withdrawal of the trocar, so that the dropsical fluid may drain away through them, a drainage-tube being attached to each canula. By this method a considerable quantity of fluid is often rapidly removed.

5. *Improvement of the condition of the general system and blood.*—Treatment directed to the object is generally of much service, and it may be the chief thing called for, as in cases of dropsy due to anæmia. The digestive and nutritive functions must be attended to, as well as the diet, which should be of a nutritious character, without much liquid. All hygienic conditions must be properly regulated. Tonics are often indicated, and above all some preparation of iron, especially the tincture of the perchloride, which has a marked influence upon the composition of the blood.

6. *Prevention of irritation of dropsical parts.*—It is important to keep all external dropsical parts clean and dry; to prevent them from being unduly pressed upon; and to ward off all other sources of irritation.

FREDERICK T. ROBERTS.

In general dropsy oxydendrom, given in the tincture, commencing with one drop in the morning, two at noon, three at night, thus increasing the dose by one drop at each repetition until eighteen drops are taken at one time, then decreasing in the same ratio, one drop at a time, is reported to have effected numerous cures.

Symptomatic Indications.—*Apocynum* can rapidly restores the urinary secretion, and is valuable in many forms. It is especially indicated by a sinking sensation at the pit of the stomach. *Apis mel.* is indicated in dropsical conditions, by rapid swelling of the part, and absence of thirst. It is useful in dropsy complicated with stranguary and urinary diseases, in febrile dropsy after a chill, after peritonitis and pleurisy and after scarlatina and diphtheria. In cardiac dropsy, œdema of the lungs, œdema of face, hands, and feet, anasarca, ascites from enlarged liver and spleen, *arsenicum* is a most valuable medicine. It is especially indicated when the dropsy is attended with debility, emaciation, depression, suffocative sensation, and intense thirst,

although drinking only small quantities. In recent febrile dropsy, associate with cardiac disturbance or organic cardiac disease *aconite* will frequently prove serviceable. In ascites of scrofulous patients, with disease of the liver, and in anasarca after intermittent fever, *aurum* will often cure when other remedies have failed. *Helleborus* is useful in many forms, after scarlatina, and in hydrocephalus, hydrothorax, etc. *Ferrum* is frequently useful in dropsy in anæmic or chlorotic females, anasarca from functional weakness.

DIURETICS are remedies which cause an increased secretion of urine. They effect this by their influence upon the vascular system, or by a more direct action upon the kidneys.

The former class comprises those which raise the blood pressure generally throughout the body, such as digitalis, squill, draughts of water, alcohol, scoparium, and the application of cold to the surface, and those which produce dilatation of the renal vessels. Squill and digitalis act in this way also; others are spirits of nitrous ether, belladonna, cantharides, and aconite.

Substances which have a more direct action upon the kidney cause diuresis either by the effect of an alteration in the composition of the blood on the renal epithelium, or by an influence upon the vessels. Salines act in both of these ways, while juniper, copaiba, turpentine, cantharides, and all the aromatic and volatile oils and resins act partly on the renal epithelium. In dropsy dependent upon cardiac failure, digitalis and squill are most useful, the other diuretics being more efficient in renal dropsy and in ascites from obstruction to the portal circulation. The action of diuretics is often much increased by the previous administration of a purgative and by the combination of several in one prescription.

DROWNING.—In the event of a dead body being found in the water, the following questions may arise: (1) Was the deceased alive at the time of entering the water? (2) If so, was death due to drowning? (3) If death occurred before submersion, to what was it due?

The most important *signs* of death from drowning are: the condition of the skin known as “cutis anserina” or

“goose skin;” froth at the mouth and nose; the presence of excoriations or abrasions of the skin; retraction of the penis; the presence, in the stomach and lungs, of water similar in character to that in which the body was found; the presence, in the hands or under the nails, of mud, gravel, sand, or weeds, taken up from the bottom in the death struggle. The other internal appearances may be those of asphyxia (engorgement of the right cavities of the heart, etc.) or of death from syncope.

When a body has remained but a short time in the water the skin will be pale and present the condition of “cutis anserina,” above referred to, produced by contraction of the muscles acting on the hair follicles. If the period of immersion be longer, a few days or so, the skin becomes white, swollen, and sodden, and gradually separates.

A person may fall into the water while suffering from syncope, epilepsy, or concussion, in which case some of the characteristic signs of death from drowning and of asphyxia will be absent.

In the case of a body being thrown into the water after death, in addition to the absence of the signs of death from drowning, some injury or other sufficient cause of death would be disclosed by the post-mortem examination.

It may be stated that, as a rule, it is extremely improbable that a person could survive entire submersion for two minutes.

In attempting to restore animation in a case of apparent death from drowning, the first thing to do is to clear the mouth and nostrils of any mucus or foreign body. The body should then be placed face downward for about half a minute, to permit any water to run freely out of the mouth. Artificial respiration by Silvester's method should then be performed, as follows: The patient is placed on his back, the person who is to perform the artificial respiration then grasps the arms near the elbows and slowly brings them up over the head, keeping them fully extended for about three seconds. He then brings them down to the side and compresses the thorax laterally at the same time. This is repeated about fourteen times a minute. It is extremely important that none of these movements should be at all hurried, in order that air may be gradually and regularly introduced into the thorax and squeezed out

again, after the manner of normal respiration. The body must as soon as possible be wiped dry and covered with dry clothes, and warmth applied to the extremities. Friction may be used to the extremities, and hot sponges applied over the heart at the same time. When spontaneous breathing has been established satisfactorily, hot drinks should be given and the patient put to bed and kept warm.

JOHN ABERCROMBIE.

DRY MOUTH (Xerostomia).—This condition is a definite clinical state, for which the term "Xerostomia" is an appropriate synonym.

Symptoms.—In all the cases the condition of the mouth has been the same. The tongue is red, devoid of epithelium, cracked, and absolutely dry; its appearance is like that of raw beef. The inside of the cheeks, the hard and soft palate are also dry, and the mucous membrane smooth, shiny, and pale. The salivary glands appear normal, and no obstruction can be detected in their ducts. The general health remains unimpaired, and it is interesting to observe that in no case has digestive disturbance been described. The urine is normal, and the absence of sugar has been expressly noted. From the absence of saliva speech is often difficult, and swallowing has to be assisted by constant sipping. In exceptional cases, dryness of the pharynx, diminished secretion from the nose, arrest of the lachrymal secretion, dryness of the skin, and falling out of the teeth have been noted. The disease reaches its greatest intensity rapidly, sometimes suddenly, and then remains without change for years. This condition of dry mouth is clearly not dependent on gross change in the salivary glands, but should probably be ascribed to some persistent functional disorder of the nerve apparatus. The fact that the secretion of all the salivary glands, as well as the buccal glands, becomes arrested, strongly suggests the existence of a general controlling nervous center.

All the subjects hitherto have been women, and most of them were between the ages of fifty and sixty-five; in one instance, however, the onset occurred at the age of twenty-three. In three recorded instances the disease began suddenly, being preceded in two by severe mental shock.

Treatment.—Much benefit follows the use of the tincture of jaborandi in doses of 30 or 40 minims three times daily. Pilocarpin also is useful, but less so than jaborandi. Iodide of potassium has been recommended; mercury, quinine, steel, and opium have been tried ineffectually. The application of glycerine to the mouth is of decided value in relieving the local discomfort.

W. B. HADDEN.

Symptomatic Indication, Hyoscyamus.

DUODENUM, ULCER OF THE.

—**Acute duodenal ulcer** is an occasional sequela of extensive burns or scalds of the surface of the body, but the statements of authors vary greatly as to the relative frequency of its occurrence. Probably a large number of cases recover or give rise to no symptoms. If symptoms show themselves during life, they generally do so between the seventh and twenty-first days, and the condition may prove fatal, especially by perforation, up to the sixtieth day. Acute ulcer has also been observed as the result of exposure to extreme cold.

Chronic duodenal ulcer is a more common condition, and one about which little information is usually provided in text-books. It may result from chronic duodenitis, from the presence of ascarides, and possibly from syphilis, while it is occasionally associated with pulmonary tuberculosis. It may occur, like the majority of gastric ulcers, in connection with anæmia in young women, but far more frequently it is found in older persons of the male sex and of alcoholic habits. Its usual seat is the first part of the duodenum, where the acid gastric juice comes in contact with the wall of the viscus, the nutrition of a part of which is presumably defective. Below the opening of the biliary and pancreatic ducts, where the acid is neutralized, ulcer is of extremely rare occurrence. The ulcer may be situated on the anterior or posterior wall, the symptoms varying accordingly. The pathological appearances, and the theories evoked to account for their development, are the same as those of gastric ulcer, to which reference may be made.

The *symptoms* are generally very obscure, often entirely absent, and when present sometimes indistinguishable from those of gastric ulcer. Pain is, however, generally less acute, the food not being

submitted to the same churning movement as in the stomach; it follows the ingestion of food at a longer interval, often two or three hours after meals, and, if evoked on pressure, is so more to the right of the middle line. Sometimes an indistinct sense of resistance or thickening may be detected on palpation. The presence of altered blood in the motions in considerable quantities in connection with such symptoms, and without true gastric symptoms, is often suggestive. If situated on the anterior wall, perforation and rapidly fatal peritonitis often ensue. In the majority of cases, however, cicatrization occurs, with contraction; the pylorus is often thus involved, and may even finally be obliterated, the duodenal symptoms being merged in those of dilatation of the stomach (*q. v.*), or the stomach and the part of the duodenum in front of the contraction may be thrown into one, the pylorus being widely dilated. Adhesions may form with the liver, gall-bladder, pancreas, or other surrounding organs, into which the erosive process may extend deeply, while fatal hemorrhage may occur from the pancreatico-duodenal or hepatic arteries, from the portal vein, or even from the abdominal aorta. Thrombosis of the portal vein has also been observed. Periduodenal and peri-hepatic abscesses often form, and may rupture either into the peritoneum or through the diaphragm into the pleura. Obliteration of the choledic duct results in persistent jaundice, the distention of the bile ducts throughout the liver, and multiple hepatic abscesses.

The *treatment* must be on the same lines as for gastric ulcer. Possibly a certain number of cases giving rise to obvious gastric dilatation, if seen before the patient is too exhausted, would be favorable subjects for Loretta's operation of digital distention of the pylorus, or for gastro-duodenostomy—an operation which consists in uniting an opening in the stomach to one in the third part of the duodenum. J. J. PRINGLE.

DUODENITIS.—See ENTERITIS.

DURA MATER, FUNGUS OF.

A tumor springing from the dura mater and pressing outward through the cranium; simple and malignant forms; the thinned skull may be felt crackling over the tumor after it has pressed its way

through, and the tumor pulsates with the respiratory movements like the brain. Before the tumor appears externally, there are usually signs of intracranial pressure, *e. g.*, diplopia, or even convulsions.

Prognosis.—Eventually fatal, without treatment; very unpromising with.

Treatment.—Moderate compression gave relief in some cases. In suitable cases expose tumor by a crucial incision; enlarge opening in skull, if necessary, with trephine, and remove tumor from dura mater, if possible. It is next to impossible to diagnose, before operating, whether similar tumors spring from the dura mater or from the cranium itself.

Dura Mater, Irritation of.—Injuries of the head which cause this produce symptoms such as contractures and convulsions on the same side of the body. A very severe case of this affection recovered under cold douche.

C. B. KEETLEY.

DYSÆSTHESIA.—See HYPERÆSTHESIA.

DYSENTERY is an acute specific disease of the large intestine characterized by inflammation and necrosis of the mucous membrane, by tormina and tenesmus, and by the passage of scanty, non-feculent mucous or blood-stained stools.

The disease is endemic in most tropical and subtropical countries; sporadic cases are also rarely observed in temperate climates, and hence the specific nature of the disease has been questioned.

First stage.—The earliest symptoms of an attack of acute dysentery are loss of appetite, furred tongue, constipation alternating with diarrhea, malaise, evening pyrexia, and chills.

Second stage.—The pyrexial symptoms grow more marked after three or four days, though the temperature is never much raised (100° F.); colic becomes troublesome, and the lower bowel, unless diarrhea has been considerable during the premonitory stage, is emptied of its feculent contents. As the disease develops, colic becomes more painful and recurs more frequently; there is constantly recurring desire to go to stool, and the patient suffers severely from burning pain in the rectum.

Third stage.—The attacks of abdominal pain and the rectal pain and

burning become more frequent and severe, and the calls to defecation do not cease; in the intervals between the attacks of colic, localized tenderness, but no tumor, can be made out; the pulse, which has been gradually increasing in frequency, is now very rapid and weak; there is much depression and exhaustion, and the patient not infrequently faints at stool. Thirst is constant and distressing. The urine is small in quantity, loaded with lithates, and passed with pain and difficulty, or there is retention. The straining at stool is only effectual in passing small quantities of bloodstained mucoid or gelatinous material of a non-feculent character, but having a peculiar odor.

Fourth stage.—All the above symptoms are aggravated, and a rigid contraction of the abdominal muscles is a notable symptom; the stools are now more copious, contain larger masses of bloodstained mucoid material, and have the peculiar offensive sickly smell very pronounced; they sometimes contain pus, or the mucoid material has a peculiar appearance resembling boiled sago.

Fifth stage.—The symptoms of nervous prostration become greater, the heart's action and the pulse feebler; the features are pinched; the whole body shrunk, and often covered with a cold sweat; the tongue is brown and dry; portions of sloughing tissue may be found in the stools, which are horribly offensive; hemorrhage is generally present and may be considerable, greatly increasing the general prostration; abdominal tenderness and rigidity of the abdominal muscles are very marked, and a soft doughy tumor may be felt in the course of the colon. The patient sinks into a drowsy, dull state, and dies from asthenia; or the fatal issue may be hastened by perforation of the intestine and consequent peritonitis.

Sixth stage.—The sloughing may be very extensive, so that the sloughs become gangrenous, very large areas or almost the whole of the mucous and sub-mucous tissues being detached; the general prostration is intense, but the colic and tenesmus, which had previously been severe, cease; the abdomen becomes tympanitic, but not tender; everything taken by the mouth is rejected, the features are pinched, the tongue brown and cracked; the prostration deepens

into collapse like that of cholera, or low delirium ensues, and the patient dies after a few days. The stools at first contain mucus, detritus, and bloodstained gelatinous material, but later are watery, black (the so-called "meat washings"), and have a very offensive gangrenous odor.

The symptoms have been for convenience described in six stages, but no case runs through them all; the first two stages are generally to be distinguished, but vary much in duration; the third and fourth may be hurried through, the patient passing into the fifth or sixth in two or three days; the fifth stage may be well established at the beginning of the second week, the sixth at the end of the first week.

The *diagnosis* from ordinary diarrhea rests chiefly on the gravity of the general symptoms, but especially upon the acute suffering caused by the frequent attacks of colic, and by the extreme rectal burning and straining; in a later stage the character of the stools gives assistance.

Prognosis.—The absence of complications (of the liver especially), a good pulse, moderate tormina and tenesmus, a pallid expression, absence of extreme offensiveness of the stools, and the early reappearance of feculence are favorable signs. The unfavorable symptoms are persistent fever, quick or feeble pulse, dry brown tongue, severe tormina and tenesmus, sudden cessation of severe tormina, increase of putrescence of the stools, the appearance of gangrenous material, and the onset of complications. The previous state of health of the patient and the stage of the disease at which he comes under treatment are important points greatly affecting the prognosis, favorably or otherwise. Abscess of the liver is frequently observed after dysentery, and enlargement of the liver and of the spleen, malarial fever and scurvy are common complications.

Pathology.—The essential lesion appears to be an acute inflammation of the whole glandular structure of the mucous membrane of the large intestine; the condition in any given case will vary with the stage and intensity of the inflammation. The first changes are those common to catarrhal inflammation in any situation, and there is conspicuous swelling of the solitary glands; the mucous membrane is injected in patches and

streaks, the summits of ridges and folds being particularly affected. The surface is covered by mucus streaked with blood. Inflammatory exudation then occurs; the mucous membrane becomes thickened and reddened, and the solitary glands, distended with "gelatinous mucus," stand out white and shot-like, surrounded by a red ring: the submucous tissue is greatly swollen, and the muscular coat also may be involved. The infiltration of the mucous membrane with leucocytes continuing, ulceration occurs; this takes place first over the solitary follicles, small apertures being formed, through which, in time, the gland is discharged as a slough. The large ulcers formed by surface disintegration of the mucous membrane deepen, their yellow floors being formed of the thickened submucous tissue as a rule, but sometimes by the muscular or even peritoneal coat; in the latter event perforation may readily occur. The ulcers may have any form, and their longest diameter may be in any direction, but it is not uncommon to find them encircle the gut. The exudation may be sufficiently rapid to destroy considerable areas of mucous membrane, which then become detached as sloughs, leaving large, irregular, generally transverse ulcers of a gray or yellow color. In the most acute form of the disease there is a remarkable thickening of all the coats of the intestine (the "diphtheritic form" of German writers), which feels firm and massive. The whole is not affected to an equal degree, so that folds and grooves are formed, or the thickening may be at first in patches. Where it is well marked, the intestines offer a solid resistance to the knife; its color varies with that of the intestinal contents, and is generally yellow-gray, green, or black. The *microscopic changes* are extravasation of blood, and copious fibrinous and cellular infiltration into all the tissues. Gangrene eventually occurs; the eschars break down into shreds and scraps, the ulcers left being ragged, and of a dark olive or brown color. The "diphtheritic form" appears to be identical with the gangrenous dysentery of Indian writers. In this form the lower part of the small intestine is liable to be involved, as is also the case in severe catarrhal inflammation going on to ulceration, but even in the most severe cases the morbid changes may be entirely confined to the

large intestine. The ileo-cæcal valve may be destroyed, and the small intestine may then be invaginated into the large, and lead to acute obstruction. Recovery may take place by resolution in the early catarrhal stage before ulceration; afterward, by granulation and cicatrization, leaving, generally, much long-persisting thickening.

Ætiology.—Dysentery is related on the one side to malarial fevers, and on the other to diarrhea. It occurs especially in districts where malarial fevers are common, and disappears as they disappear. The connection is probably twofold: *i. e.*, the conditions which favor the occurrence of malarial fevers in communities also favor dysentery, and the condition of ill-health produced in individuals by malarial poisoning renders those individuals peculiarly prone to dysentery. Contamination of the drinking water with feculent matter, perhaps with matter derived from previous cases of dysentery, appears to be the most frequently operative determining cause; brackish water favors, if it cannot produce, the disease. Its prevalence is favored by a high air temperature, and is stopped by frost, but a climate presenting great fluctuations of temperature is peculiarly dangerous. This may explain the frequency with which the disease has prevailed to a serious extent in some parts of Germany, in Sweden, Norway, and even Iceland. It is not in any special sense a disease of towns, but rather the contrary, and is particularly apt to break out among troops engaged in campaigns; coarse, bad, ill-cooked, and, therefore, irritating food, is a factor of only less importance than bad water, and the combination of these two evils explains its importance as a "war pestilence." As a rule, the prevalence of the disease is very limited in extent, and it may be said to coexist at many foci rather than to prevail over large tracts of country. Rarely, and for the last quarter of a century with increasing rarity, it has spread epidemically, and has thus caused a serious mortality in Germany, France, England, and Ireland.

The personal habits or conditions of health which predispose to dysentery are chronic alcoholism, chronic constipation (probably from the irritating effect of the hardened fæces accumulated in the colon), malarial poisoning, and new arrival in an

endemic district. Surface chill from exposure to cold and damp, especially after exertion, is often the immediate determining cause of an attack. The evidence is against the disease being contagious, but, on the whole, in favor of its being communicable through water or food. It may occur at any age.

Sporadic Dysentery, as observed in temperate climates, is generally of a comparatively mild type, but does not otherwise differ from the tropical endemic form of the disease.

Chronic Dysentery often follows an acute attack.

Symptoms.—The appetite is capricious; the tongue clean, red, and glazed; there is abdominal tenderness and often masses of thickening may be felt. The patient suffers from painful colic and, if the descending colon and rectum be involved, from tenesmus. The stools are loose, and mucus, blood, or purulent matter is mixed with the fæces.

Diagnosis.—Anal fissure and rectal ulcer are liable to be confounded with chronic dysentery, and sometimes exist as complications. In other cases an attack of acute dysentery is followed by cicatricial contraction of the gut, leading to chronic constipation or to obstruction.

Treatment.—If a case of *acute dysentery* can be controlled from an early stage, the results of treatment are, on the whole, more satisfactory than in most other diseases of like severity; this is owing to the almost specific action of ipecacuanha. The patient is put to bed, and from 20 to 30 grains of powdered ipecacuanha, suspended in syrup of orange peel, are given in a small quantity of water; for the next three hours nothing else must be taken, but, if thirst be distressing, a little ice may be sucked. Nausea is generally experienced in an hour or two, and sometimes the patient vomits after two hours; if vomiting should occur earlier, so that the ipecacuanha is returned, 30 minims of tincture of opium may be given, followed by a fresh dose of ipecacuanha in half an hour. It is, however, undesirable to repeat the opium, and the ipecacuanha may preferably be given with bismuth, carbonate of sodium, camphor, chloroform, or hyoscyamus. The second dose is given eight, ten, or twelve hours after the first, and is rather smaller. When the first dose is given, a poultice or turpentine stupe should be applied to the abdo-

men, or a sinapism over the epigastrium. The dose for an infant of six months is 1 grain; of one year, 2 grains; and 1 grain more for each additional year of age. Pregnancy is not a contra-indication; severe dysentery, if unchecked, usually causes a pregnant woman to abort, and death almost invariably ensues. The ipecacuanha is repeated night and morning until the tormina and tenesmus cease and the stools begin to be feculent.

During this period the diet should consist only of chicken, mutton, or veal broth, meat jellies, and arrowroot or sago, with, as a stimulant, port wine or brandy. When dysentery is complicated by malaria or is suspected to be so, 10 to 20 grains of quinine should be given at the commencement of the treatment, and subsequently doses of 10 grains in the intervals between the ipecacuanha. The malarial complication is said to be frequently responsible for vomiting when it occurs after ipecacuanha. In mild cases, a hot bath, followed by rest in bed, a few doses of ipecacuanha (grs. xv to xx); and subsequently, a draught containing castor oil (3 j to 3 ij) and opium may suffice.

In *chronic dysentery*, the first indication is change of air—in tropical cases, to the temperate zone. Woolen clothing must be worn, especially over the abdomen; the diet must be very bland and unirritating—often a milk diet for some time will be best. In bad cases, irrigation of the bowels with large quantities of a solution of nitrate of silver (3 j to Oj) or alum may be efficacious. Even in the acute stage ice-water injections, with or without an astringent, have been advocated; about 3 or 4 pints will be required, and the injection must be suspended when pain comes on, and be resumed when it passes off. DAWSON WILLIAMS.

Symptomatic Indications.—The most generally useful remedy is *mercurius cor.*, especially indicated when the evacuations are bloody, mucous, with severe tenesmus after stool. *Nux vomica* is frequently indicated; the evacuations are small, frequent, with violent tenesmus which ceases after the stool. *Arnica* is valuable when there is much tormina, tenesmus, and hemorrhage; tenesmus of the bladder. The discharges are slimy and purulent, also when the vital powers are greatly depressed. *Arsenicum*, when the disease is attended with great prostration, intense thirst for small quantities of

water, burning pains. Also in chronic dysentery. *Ipecacuanha* in fall dysenteries, bilious type, violent tenesmus and colic, and in summer dysentery of children, greenish stools, mucus, and blood. *Aconite* may be useful in early stage, with febrile symptoms. *Hamamelis*, when the stools contain much blood. *Podophyllum* is one of the best remedies for dysentery in children, particularly when attended with prolapse of the bowel.

DYSMENORRHEA.—Any kind of pain which recurs once a month, and appears to depend on menstruation or ovulation.

1. Obstructive dysmenorrhea.—It has been maintained that not only in the majority, but in all cases, dysmenorrhea is due to mechanical obstruction, and that, owing to narrowing of the canal, the uterus has to contract more vigorously in order to force the blood past an obstacle, the pain being due to these violent contractions. There is no doubt that obstructive dysmenorrhea exists, as, after amputation of the cervix, gradually increasing menstrual pain may occur from progressive contraction of the orifice, which may ultimately produce complete atresia and retention of the menses. It may result from contraction of the cervical canal following the use of caustics, or from blocking of the canal by fibroid polypi, or cancer. Obstructive dysmenorrhea of this kind is rare, and does not date from the beginning of the menstruation. But it is also supposed that obstructive dysmenorrhea is common as a primary condition, dating from the establishment of menstruation, and that it is then due to stricture at either the internal or external os or flexion of the uterus, the canal being flattened at the point of flexion. The writer is not aware of any accurately measured case of stricture (*i. e.*, organic narrowing) of the internal os. A very narrow external os, so that it will only admit a No. 1 or 2 bougie, or not even that, is occasionally seen, and in most cases is not accompanied by any dysmenorrhea. Blocking of the uterine canal by flexion and dilatation of the uterine cavity behind the obstruction is sometimes seen in old women, in whom the uterine wall is thinned by atrophy; and also when the uterus is fixed in the bent position by adhesions, and therefore cannot contract properly; but it has never been found in

a uterus which was free to contract and had a wall of natural thickness. It is, therefore, very doubtful whether there is such a condition as primary obstructive dysmenorrhea; and it is quite certain that, if it exists, it is extremely rare. The pain in genuine obstructive dysmenorrhea does not reach a high degree of severity.

The *diagnosis* can only be made by physical examination. When an attempt is made to pass a sound, the canal is found to be blocked, and the sound cannot be passed. If a fine probe be forced past the obstruction, it is gripped, and its withdrawal is followed by escape of retained fluid.

The *treatment* is to open up a passage, either by dilating, or by cutting, or by removing that which is blocking the canal, according to the nature of the case; and, when this is done, relief at once follows.

2. Spasmodic dysmenorrhea.—This is a nervous disease; sometimes described under the name of "neuralgic" dysmenorrhea, but this term is better reserved for a different class of case.

The pain is due to spasmodic uterine contractions. It is frequently coincident with deficient uterine development, and this seems to point out the direction in which preventive treatment should tend. Pain of this kind generally dates from the beginning of menstruation, but may come on later, even after the patient has had many children, and in some such cases is due to fibroids. After it has been cured by dilatation, relapse may occur. When the disease has lasted long, ovarian pain is often added to the uterine pain, which gradually becomes longer in duration, until the patient is never free from pain. Should the patient marry early and become pregnant, the dysmenorrhea will probably be cured. But frequently it is associated with lack of sexual desire and enjoyment, and even repugnance to and pain in sexual intercourse, and with sterility. In that case, if the dysmenorrhea be cured, pregnancy may follow. This affection has been called by some "obstructive" dysmenorrhea, and ascribed to stricture or flexion of the canal. But there is no stricture; the proof of this being that at the height of the pain a No. 7 or 8 bougie may be passed without being gripped, and when withdrawn no blood follows. This form of the disease occurs quite as often in uteri that are straight as in those that are bent. It has been ascribed

to malformation of the cervix, the vaginal portion being conical and the os externum circular. These conditions are often met with in this disease, but in many cases they are absent, and the os externum is generally so large that if the hole were in a blood vessel the patient would bleed to death in a few minutes.

The *diagnosis* rests mainly upon the following points: (1) The exceeding severity of the pain. (2) The pain, although severe, is usually of short duration. (3) The pain is generally paroxysmal, depending on clonic contraction of the uterus, each paroxysm lasting a few minutes. But the contraction is sometimes tonic, and the pain continuous. (4) It is not localized in one spot, but referred to the back and lower abdomen generally. (5) It is not relieved by lying down. Lastly, the proof of the diagnosis is that the pain is cured by dilatation of the cervix. The pain, as a rule, either begins with the flow or precedes it by a short interval. It may occur in the menstrual interval, and not during the flow, but this is very rare.

The *prognosis* is more favorable than in any other form of dysmenorrhea except the obstructive. Cure is least likely in cases in which the disease occurs along with an imperfectly developed uterus.

Treatment.—Dilatation of the cervical canal is usually the best treatment. There are various ways of effecting this, but it is best performed with metal bougies. No. 6 can usually be easily passed, and then successive sizes can be introduced, one after the other, until a size is reached which is gripped by the canal. Each bougie should be left in until the pain caused by its introduction has subsided, which will usually be in two or three minutes; if the pain should not subside within ten minutes, the bougie should be withdrawn, and further dilatation desisted from. The patient should afterward keep her bed for the rest of the day. Those who practice incision of the external os for the relief of this condition generally combine with it some kind of dilatation of the os internum. But if there be distinct deformity of the vaginal portion, with narrowness of the os externum, it will be well to combine division of this part with dilatation of the os internum. If the dysmenorrhea be associated with ovarian pain, it is well to keep the patient in bed until the next period is over. In the experience of the

writer, about one-fourth of the cases of primary dysmenorrhea can be cured by dilatation alone. The best medical treatment consists in the administration of antipyrin, of which three doses of 15 grains each may be given, and of diaphoretics, such as liq. ammon. acet. $\frac{3}{4}$ j, or amm. chlorid. \mathfrak{D} j. or mist. guaiaci $\frac{3}{4}$ j. Hot applications to the hypogastrium and hot gin and water are popular domestic remedies. Opiates should on no account be given, nor should alcohol be recommended. If the disease be so severe as to interfere with the patient getting her living or fulfilling her social duties, and other treatment fail, it can be cured by removing the ovaries, which is preferable to teaching the patient to resort to opium or alcohol.

3. Membranous dysmenorrhea is due to the menstrual decidua, instead of undergoing disintegration, being shed in one or more large pieces, which obstruct the cervical canal, and so cause painful menstruation. This form is literally obstructive, but the obstruction is in the flow, and not in the uterus. The membranes shed usually show appearances of slight inflammation, and hence this disease is commonly regarded as a form of endometritis. Some cases are really instances of monthly abortions, their nature being shown by there being neither passage of membranes nor pain while the patient is leading a single life. The disease occurs at all periods of menstrual life in the virgin, the married, and the parous.

The *diagnosis* is made by finding the membranes. The affection is probably much commoner than is generally supposed, because, in the majority of cases, the patients are unaware that they pass membranes until they are asked to examine the discharge. Pieces of membrane can be distinguished from clots by their being, when unfolded (for they are usually passed rolled up), smooth on one side (the inner) and dotted with the openings of the utricular glands, while on the other (the outer) they are rough. In case of doubt, a microscopic examination should be made.

Treatment of membranous dysmenorrhea is unsatisfactory, and there is no treatment from which success can be predicted. Arsenic has been given, and perchloride of mercury sometimes succeeds. Intra-uterine applications generally fail to do good. The best treatment

consists in the use of tonics to improve the general health and increase the resistance of the nervous system to painful impressions. In the virgin local treatment should not be practiced. In the married the cervical canal may be dilated; this may relieve the pain, although it cannot be relied upon to cure the affection.

4. Ovarian dysmenorrhea is the form in which the pain is not in the uterus, but in the ovaries. This kind of pain may be due to ovulation, or to the general congestion of the pelvic organs which precedes menstruation. Nothing is known about the changes in the ovary that give rise to the pain. The characters of the pain are (1) it is localized, usually at a spot about two inches internal to the anterior superior iliac spine; (2) it is neither severe nor paroxysmal, but gradual in onset and subsidence, may last some days, and is usually described as "aching" or "burning"; remissions and exacerbations may occur; (3) it is relieved, but not altogether removed, by recumbency, and is aggravated by exertion, alcohol, and constipation.

The *diagnosis* is made by the characters of the pain, combined with tenderness in the situation of the ovary, either on pressure abdominally, per vaginam, or per rectum.

The *prognosis* depends chiefly on the duration of the disease. If of only a few months' date, it can generally be cured; if it have lasted for years, the prospect is unfavorable.

Etiology.—Its most common cause is child-bearing and lactation, together with depressed conditions of health, such as anæmia and nervous exhaustion. Among other causes are gonorrhea, the excessive use of alcohol, and morbid sexual excitement. Sometimes it remains after the acute exanthemata. It may be secondary to some disease of the uterus, such as spasmodic dysmenorrhea, retroflexion, or inflammation of cervix.

Treatment consists in the cure of any disease of the uterus that may be present, and the improvement of the general health by the removal of anæmia, if present, by iron, and by the promotion of appetite and sleep; rest in the recumbent position; laxatives; the avoidance of alcohol; counter-irritation to the iliac regions either by flying blisters or lin. iodi. Opiates should be avoided. If hypnotics be needed, the bromides are the best.

5. Intermediate dysmenorrhea is a term clinically useful to denote a class of cases in which there is pain, lasting a few days, which recurs regularly once a month, but not at the menstrual period. The characters of the pain usually warrant the belief that it is ovarian, and its monthly recurrence, that it is caused by the process of ovulation. There is evidence that the menstruation and bursting of Graafian follicles may take place at any time between two menstrual periods; and, therefore, if this process be painful, the pain may have any relation in point of time to the menstrual flow. The treatment of such cases is that of ovarian dysmenorrhea.

6. Congestive dysmenorrhea.—This term has been applied to more than one class of case.

(a) *Primary, or initial, congestive dysmenorrhea.*—This comprises cases of menstrual pelvic pain which do not fall under any of the preceding categories. The pain is not of great severity, not localized in either ovary, not paroxysmal, and is usually relieved by lying down. No membranes are found, and no abnormal condition is discovered on examination. In such cases, if the flow be scanty and the patient plethoric, leeches may be applied to the groin or perineum, saline laxatives given, and the recumbent position maintained. If the flow be profuse, the latter measures only are indicated.

(b) *Acquired congestive dysmenorrhea.*—This is a well-marked form, but not common in the virgin. A patient, who has previously menstruated without pain, after a chill or some disturbance of health, or perhaps without any obvious cause, finds menstruation getting more scanty and attended with increased pain. In such cases it is a reasonable hypothesis that the pain occurs because there is not enough blood lost to relieve the menstrual congestion.

The success of *treatment* bears out this view of the pathology. Recent cases—that is, of not more than six months' duration—can almost always be cured by local depletion. Four or six leeches should be applied to the cervix (or to the groin or perineum in a virgin). In the interval the patient should insert a glycerine pessary (gelatin grs. xx, glycerine ad 3 ij) night and morning, having first used a warm vaginal douche. Laxatives should be given. In quite a recent case,

relief will probably be complete. In cases of longer duration, the first depletion may only benefit for a short time, but after each subsequent abstraction of blood the freedom from pain will last longer. It is only in cases of very long standing that, when combined with rest, this treatment fails to afford relief.

(c) *Secondary congestive dysmenorrhea* includes those cases in which the pain is due to the aggravation of some morbid condition by the menstrual congestion. In uterine displacements, pelvic peritonitis, diseases of the fallopian tubes, vaginitis, hemorrhoids, movable kidney, and many other conditions are usually worse at the menstrual period. Investigation will detect its cause. The *treatment* is that proper for the disease underlying the complaint.

7. Neuralgic, or neurotic dysmenorrhea.—There is a class of patients in whom the nervous system is comparatively unstable, who are easily upset by trifling causes, are very sensitive to pain, and liable to neuralgias of all kinds. In them the vascular and other disturbances accompanying menstruation may evoke manifestations of nervous disturbance in remote parts, with or without pelvic pain. There may be headache, facial neuralgia, nuchal pain, epigastric pain with or without vomiting, intestinal colic followed or not by diarrhea, ocular symptoms, temporary mental derangement or emotional excitement. This form of dysmenorrhea is identified, first, by the irregular character of the morbid sensations, which are diffused, and not confined to the pelvis, and do not follow a regular type; and secondly, by the kind of patient in whom it occurs: *i. e.*, in weakly, nervous, anæmic, often badly developed subjects.

The only *treatment* that can do any good is of a kind beneficial to the nervous system—tonics, iron, change of air and scene, regular hours, and good food. Removal of the ovaries in such cases may sometimes stop menstruation, but does not remove the pain.

G. E. HERMAN.

Symptomatic Indications.—In the spasmodic form *gelsemium* is an excellent palliative. *Viburnum op.*, in spasmodic or neuralgic dysmenorrhea, is nearly specific. *Chamomilla* in neuralgic dysmenorrhea, particularly when the temper is much disturbed, pains unbearable. *Pulsatilla* in congestive dys-

menorrhea; the discharge is scanty, dark and clotted, with depression of spirits. *Aconite* in congestive form, plethoric subjects, bright red blood. *Belladonna* is often useful in neuralgic type, pains come and go suddenly. Also in the congestive, with profuse flow, congestion to head, and confusion of sight. *Cimicifuga* in women subject to rheumatism, neuralgic and congestive forms. *Borax*, in membranous form, has proved useful in 5 grain doses *ter die*. *Secale* in congestive form, with expulsive forcing pains, lumpy dark discharge. *Collinsonia* is recommended in membranous, when attended with hepatic disturbance.

DYSIDROSIS.—This is due to an inflammation of the sweat structures of the hands and feet. The patient may be found, in severe cases, with the hands held up to prevent their distention with blood, and wrapped up on account of their swollen, painful condition. This is an indication that the disease is clearly inflammatory and painful. Dysidrosis is characterized clinically at the outset by a certain amount of tumefaction and redness of the part affected, and the rapid development or distention of the sweat ducts, which look like small sago-grains imbedded, and at first not rising above the level of the skin. The sites affected, and generally symmetrically, are the sides and palmar aspect of the fingers, the palms, and often similarly the feet. There may also exist miliaria of the general surface. Unless the attack is excessively mild the parts soon become decidedly reddened, tender, and swollen, and they itch and burn. As the collected fluid, which is at first acid as it issues from the patent orifices but rapidly becomes mixed with serum and alkaline, increases in amount, the vesicles get larger and project above the surface, and then become confluent, finally forming large bullæ-like collections of fluid. The cuticle macerates and peels off, exposing a reddened hyperæmic surface, which, however, does not discharge like an eczema. The disease tends to run a definite course of one to three weeks, but the hand may remain considerably inflamed for some time. There is, however, a great tendency to the recurrence of the affection. It occurs more frequently in summer, and it especially attacks weakly persons who are the subjects of nerve debility. The patient

usually has a pallid look, and complains of weakness and debility.

Diagnosis.—The diseases which may be confounded with dysidrosis are eczema and pemphigus. It must be a very rare occurrence for eczema to be limited symmetrically to the hands and feet, and especially to their palmar aspects. Dysidrosis also lacks the prominent catarrhal features of eczema and the characteristic sero-purulent discharge. Pemphigus, with little or big bullæ, sometimes occurs limited, for a time, to the hands, but rarely, if ever, to the palms. The history of the evolution of the bullæ is quite different, the imbedded aspect of the vesicles in their early stage, which are seated at the sweat ducts, and the loculated appearance of the dysidrosis bullæ are peculiar. Drs. Tilbury Fox and Crocker, in an elaborate microscopic report upon portions of skin removed from a typical case in the earliest stage, have thoroughly established the connection of the disease with the sweat glands, which had been concluded from clinical facts. They found all of the tissues very hyperæmic, the sweat glands and ducts especially so, and exhibiting signs of inflammatory irritation. In the rete were found the vesicles filled with inflammatory products. They were in direct communication with the sweat ducts, and situated in the inter-papillary portion.

Treatment.—Diuretics should first be given, especially in gouty subjects or those in whom the urine is loaded or scanty, and these remedies should be followed up by tonics, such as quinine and iron. A cool regimen should be adopted, hot drinks and whatever increases perspiration avoided. If the body generally be affected with miliaria, alkaline baths may be prescribed. There should be great effort made to soothe the inflamed parts at the outset by wrapping them in some bland or oily substance such as Carron oil, and to subsequently use a slight astringent. Some patients affected by dysidrosis are very weak, and in such the disease may lapse into a semi-chronic state, and then a long course of tonic treatment, including quinine, mineral acids, and nux vomica, should be adopted.

DYSPAREUNIA.—Difficult or painful coitus may be due to areolar hyperplasia, imperfect rupture of the hymen, or

hyperæsthesia of the carunculæ myrtiformes, constriction in the vagina, disparity between the organs in the sexes, cervicitis, vaginal tumors, vaginitis, vaginismus, or ovaritis, which render the action excessively painful or altogether prevent it.

Diagnosis.—Concerns mainly the cause, which physical examination will usually detect.

Prognosis.—Depends upon the cause, being favorable as the cause can be found and removed.

Treatment.—Is that of the cause. If from imperfect rupture of the hymen, the remains should be completely and carefully dissected off, and Sims's vaginal dilator frequently used; if from constriction of the vagina, by the vaginal dilator; if from areolar hyperplasia; cervicitis, vaginal tumors; vaginitis; vaginismus; ovaritis; by treatment according to the case.

DYSPEPSIA, ACUTE.—Acute dyspepsia is generally traceable to errors in diet; it occurs at all ages; it is more frequent in dark-complexioned than in fair persons, and is especially frequent in the gouty.

The *symptoms* are headache—frontal, occipital, or general—anorexia, nausea, and vomiting. The tongue is coated or plastered, and the breath foul. Food cannot be retained. Occasionally there are chills, rigors, epigastric pain, and slight icterus. The vomited matters usually contain more less bile. The bowels are generally confined.

The *prognosis* is favorable; the affection usually subsides under appropriate treatment in a few days.

Treatment.—The administration of food must not be attempted till vomiting ceases. Then a breakfast-cupful of beef tea, alternately with the same quantity of milk, thin gruel, or arrowroot, should be given every three or four hours. A little toast may be allowed, but no other solid food; soda-water is permissible. The diet is to be extended cautiously, as the symptoms subside and the tongue clears. Alcoholic liquors are to be avoided. Pil. hydrarg. in doses of 3–5 grains, or 2–4 grains of calomel, should be taken at once, and mist. sennæ co. $\frac{3}{4}$ j–ij three hours later. If vomiting be troublesome, ac. hydrocyan. dil. m. iij, with sod. bicarb. grs. xx, should be given in $\frac{3}{4}$ j of plain water every six hours.

ISAMBARD OWEN.

DYSPEPSIA, CHRONIC.—This term is applied indifferently to all forms of chronic disturbance of the gastric functions which are not traceable to organic or reflex causes or to direct irritation.

These disorders are variously referred to chronic catarrh of the mucous layer, to enfeebled action of the muscular coat, to exaltation of sensation, to perversion of secretion, to the presence of abnormal ferments, to deficient action of the liver causing portal congestion, or to several of these causes combined.

The catarrhal forms are usually distinguished as “irritative” dyspepsia; those thought to be due to enfeebled action of the muscular coat or secreting glands, as “atonic” dyspepsia.

Symptoms.—Sensations in the epigastrium, varying from slight uneasiness and a sense of “sinking” to “weight” or “fullness” or to actual pain, which often extends to the interscapular region. These sensations usually commence from a few minutes to a few hours after taking food, and pass away as the stomach empties itself, but sometimes are constant throughout the day, and in some cases most acute when the stomach is empty, food bringing relief. The appetite is usually diminished, the tongue swollen or reddened, and covered with a slight white fur. The patient is generally languid and depressed, his temper irritable, and he is troubled with eructations. It is less usual to find the pain localized in the mid-sternal, cardiac, hepatic, splenic, or umbilical region. Flushing of the face after meals, oppression of breathing, palpitation of the heart, and headache, usually occipital, are sometimes complained of; nausea, retching, and vomiting are not infrequent. A somewhat rarer manifestation of the disorder is a craving for food at a time when the stomach is full. In a few cases the patients describe shooting pains in the shoulders, neck, and arms; and still more rarely numbness of one or more digits, apparently caused by a reflex vasomotor spasm. The bowels in all cases are liable to be confined; diarrhea rarely occurs. The epigastrium is usually found to be more or less tender on pressure, the tenderness being fairly equally diffused.

The “irritative” forms of dyspepsia are especially indicated by acuteness of the pain, redness and furring of the tongue, marked loss of appetite, nausea, and liability to vomiting. The purely “atonic”

forms, on the other hand, are recognized by the dullness of the pain, the flabbiness and pallor of the tongue, the presence of appetite, and the absence of nausea. The distinction is, however, very indefinite in practice, and probably a purely “atonic” condition of the gastric wall is rarely met with. The products of disordered digestion can hardly fail to excite local irritation in some degree.

Prognosis is generally favorable, but dyspepsia is often obstinate and may last during life. In persons predisposed to tubercle it should be looked upon with suspicion; it is sometimes premonitory of phthisis.

Ætiology.—Chronic dyspepsia is undoubtedly due in some cases to anæmia, to debility from various causes, lithiasis, diabetes, chronic renal disease, chronic heart disease (causing passive congestion), hysteria, habitual constipation, and habitual cough. It may be traced in some cases to loss of teeth, to a sedentary life, errors in diet, the abuse of alcoholic liquors, condiments, tea, or tobacco, but frequently occurs without any discoverable cause.

Treatment.—The first point to be attended to is a strict observance of proper intervals between meals, and to forbid the taking of food or drink between the regular times. The rate of digestion in the subjects of dyspepsia is usually slow, and an interval of five hours will generally be required after a moderate, and one of six after a full, meal. The patient must be warned not to mistake the “sinking” or craving of an irritated stomach for a demand for food. It is also necessary to restrict the amount of food taken as nearly as possible to physiological requirements, so as to throw no more work than is necessary on the disturbed organ. Unless much irritation of the stomach be present, the tendency of the dyspeptic is nearly always to exceed the requirements of the system.

A specific prohibition of sticky, heavy, or greasy articles of food, and in “irritative” cases of highly seasoned dishes and condiments, is necessary, as such are much affected by many dyspeptics. Pastry, cheese, pork, salt meats, crabs, and lobsters, uncooked vegetables, and fruits are especially apt to disagree, and should be forbidden. In many cases potatoes are found to be inadmissible. Butter may be allowed in moderation. Constant regard must, however, be had

to *idiosyncrasy* in matters of diet, which is often singular and unaccountable.

Alcoholic liquors should be forbidden in "irritative" cases. Light wine or beer is sometimes beneficial in "atonic" cases, and, in the aged, small quantities of spirits are at times found to stimulate a failing digestion. The stronger wines are seldom of service. Alcoholic liquors should never be ordered for women in dyspepsia without urgent cause. The practice of taking them to relieve epigastric "sinking" is one of the most prolific sources of female drunkenness.

It is as well to prohibit the use of strong tea, which women in particular are apt to drink to excess. Coffee and weak tea are matters of individual idiosyncrasy, and their admissibility can only be decided by experiment. Cocoa is well tolerated by many. If the bowels be costive, they should be regulated, not by the occasional administration of strong purgatives, but by the use of habitual mild laxatives, to which small amounts of mercury, podophyllin or euonymin may be added, if the tongue show a tendency to display a loose coating. Cascara sagrada, in doses carefully regulated so as to avoid griping and irritation, is a valuable laxative in "atonic" cases. Daily injections of a dram of glycerine will sometimes procure a regular alvine action.

It must be carefully ascertained whether the teeth are in working order and whether mastication is properly performed. In elderly people a set of artificial teeth may be the only treatment required. Anæmia, debility, lithiasis, diabetes, disease of the heart or kidneys, or hysteria, if present, must be combated by the treatment appropriate to those conditions; and, if sedentary pursuits appear to have induced the dyspepsia, regular, not excessive, exercise should be ordered.

In "irritative" cases relief is often afforded by the salts of bismuth. They may be administered three times a day, just *after* a meal; bism. subnitr. et mag. carb. levis aa grs. x, suspended by a dram of mucilage in aq. menth. pip. \mathfrak{z} j. If there be much pain, liq. morph. bimec. m. iij-v, or tr. belladonnæ m. vj, or tr. hyoscyami \mathfrak{z} ss, may be added with advantage; and ac. hydrocyan. dil. m. iij should be introduced if nausea or vomiting be present. The morphine should not be continued for more than a fortnight if it can be avoided.

In "atonic" cases the best results are obtained from a combination of an acid with a vegetable bitter; *e. g.*, 10 to 15 minims of a dilute mineral acid, flavored with 1 dram of syrup of orange peel, in infusion of quassia, calumbo, or gentian, taken three times a day an hour after a meal. Liq. strych. hydrochlor. m. iij, or tr. nuc. vom. m. x, may be added to, or substituted for, the bitter infusion, and stimulating aromatics, such as clove, nutmeg, or ginger, are at times of service. In some cases it will be found that an alkali (liq. potass. m. x, or sod. bicarb. \mathfrak{D} j) alone, or in combination with a bitter, affords more relief than the acid. There is no trustworthy indication as to the cases in which acids or alkalies respectively are preferable.

In "irritative" cases flatulence is often troublesome. It is best combated by the use of anti-ferments. One grain of carbolic acid, or 1 minim of creosote, or $\frac{1}{2}$ grain of thymol may be given in a pill twice a day, or ac. sulphurosi \mathfrak{z} j in 3 ounces of water once or twice daily. In "atonic" cases aromatics and bitters are the best preventives of flatulence.

Pepsin, to the extent of 5 grains in pill or powder, or a teaspoonful of one of the liquid preparations of pepsin given after meals, is sometimes found to aid digestion in "atonic" cases. Extract of malt (a tablespoonful twice a day after meals) is also of service in certain cases. Small doses of arsenic are not infrequently of benefit in "atonic" cases, when general nervous debility is present, and the dyspepsia appears to be but a symptom of the general state. In severe cases a much more restricted diet may be required for a time, the case being treated practically as one of mild gastritis.

ISAMBARD OWEN.

In atonic dyspepsia Page's Tonic Tablets (Williams, Sliger & Co., New York) will do excellent service.

Symptomatic Indications.—*Nuxvomica*, in all forms of dyspepsia, is the most useful remedy, especially in acute indigestion from rich or highly seasoned food, with spasmodic pain and flatulence. In the simple atonic form, the dyspepsia of drunkards, and in chronic dyspepsia, with pain after food, headache, constipation, and piles, it will always palliate and often effect a cure. Following *nuxvomica cinchona* is frequently useful, especially when there is much flatulence,

with oppression after eating. *Cinchona* is especially valuable in the atonic dyspepsia of town dwellers and elderly people, checking excessive fermentation in the alimentary canal. *Arsenicum* is frequently indicated in irritative dyspepsia from sour fruits and vegetables, in gastritis, duodenitis, and in chronic gastroenteritis, with general emaciation. *Pulsatilla* does good service in acute indigestion, with depression and feeling of weight in stomach, white-coated tongue, nausea, eructations, dyspepsia from fat or rich food. In dyspepsia of bilious origin, bitter taste, vomiting, headache, irritability of temper, *bryonia* is indicated. In chronic dyspepsia with much flatulence, pain, and diarrhea, *carb veg.* does excellent service, and is especially useful in the dyspepsia of aged persons. Atonic dyspepsia, with much flatulence, with constipations, yields to *lycopodium*. *Hydrastis* is frequently useful in atonic dyspepsia, with torpor of liver and constipation, particularly when the complaint is induced or aggravated by the constipation. Acute indigestion, with much nausea and vomiting, disagreement of fatty food, will frequently yield to *ippecacuanha*. Dyspepsia of women and children, particularly when from worry or cold, is frequently relieved by *chamomilla*. *Antimonium crude*, is an excellent remedy for gastric indigestion, with nausea, vomiting, foul taste, fetid flatulence, white-coated tongue. *Mercurius* is sometimes useful in dyspepsia from torpor of the liver, pale stools, soreness of colon, bad breath and taste.

DYSPHONIA (Hoarseness) is brought about by much the same set of conditions as give rise to aphonia (*q. v.*), but they are of a less pronounced character. Hence, hoarseness frequently precedes or follows aphonia. The most frequent causes of hoarseness are conditions which produce irregular vibration in the vocal cords, as, for example, inflammatory conditions of the cords, adherent mucus, new growths or ulceration, and paralysis of one cord,

Symptomatic Indications.—*Kali brom.* for hysterical dysphagia, particularly of liquids in children, when not due to malformation; when from dryness of mouth or fauces, *belladonna* may relieve. Paralytic weakness is benefited by *cocculus*; paroxysmal attacks by *antimonium tart.*

DYSPNŒA.—Difficulty of breathing, from whatever cause it may arise. It may be due to laryngeal or tracheal obstruction, to lung disease, such as emphysema, phthisis or pneumonia, to pleurisy, or some affection of the heart, or may result from anæmia. If the dyspnœa be so urgent that the patient can only breathe when supported in the upright position, it is termed "orthopnœa."

Symptomatic Indications.—Dyspnœa being merely a symptom, the remedy will be found under head of the disease to which dyspnœa is due. *Arsenicum* or *cimicifuga* is the most useful remedy in cardiac dyspnœa; *antimonium tart.*, *ippecacuanha*, *lobelia*, *kali bich.*, in bronchial; *grindelia*, *nux vomica*, *belladonna* in asthmatic.

DYSTROPHIA CUTIS.—*Definition.*—Certain changes in the skin, usually of an atrophic, inflammatory, or gangrenous nature, which arise under the direct influence of lesions of the nervous system.

Symptoms.—The appearance met with may be arranged under the heads: 1. Atrophic or "glossy skin." 2. Œdematous. 3. Eruptive, erythematous, papular, vesicular, or bullous. 4. Ulcerative or gangrenous "acute bed sore."

1. "Glossy skin" is applied to a peculiar condition, somewhat resembling scleroderma, which follows irritative lesions of the peripheral nerves. It sometimes follows a clean cut, entirely dividing the nerve; but more commonly a partial division, contusion, laceration or compression in a cicatrix, callus, etc. The skin is smooth, pale, and anæmic, or pinkish and blotched, as if by chilblains; glossy, and its natural wrinkles effaced. The epidermis is often fissured, the nails are cracked and distorted, the hair is shed, and the sweat glands are atrophied, and their secretion diminished. The affected part is usually extremely tender and the seat of neuralgic pain, and its temperature is often lowered.

2. *Œdematous.*—Slight œdema of the skin and subcutaneous parts in paralyzed limbs, which lasts for a considerable time, and gradually disappears as recovery takes place, is not uncommon. Peculiar pale or slightly erythematous localized swellings of the skin and subcutaneous tissue, resembling chilblains, are also met with, appearing after neuralgic attacks at the sites of pain. They are sometimes de-

scribed as urticarial, but are attended by intense shooting or burning pain, and not itching.

3. *Eruptive*.—The “lightning pains,” of locomotor ataxy, and the neuralgic attacks met with in pachymeningitis, caries, or cancer of the vertebræ, and other affections in which there is compression and irritation of the posterior nerve roots, are frequently accompanied by an eruption on the painful points of skin, erythematous, papular, vesicular, pustular, or bullous in character. The patches correspond in situation as in zoster, with the distribution of cutaneous nerves, and in their course and duration resemble that disease.

4. *Ulcerative and gangrenous patches* may occur as the sequelæ of the last-mentioned changes, or as an independent form in “acute bed sore” (Charcot). This lesion, of grave and usually fatal import in the prognosis of cerebral or spinal disease, appears a few days, or sometimes only a few hours, after the onset of the nerve symptoms, as an erythematous patch of variable extent and irregular shape, seated, in spinal disease, over the sacrum, in cerebral usually on one of the buttocks. The color, at first light red, or somewhat bluish, fades on pressure, and in some spinal cases there is a phlegmonous-looking infiltration, attended at times with anæsthesia, at others with severe pain. After a day or two vesicles or bullæ, containing clear brownish or sanguineous fluid, appear in the center of the patch; these soon burst, exposing a bright red base, dotted with purplish-black spots of cutaneous hemorrhage, which often extend as deep as the subcutaneous tissue or muscles. The purple spots soon become confluent, necrose, and form a black slough surrounded by a margin of erythema. Patients rarely live long enough for the slough to be cast off, but in more chronic case septicæmia and gangrenous meningitis soon prove fatal. These patches appear even when the most scrupulous care is taken to avoid pressure or any irritation of the skin from the urine or fæces.

Diagnosis.—The occurrence of these phenomena in connection with severe diseases of the nervous system, their restriction to certain special sites, usually related to the cutaneous distribution of nerves, and the presence, before or throughout their course, of neuralgic

pain, will clearly indicate their nature.

Prognosis.—As these skin manifestations are merely symptomatic, their prognosis is that of the diseases in which they occur.

“Acute bed sore” is an omen of a fatal result.

Treatment.—In “acute bed sore” keeping the part clean, the frequent application of some antiseptic lotion or powder to diminish the risk of septicæmia, and poultices to promote the separation of the sloughs should be employed.

EARACHE.—See EAR, INFLAMMATION OF.

EAR, DISEASES OF.—**Examination and treatment.**—In children, the external auditory canal, it must be remembered, differs from that of adults in being less in its vertical than in its horizontal diameter. An otoscope is serviceable; but a concave mirror, with a forehead strap for use if required, and an ordinary silver ear speculum, suffice.

A healthy drum-head appears of a delicate blue-gray color, and through it is seen the handle of the malleus running downward and backward, with the apex of the white spot at its extremity.

To test a patient's hearing power, bring the watch or other sound-producer gradually to the ears, and make a note of the distance at which it is first audible. Conversational tests must be applied so as to preclude lip-reading. Bear in mind that the relative audibility of different sounds may vary with the patient's condition. The tuning fork applied to the forehead distinguishes betwixt mere obstruction to the passage of sound reaching the meatus and defect in the auditory nerve (*i. e.*, betwixt impairment of the sound-conducting and the sound-perceiving capacity of the ear), its vibrations in the former case being by reverberation considerably intensified, although the ear may be totally insensitive to aerial sound waves. Diminished audibility of bone-conducted sounds may be due to senile changes in the auditory nerve, or to acute otitis.

Whispering, in which diminution in the vowel sounds renders the consonants the more easily distinguishable, is usually better heard by the deaf than ordinary speech. Increase in the apparent per-

ception of high musical tones is said to indicate greater though limited tension of the drum-head, or breach of its substance, admitting the easy passage of short sound waves to the labyrinth. Paracentesis Willisii, or improvement in the hearing of some deaf persons during noise, is compatible with very different conditions of the drum, and may be due to an exaltation by the noise of the impaired functions of the auditory nerve, without the creation of corresponding auditory impulses. Another, and perhaps more probable explanation, is that the improvement in a noise is consequent on the extra shaking of ossicles which have become fixed from some catarrhal inflammation.

Diseases of the external meatus.—

Impacted wax in the ear can usually be removed by gentle syringing with water at 100° F.; in some instances it should be previously softened by the installation of warm solution of bicarbonate of soda (gr. x ad $\frac{3}{4}$ j), which is especially useful where there is an overaccumulation in the meatus of epithelial laminæ.

Abnormal dryness of the external meatus may be indicative of disease of the internal ear. Fluidity and offensiveness of cerumen in children, if not corrected, are apt to lead to catarrhal inflammation or worse results.

Foreign bodies.—Ascertain, by means of the speculum, that there is actually anything foreign to be removed. Avoid, where possible, instrumental interference, to which complete inaction may be preferable. Careful syringing along the roof of the meatus, the auricle being drawn upward and backward, is generally all that is required, the patient, if necessary, being placed on his side or back. But this treatment should not be adopted if the foreign body has occasioned much swelling of the soft parts; in this case the inflammation should be relieved by leeching freely in front of the tragus. The offending substance may sometimes be removed by affixing it with glue or coaguline to a piece of linen or a brush, or by the use of adhesive plaster on a string. If it is swollen by absorption of moisture, the use of glycerine may be effectual. In some cases an anæsthetic is necessary. Epileptiform convulsions or symptoms like those of Ménière's disease sometimes result from irritation caused by foreign bodies in the meatus.

Insects or their larvæ in the auditory canal can be destroyed by warm oil or chloroform vapor, and then removed by syringe or forceps.

Aspergillus, the fungus most usually met with in the ear, follows on eczema or other inflammation affecting the epidermis. Its growth is fostered by a damp, ill-ventilated atmosphere. With the symptoms characteristic of inspissated cerumen, it causes dull pain. It is best combated by frequent applications of solution of lead acetate, chlorinated lime, or of potassium permanganate, or by chlorine, bromine, and iodine water, or applications of alcoholic 2 to 4 per cent. solution of salicylic acid.

Narrowing of the meatus from chronic inflammation indicates recourse to constitutional remedies, and locally the application of strong solution of silver nitrate, or of ointment of ung. hydrarg. nit., and ung. zinci (1 to 8). The insertion of a series of lubricated, short, imperforate drainage-tubes may at times be useful. Erysipelas, molluscous or sebaceous tumors, and various other causes of stenosis must, of necessity, receive specific treatment.

Otorrhagia (bleeding from the external auditory meatus) usually results from polypus, or it may be due to injury to the base of the skull or to the internal carotids, the membrana tympani, or the walls of the meatus. It may occur also in purpura, yellow fever, and malignant smallpox, in acute aural catarrh, in Bright's disease, in the condition known as otitis hemorrhagica, and in suppression of the menses.

"*Ear cough*," due to irritation of the external auditory meatus or of the outer layer of the drum-head, is regarded as a result of affection of a branch of the pneumogastric supplying the same.

Diminution in the caliber of the external auditory canal from diffuse thickening of its bony walls may be treated by the insertion of small ivory bougies. The commonest bony outgrowths, or *exostoses*, in the meatus originate usually in inflammation of the middle ear, are of rapid growth, and mostly pedunculated. Being of the nature of spongy osteomata, they can be removed by the écraseur. In minute structure they resemble newly formed bone. The majority of the multiple outgrowths, which are commonest in the wealthy classes, are more com-

pact, and histologically comparable with syphilitic nodes on the cranial flat bones. True ivory exostoses, or hyperostoses, are still denser in structure, and of rarer occurrence; painless, and usually bilateral; and are the effect neither of active inflammatory changes nor of congenital tendency, but apparently of a chronic irritation of the meatus, such as is producible by constant sea-bathing. For their removal, drilling with a dental engine has proved the most effective measure. During the operation a steel guard is needed to protect neighboring structures.

Diseases of the auricle and associated parts.—*Malformations* may be due to defective or excessive developmental activity in the tissues bounding the first post-oral cleft, in the minute folds of which dermoid cysts in the external meatus probably originate.

Among other affections of the auricle are warts, chalk-stones in the upper part of the helix in gouty persons, epithelioma, keloid growths, and cicatrices caused by earring punctures, traumatic and idiopathic othæmatomata, or blood tumors, herpes, erysipelas (usually chronic), and syphilitic eruptions.

Idiopathic *othæmatomata* usually occur in the insane, and are pathognomonic of disease of the base of the brain. Contagious impetigo of the auricle requires, first, removal of scabs, and then destruction of pus by carbolic lotion and mercurial ointment. Chilblain is best treated by warmth and spirit liniment, and pruritus by soothing lotions and ointments containing opium, creosote, hydrocyanic acid, and mercurials. Ichthyosis of the auricle is alleviated by the continued application of glycerine. For lupus erythematosus treat by early incision with cod-liver oil, followed by scarification and general tonics.

Syphilis, either secondary or tertiary, has been observed to affect the ear (probably both the middle ear and labyrinth), by bringing on changes in the drum-head; and deafness, which is usually painless and unilateral, is rapid in onset, and is like that produced by obstruction in the meatus, so that by bone conduction a tuning fork is better heard in the affected ear. Again, syphilis attacking the labyrinth or auditory nerve may cause deafness, commonly absolute, of one or both ears, the healthy ear alone being then sensitive to bone-conducted

sound. Syphilitic throat disease is a not uncommon origin of acute aural catarrh. Nervous deafness from hereditary syphilis generally comes on between the ages of ten and sixteen together with chronic interstitial keratitis, and is much more common in girls than boys. Undoubtedly the best treatment is the administration of gray powder; but the prognosis is unfavorable.

Aural catarrh.—Acute aural catarrhal inflammation, usually unilateral and the result of catching a cold, is characterized by increased vascularity of the drum-head, and by continuous intense pain preceding the discharge, as also by pain on eructation or forcible expiration, and in children notably by intolerance of rest of the head on the side affected. Convulsions are an occasional complication. Fomentation by instillation of warm water, mild purgation, the careful use of Politzer's bag to favor escape of pent-up pus from the eustachian tube, and also leeching in front of the tragus, are the usually efficacious modes of treatment. Simple acute non-suppurative catarrh rarely causes perforation of the drum-head. It may originate in inflammation of that structure only. Foul air and also overdoses of quinine have both been known to produce aural catarrh. In cases of chronic catarrh attention should be given especially to the promotion of the general health by the use of warm clothing, by the administration of cod-liver oil, and also by the application of astringents to the throat and of iodine over the mastoid process; inflation of the tympanum with Politzer's bag, or with simply a piece of rubber tubing in the case of children, may often prove of great value.

Politzerization, commonly practiced at the moment of swallowing, may be promoted also by the pronunciation of certain syllables (as "huck"), or by puffing out the cheeks. The diagnostic or auscultation tube, one end of which is placed in the patient's the other in the surgeon's ear, enables the observer, by the sound, gurgling or whistling, at the moment of politzerization to ascertain the existence of fluid in the tympanum or of a perforation in the drum-head.

Excision of the tonsils and prolonged treatment of the naso-pharynx may be necessary in cases of deafness from continued closure of the eustachian tube,

one evil result of which is to cause inward bulging of the drumhead from exhaustion of the tympanic air.

In aural catarrh unbenefited by politizerization, the eustachian catheter must, except with children, be employed. To those who are unaccustomed to the instrument, the following method of using it will be found serviceable. It should be passed along the floor of the nares to the posterior wall of the pharynx, withdrawn, and turned inward to hook round the vomer, and then semi-rotated downward till the point is directed outward and slightly upward, when it enters the mouth of the eustachian tube. The introduction of air or fluids into the tube is best effected through a piece of india-rubber piping connected with the injector or india-rubber bag, which is suspended from the operator's coat, and is compressed with the right hand while the left steadies the catheter. Variable hearing is a pretty sure sign of defective action of the eustachian tube. Its intermittent and progressive dilatation by bougies introduced through a catheter has been successfully practiced.

In chronic non-suppurative inflammation of the middle ear, vapors of ammonium chloride are recommended in a catarrhal, and simple or iodized aqueous vapor in a dry condition of the mucous membrane; but injection of astringent and slightly stimulating fluids is often useful.

Daily massage over the mastoid region is recommended for acute and subacute middle-ear catarrh.

Symptomatic Indications.—*Pulsatilla* is the most useful remedy in catarrhal inflammation, especially of the subinflammatory form. In acute form, with fever, severe pain, *aconite* quickly relieves. Congestive form, throbbing pain, quickly coming and going, *belladonna*. In suppurative inflammation of the middle ear, *baryta* will prove useful.

Where the cause of *deafness* is due, not to deficiency of atmospheric pressure, but to the thickening of the mucous lining of the middle ear, or to adhesions within the tympanum, the local effect of solution of potassium iodide (gr. x ad $\frac{3}{4}$ j) is beneficial; and, similarly, weak solution of iodine, copper sulphate, potash, silver nitrate, or of chloral hydrate may be very efficacious, as well as the internal administration of potassium iodide and mercury perchloride, these last particularly in

strumous patients. The severance of adhesions is sometimes to be effected by the use of a pneumatic tractor. Words spoken into the eustachian catheter are not heard if the stapes is fixed, fixation of the malleus and incus alone not preventing their audibility.

Adenoid vegetations in the pharynx may be the source of deafness by closing the mouth of a healthy eustachian tube, or by so blocking the nares that swallowing occasions rarefaction of the tympanic air. These growths may be removed very easily with instruments, or even with the finger nail.

Serous effusions in the tympanum are commonly absorbed after politizerization. Where catheterization does not avail for syringing out the tympanum, puncture of the drumhead may be of value. This should be effected in the lower portion, before or behind the handle of the malleus. The tympanum can then be evacuated by inflation, or by the use of a Siegle's speculum. Paracentesis is required also when, in acute suppurative aural inflammation (a possible sequela of scarlet fever, typhoid, typhus, diphtheria, and other diseases), pus pent up in the tympanum fails to burst through the membrana tympani, or to escape through the eustachian tube, and so causes the drumhead to bulge outward. Spontaneous perforation is otherwise a probable event; but in some cases the accumulated pus rapidly produces fatal meningitis or cerebral abscess.

Symptomatic Indications.—Deafness from concussion may be relieved by *arnica* or *cinchona*. Indications for *cinchona* are buzzing in the ears, noise in the head, and vertigo. Recent deafness from cold may require *aconite*, *belladonna*, or *pulsatilla*; *aconite* or *belladonna* being indicated by the febrile condition. *Belladonna* is also useful in deafness from suppression of acute scarlatina or measles. Deafness of scrofulous patients is frequently relieved by *arsenicum*, particularly when induced by exposure to damp winds. *Sulphur* or *belladonna* is useful for deafness following eruptive fevers. *Baryta* and *mercurius* in chronic deafness from enlarged tonsils. *Pulsatilla*, eustachian deafness, recent from catarrh. *Iodine* in chronic throat deafness.

Otorrhœa, or discharge of the pus from the middle ear, is not necessarily

ushered in by acute otitis, being a common symptom in struma. For treatment, the main indications are restoration of the general health, thorough cleansing of the ear, and frequent syringing with warm water, and afterward the application of lotions containing zinc salts, carbolic acid, or rectified spirits. These various astringents should be changed occasionally. Counter-irritation behind the ears, and the insufflation of powdered alum, iodoform, or boracic or salicylic acid, and repeated applications of boroglyceride, may be very useful. The origin of inflammation in an atmosphere contaminated with sewer gas must be guarded against. The introduction into the tympanum of a medicated fluid poured into the meatus may, when a very small perforation in the drumhead exists, be simply effected by closing of the mouth and nostrils, and blowing, the bubble of air then conveyed by the eustachian tube being replaced, as it passes out through the drumhead, by a drop or so of the fluid. Neglected otorrhœa may become chronic, and may cause polypus, thickening of the drumhead, destruction of the ossicles, and caries of the mastoid, or even facial paralysis, hemorrhage from the carotid artery, inflammation of the brain, epilepsy, or by the formation of thrombi in the lateral sinus or the jugular, pyæmic lobular pneumonia.

Symptomatic Indications.—In scrofulous cases the best remedy is *mercurius*, when the discharge is thick, bloody, and fetid. *Kali bichrom.*, or *pulsatilla*, thin discharge, and after measles. *Pulsatilla* is also useful when the discharge is thick and bland, catarrhal otitis and otorrhœa. *Aurum*, when discharge is yellow and fetid, *arsenicum iod.*, fetid corrosive discharge.

Affections of the membrana tympani.—Traumatic slits or cuts in the membrana as a rule heal readily, and the tendency in cases of direct injury generally is toward recovery. Perforations from disease, however, are apt to become permanent, if otorrhœa be not arrested, and the health of the middle ear restored. A perforation is not incompatible with fair audition, its position and the state of the ossicles having considerable influence. Deafness owing to a perforation or to separation of the ossicles is sometimes greatly benefited by the pressure or support afforded by an artificial

membrane or a plug of cotton-wool, which may be suitably combined. Dr. C. W. Tangeman has recorded a case of double perforation successfully treated by skin-grafting. Mammiliform perforations may be effectually treated by instillation of rectified spirit, as shown by Professor Zaufal.

Disease of the mastoid process is characterized by deep-seated local pain and signs of inflammation. Early and thorough incision over it down to the bone, followed by free leeching, repeated washings with antiseptic and astringent lotions, and treatment of the general health should invariably be resorted to. Should these measures fail, in order to obviate the dangers of retention of pus, trephining about a quarter of an inch behind the meatus and a little below the level of its upper wall, or the removal of carious bone by knife or probe is necessary.

Polypi of the ear, generally due to catarrh thereof, are composed of tissue which is either (1) soft and granular; (2) mucous; (3) fibrous; (4) hyaline or gelatiniform or myxomatous, the last being the rarest. Their common seat is the tympanum.

Granulation tissue in the ear, if not amenable to the treatment for aural catarrh, or to the instillation of rectified spirit, or touching with perchloride of iron, may require removal by scraping.

For the larger polypi excision with a snare such as Wilde's, and subsequent cauterization of the root with saturated solution of nitrate of silver with chloracetic or chromic acid, and removal of the cause, comprise appropriate treatment. Mucus polypi may be shrunk or, if small, obliterated by repeated instillation of rectified spirit.

Abscesses of the brain due to ear disease are usually single, and situate in the white matter of the hinder part of the middle lobe, the posterior lobe, or the cerebellum.

Pain in the ear, if not the result of a recognizable affection of the meatus, points either to catarrh, or to more or less acute, and hence dangerous, otitis interna. Pain caused by an affection of the ear may not be distinctly referable to that organ. Conversely, aural neuralgia may be caused by dental caries or by general malarial poisoning.

Disease of the internal ear, *i.e.*, of the

labyrinth and its contained structures, rarely primary, is secondarily of either traumatic or constitutional origin. Traumatic causes are repeated concussive shocks, injuries to the brain, or local lacerations, and effusion of blood or serum; and the constitutional include developmental defects, exposure to cold, rheumatic degeneration, middle-ear affections, fevers, mumps, syphilis, meningitis, and sometimes tabes dorsalis. Lesion of the internal auditory apparatus is distinguished by deficient perception of both cranially and aërially conducted vibrations; the patient suffers from true nervous deafness. Nervous deafness dependent on hyperæmia of the labyrinth is at once relieved by leeching and blistering behind the ears.

Ménière's disease is by some understood to be simply hemorrhage into the semicircular canals; by others it has been defined as an abnormal irritation in the semicircular canals, or inflammation in these or the middle ear, causing vertigo. Its vital or medullary symptoms (*e.g.*, faintness, perspiration, irregularity of pulse) have been held due to affection of the cochlear nerve, and its locomotor or cerebellar symptoms (vertigo with or without reeling) to affection of the semicircular canals. In cases regarded as typical the giddiness is usually preceded by a feeling of vertical rotation, and is accompanied by that of forward and backward movement about a transverse axis. Subjective auditory sensations are common. The attacks tend to merge into an habitual vertiginous state. Counter-irritation behind the ears, large doses of potassium bromide, and also quinine and ammonium chloride, are useful in many instances. As vertigo may be produced in a variety of ear lesions, the discovery and treatment of the cause must be aimed at.

Symptomatic Indications.—*Sodium salicylate* has been used with good result. *Arnica*, when the result of concussion or injuries.

Electricity in aural disease.—The induced electrical current has been successfully employed in several cases of intra-tympanic disease; and stimulation of the ear muscles by the continuous current is sometimes beneficial.

Tinnitus aurium, or persistent subjective sound in the ears, when not ascribable to sympathetic or to cerebral

stimulation of the auditory nerve, would appear to be usually the result of abnormal pressure upon the labyrinthine nerve fibers, which again is generally due to some affection of the drumhead. It may be dependent on spasm of the tensor tympani and stapedius, or on the existence of free fluid in the tympanum, and may occur also as a symptom in various disturbances of the circulation, in debility, alcoholism, exophthalmos, and other conditions. For its alleviation have been employed medicinally pilocarpine injections, zinc valerianate, digitalis, arnica, ammonium chloride, quinine and morphia combined, and hydrobromic acid, and locally chloroform vapor and warm glycerine and laudanum for the meatus, strychnine solution injected through the eustachian catheter, the air douche, faradization, and section of the posterior fold of the membrane. Autophony, or the hearing of one's own voice in the head, a symptom in sundry aural affections, appears to result from defective mechanical action of the membrana or the ossicles.

Deaf mutism, or deaf-dumbness, affects on an average one person in some 1550, and males more than females. It is congenital or acquired, according as produced by causes arising before birth (consanguinity, heredity, syphilis, inebriety), or after birth (as fevers, scrofula, catarrhal inflammation, and falls and blows). It is rare that the parents of deaf mutes are deaf and dumb. For the acquisition of speech by deaf mutes the German or pure oral method is that best adapted, the pupil learning both by personal practice and by ocular demonstration (lip reading) the mechanism of speech.

Instrumental aids to deafness.—Of the various instruments for the improvement of hearing by reflection of sound a hollow cone is the simplest and most efficient. Small globose or conical resonators may be of great benefit. Hearing through the teeth may be rendered possible by the use of the audiphone or one of its numerous modifications.

GEORGE P. FIELD.

EAR, ACUTE INFLAMMATION OF THE TYMPANIC CAVITY.—EARACHE.—The most prominent characteristic of this disease is earache; it is extremely painful. The onset is usually

sudden, although, if the disease begins in the throat, there may be some angina preceding the pain in the ear, but the pain soon passes up the eustachian tube to the middle ear. The character of the pain is that of fullness, which is aggravated by the impulse of the heart, which gives it a throbbing character. The pain may continue from one to several hours, when rupture of the membrane, attended with a discharge of mucus, pus, serum, or blood, or a mixture of all, gives relief. Untreated, the pain may recur every day, more usually at night, for several days or longer. While the seat of the pain is in the ear, the whole side of the head may be painful, and the part about the external ear quite tender. Constitutional disturbance may be present in some cases. In severe cases there will be febrile symptoms, elevated temperature, occasionally delirium, and in the case of children there may be convulsions, the symptoms simulating those of disease of the brain. The discharge varies in amount and quality, with the severity of the attack. When largely purulent and excessive in quantity, it is known as purulent otitis; if mainly mucous, catarrhal otitis; if principally of blood, hemorrhagic otitis; when mainly of serum, as is usual in the milder cases, serous otitis media. The discharge continues usually until the membrane heals, which may be from a few days to several weeks, if the disease was cured during the acute stage; otherwise, it may continue as chronic otitis. Tinnitus aurium is present, and the patient's voice re-echoes in his ears with unpleasant distinctness (autophony). During the course of the disease, prolonged crackling, snapping, or hissing sounds may seem to dart with sharp pains through the ears, which are premonitory of relief. At the onset of the disease the hearing is usually very acute, with painful sensitiveness to noise; but as the disease progresses the hearing becomes less acute until almost lost. The tuning fork may be heard most plainly in the affected ear, unless the tympanum is filled with inflammatory products, or so much congested as to interfere with the vibrations, when the contrary will be the case. On inspection, swelling of the canal may prevent the membrane from being seen, but if visible before the rupture, it will be partially or wholly reddened, presenting, in the latter case, something of

the appearance of raw beef; in the former, the redness may be along the malleus handle, including the region of the short process, or the periphery may also be infected. If the tympanum is full of fluid it will show a bulging appearance, so that both sides of the malleus handle may be pushed out, leaving a depression at the handle, but the protrusion is more generally in the supero-post part. After the discharge, the membrane will have a dull, whitish, sodden look, from softening of the outer layer. If this is wiped off with cotton-wool, it is sometimes partly separated—the membrane will appear red, and in recent cases, the perforations may sometimes be seen, but as a rule they are so slight that the swelling of the membrane closes them. If the tympanum be inflated, air or fluid may be blown through the aperture, producing perforation whistle, which settles the diagnosis. If there is pulsation of the membrane, perforation is probable. If after cleaning the ear with absorbent cotton, it soon becomes moist, or if after cleaning a light reflex is seen, perforation is almost certain—as a rule, severe pain, followed by a profuse discharge, is diagnostic of perforation.

Diagnosis.—Severe throbbing pain in the ear, with impairment of hearing, tinnitus aurium, autophony, and swelling of the meatus are diagnostic, but all may not be present. Pain in the ear from decayed teeth may lead to a suspicion of otitis, but the natural appearance of the membrane, and absence of other ear symptoms, will make the diagnosis clear. In children it may be more difficult, as the likeness of the symptoms of brain disease and otitis may require an inspection of the membrane to decide. The appearance of the discharge will dispel doubt. As even the least discharge will produce an odor, it has been recommended in doubtful cases to use the sense of smell.

Prognosis is favorable, although neglected or badly treated cases, or those occurring in scrofulous children, may involve the brain, giving rise to serious lesions and causing death, or cause serious mastoid trouble, or continue as a chronic suppuration with the production of carious bone, cerebral abscess, polypi, etc. Otitis following measles or scarlet fever is more likely to prove serious.

Causation.—Sore throat, extending

through the eustachian tube to the middle ear, or exposure to cold, any cause producing inflammation of the naso-pharynx, as the exanthemata, may produce it; or any violence upon the membrane or cavity, concussions, or explosions, a box on the ear by suddenly compressing the air in the meatus may be sufficient, sea bathing, nasal douche, etc.

Treatment.—The first point requiring attention is the pain, for which the application of one or two leeches to the posterior face of the tragus may be effectual; care should be taken that the leech does not take hold of the cartilage of the concha, as inflammation may result. Should the pain continue after the application of the leeches, a hypodermic injection of morphine may be given. Dry, hot applications, as hot flannel, rubber bag, or bottle of hot water, will often give relief. A roasted onion or potato often palliates the pain, as will a bag of hot salt. Moist applications are grateful, but should not be applied too long, as they soften the parts and perhaps induce otorrhœa. Water, too hot or too cold, increases the pain, which is also aggravated when lying down. Opium, as paregoric, dropped upon cotton, may be cautiously used, or atropine, grs. iv to the ounce of water, may be dropped very cautiously into the ear, watching the dilatation of the pupil for indications of constitutional effect. Steam or tobacco smoke is also sometimes useful.

If the membrane is convex or from any other sign there appears to be a collection in the tympanum, paracentesis will be more appropriate to the relief of pain than leeches, besides being a more rational treatment. For this a broad needle from an ophthalmic surgeon's case is the best instrument. If the shank is extra long it is better. Poise the instrument over the most protruding portion of the membrane, and approach very near to it, for the external canal may be pricked instead of the membrane, and by a gentle thrust push the instrument forward until it touches the bony wall of the tympanum. If the instrument is held loosely in the fingers it will be less likely to make a violent thrust. If no discharge follows the puncture, incline the head to the same side as the affected ear, and all the discharge may be blown out. This operation may be repeated every day until there is no longer any collection. If after

a puncture there is a relief to the ear symptoms, and the old symptoms recur after a few hours or days, another collection may be suspected (Pomeroy).

When the pain is relieved, cotton-wool should be kept in the ear, removing it as often as it becomes moistened. After several days, during which time the ear should be kept clean by carefully syringing it out once or twice a day with warm salt and water and then drying with absorbent cotton, the cavity may be inflated, and if the discharge continues, astringents may be used, and should the discharge still continue, the canal may be packed with finely powdered boracic acid, retained by a piece of cotton-wool, which may remain until moistened by the discharge, when the ear may be gently syringed out and the boracic acid renewed. Astringent lotions: Plumbi acet., grs. ij to v; water, f $\frac{3}{4}$ j. Argent. nit., grs. ij to v; water, f $\frac{3}{4}$ j. Acid. carbol., $\frac{3}{4}$ j; water, Oj.

Symptomatic Indications.—The most generally useful remedy is *pulsatilla*, especially in the subinflammatory form. In congestive form *belladonna* is valuable. Neuralgic form will require *chamomilla* or *gelsemium*. *Conium* when there is an excessive secretion of wax. See INFLAMMATION.

EAR, ECZEMA OF THE.—A catarrhal inflammation of the skin of the ear, often associated with eczema of the face and scalp, or with acrid discharges from the ear. Scrofula is a predisposing cause, exposure to cold, dentition, or any irritation being sufficient to excite it to action. When the disease is established, the auricle is intensely red, tender, hot, tense, and swollen, upon which are developed vesicles which, after discharging freely, dry into crusts, which fall off, leaving a dull, red surface beneath. The acute variety is most often seen with children, the chronic with adults. In the latter form there are few or no vesicles, and the skin will be dry, scaly, fissured, and in some cases hypertrophic, with distortion of the auricle. Eczema impetiginoides, accompanied by abscesses, may be present if the auricle is much hypertrophied. Should the disease invade the meatus, it may give rise to tinnitus aurium, deafness, and a feeling of stuffiness in the ear.

Diagnosis.—From intertrigo and her-

pes. At some stage of the disease moisture will be apparent, while herpes has no moisture. In intertrigo there are no vesicles, while in eczema vesicles may be occasionally found.

Treatment.—Scabs may be removed by poulticing, and the parts bathed with bran water. For the irritation acetate of lead and powdered opium, aa ℥j; boiling water, Oj, applied on small pieces of lint, will do good service. A paste of whiting and water is also soothing. Equal parts of bismuth, camphor, and starch, dusted into the part, once or twice a day, allays the irritation and diminishes the discharge. Vaseline or lime water will also prove beneficial. In chronic cases, common soap, well rubbed in, has a stimulating effect and does well. Nitrate of silver, grs x-xxx to the ounce of water, or tr. of iodine may be used after the acute symptoms have subsided. See ECZEMA.

Symptomatic Indications. *Rhus, arsenicum*, or *graphites* may be required. See ECZEMA.

EAR, ERYSIPELAS OF THE.—The auricle is sometimes attacked by simple erysipelas, which presents the appearance of erysipelas in other parts. The eruption is preceded for several days by febrile symptoms, when the auricle has a burning or smarting feeling, with tension, and presents a red, shining, puffy appearance. In the course of two or three days blebs form, which burst in a short time, and dry into scabs, when convalescence sets in and the cuticle peels off. When the swelling is extensive the meatus may become swollen, producing more or less deafness. The disease may be induced by cold, or injury, or by extension from the face, and is more common in women than men. Its usual duration is from eight to twelve days.

Prognosis.—Favorable, as there are no destructive processes as in the phlegmonous form.

Diagnosis.—Not difficult. From erythema by the tense, shining appearance, and the implication of the deeper tissues.

Treatment.—Same as in erysipelas of other parts. Cold applications should not be used for fear of effect on hearing. A weak lead and opium wash may be applied.

Symptomatic Indications.—*Rhus* or

belladonna is most generally useful. See ERYSIPELAS.

EAR, FURUNCLES OF.—Acute inflammatory swellings on the auditory canal, which resemble the ordinary boil in other parts, are not uncommon. Their usual site is in the outer portion of the meatus, seeming to originate in a hair follicle or a sebaceous gland, and may be located just beneath the skin or in the deeper tissue, or more rarely in the perichondrium or periosteum. The pain is considerable and may involve the side of the head, but has not the throbbing character of otitis. The attack may be accompanied by more or less fever. Inspection may show the canal so much swollen as to hide the site of the furuncle, or it may be easily seen and its exact location determined, as it is extremely sensitive to touch. The furuncle bursts after a few days, leaving a small opening, through which a small quantity of pus slowly exudes. Badly treated, the inflammation may involve the whole canal, even the tympanum.

Diagnosis.—From otitis, with much swelling of the canal, but in the latter case there are the symptoms of the middle-ear disease. Fluctuation in the boil will settle the diagnosis. Ostitic tumors are hard, and generally exist in both ears.

Causation.—Furuncles may be induced by the use of strong solutions of nitrate of silver in the ear, by traumatism, dentition, or cold, especially in persons of a scrofulous tendency.

Treatment.—In the first place to relieve the pain, leeches, used as for otitis, may relieve. Dry warmth is effective. Applications of strong solutions of nitrate of silver or of tr. iodine are sometimes useful. Incisions before the formation of pus are not advisable, afterward will relieve. The exact site of the pus may be found by touching the spot, which will be found a little softer than the rest, with a probe, when it may be incised by a puncture with a Graefe's extraction knife; if the pus does not flow, a small probe may be introduced. The operation should be done with the aid of a forehead mirror, so that it may be carefully performed. Should the pain recur the operation may be repeated until the pain ceases, after which, if the discharge continues, astringents may be used. Qui-

nine may be useful for constitutional treatment to prevent relapse, or calcium sulphide to prevent the formation of pus, in one-tenth grain doses several times a day, but the stomach symptoms should be guarded against.

Symptomatic Indications.—*Belladonna* will relieve and prevent recurrence. *Calcium sulphide* promotes suppuration when inevitable, checks in early stage. See BOILS.

EAR, HERPES ZOSTER OF.—

Herpes zoster of the auricle does not differ from the same disease in other parts of the body, and is attended with similar symptoms.

Diagnosis.—From eczema by the larger size of the vesicles, which do not rupture except perhaps in the meatus. The neuralgic pain and febrile symptoms which precede the appearance of the eruption aid in making the diagnosis clear.

Prognosis.—Although regarded as a serious disease from its liability to involve the meatus and tympanum, the prognosis is favorable, except in debilitated and feeble or aged persons. The vesicles sometimes leave behind them deep ulcers which are difficult to heal.

Treatment.—The auricle may be covered with vaseline, sprinkled with flour, and covered with absorbent cotton to protect from the air and cold. Collodion is also excellent for this purpose. *Belladonna* and camphor liniments, equal parts of each, will sometimes relieve the pain. Sulphate of zinc solution, or one of nitrate of silver, or of acetate of lead, 5 to 10 grs. to the ounce of water, are useful for washing out the meatus once or twice a day.

Symptomatic Indications.—*Rhus tox.* relieves the pain and itching, and shortens the duration of the disease. See HERPES ZOSTER.

EAR, INTERTRIGO OF.—Is found generally in children, appearing as an excoriation at the junction of the auricle with the head. Moisture and uncleanness are factors in its development, but the direct cause is the friction of the parts. Neglected, it may run into an eczema. It may also be developed by too much head covering, which, pressing the auricle against the head, increases friction.

Treatment.—The indications for treatment are to remove, if possible, the cause, and to protect the excoriated parts by

sprinkling on powdered starch, having washed thoroughly with warm water containing a very little baking powder. Vaseline or condensed milk (without sugar) on absorbent cotton is healing. Oxide of zinc added to 8 parts of starch is a satisfactory drying remedy. Lint soaked in camphor water \mathfrak{z} i and borax grs. x, is good. Plumb. acet., one gr. to the \mathfrak{z} i of vaseline is recommended. When the excoriation has mostly disappeared tr. iodine lightly applied will complete the cure. Collodion is a good protection, and, if there is too much discharge, it will peel off. Cleanliness must be insisted upon.

Symptomatic Indications.—*Mercurius* is useful when the parts are raw and painful; *lycopodium*, when chafing obstinately recurs and seems constitutional.

ECCHYMOSIS.—An effusion of blood into the subcutaneous tissues, whether as the result of violence or from disease. When large, there will be considerable swelling, and the part soon becomes purple, the color gradually changing to a brown and ultimately passing through green and yellow before the skin regains its natural appearance. Very small extravasations of blood do not cause any swelling; they may be known by their purple color, and by the fact that they do not fade on pressure; when small and round, they are called *petechiæ*; when occurring in lines, *vibices*.

Symptomatic Indications.—*Arnica* in recent cases. *Secale* in later stages. *Hamamelis* when there is much discoloration.

ECLAMPSIA.—See CONVULSIONS.

ECTHYMA.—A pustular eruption the lesions of which consist of large, isolated, flat, flaccid pustules on an inflamed, hard base, followed by thick, dark crusts, leaving deep pigmentation and sometimes superficial scarring.

The affection occurs only in badly fed and cachectic individuals, especially in children and old persons, and is now recognized as being almost invariably an epi-phenomenon in cases of scabies, pediculosis, impetigo, eczema, dermatosyphilis, or any other pustulating dermatoses. Exceptionally, cases answering to the above description appear to occur independently and justify the retention of the name. Any soothing local application is

effectual in bringing about cure, but constitutional treatment alone is of service for preventing fresh outbreaks.

J. J. PRINGLE.

Symptomatic Indications.—*Antimonium tart.* in simple forms, *arsenicum* in cachetic, pustules on arms, *kali bichrom.*, pustules all over the body; or appearing at root of nails, spreading over the hand; *mercurius* for suppurating or bleeding pustules.

ECZEMA (Moist Tetter).—An acute or chronic, non-infective, catarrhal inflammation of the skin; it is characterized, in its most advanced stages, by the successive development of erythema, papules, and vesicles or pustules, with serous or purulent discharge, accompanied by itching or burning, and dependent mainly on constitutional causes.

It is the commonest and most important disease of the skin, and frequently complicates other skin affections, as the result of scratching or irritating applications. Pathologically and clinically it is a typical inflammation of the skin. *Eczema erythematosum* denotes its mildest form, in which the skin is reddened, slightly swollen, infiltrated, and tense from active congestion; the color of the patches is more vivid, and their edge less well defined, than in true erythema. Soon, increase of hyperæmia, with infiltration of the papillæ and rete Malpighii with serum and migrated leucocytes, results in the formation of minute, intensely itching papules of a deep-red color and firm consistence, arranged in irregularly shaped groups (*E. papulosum*). At this stage the process may be arrested. The condition now somewhat resembles a lichen, and, was formerly described as lichen simplex; the arrangement of the papules is, however, different, and careful examination with a lens seldom fails to discover incipient vesication at some part of the eruption.

Usually, the process advances; serous exudation accumulates between the comparatively loosely connected cells of the rete mucosum, and raises the cuticle to form vesicles containing clear fluid, constituting the most constant and characteristic phase of the disease, *E. vesiculosum*. With increased duration and intensity of the inflammatory action, the fluid in the vesicles becomes cloudy from increased diapedesis of leucocytes, or frank-

ly pustular (*E. pustulosum*), the pustules being usually of larger size than the preceding vesicles. Frequently, however, pustulation does not ensue, but the cuticular covering of the vesicles yields under the pressure of the rapidly exuded serum, and the rete mucosum, covered with exudation, is exposed. Large, raw, "weeping" surfaces, studded with red points, are formed by the coalescence of these excoriations, and to this common and typical condition, which may also succeed *E. pustulosum*, the term *E. madidans* or *E. rubrum* is applied.

The fluid discharged from such surfaces stiffens linen, and, if it does not escape, macerates the surrounding skin, causing extension of the disease *per contiguitatem*, and dries up to form crusts and scabs, the color of which varies according to the amount of the contained cell elements. If these are small in number, the crusts are thin and pale-yellowish in color (*E. crustosum*); if numerous, and especially if bleeding occur from the exposed capillaries, the crusts are thick and dark in color (*E. impetiginosum*). The latter form occurs with special frequency in strumous children on the scalp and face, and the crusts may acquire a peculiarly offensive odor from the decomposition of sebum poured out in excessive quantity as the result of inflammatory implication of the sebaceous glands.

Return to health is evidenced by diminution in the amount of exudation and progressive extension of epidermic cells from the edge over the surface of the excoriated patch. Even when this process is complete, the skin remains thickened, indurated and reddened, and excessive cell formation continues on the surface of the patch, resulting in the formation of whitish, more or less adherent scales of shed epithelium (*E. squamosum*), a condition which may prove very persistent.

If situated upon parts subjected to much movement (*e.g.*, the hands, articulations), deep, painful cracks or fissures are liable to form in the hardened skin in a direction similar to that of its normal folds, and transverse to the direction of the principal movements of the part (*E. rimosum* or *E. fissum*). Where a tendency to passive congestion exists, as in the lower extremities, recovery is naturally slower than where the circulation is active, the papillæ of the skin may permanently hypertrophy, and cause general or

limited warty outgrowths (*E. hypertrophicum*, *E. verrucosum*). There is also a special tendency to chronicity around hair follicles, where irritable, acuminate papules may persist for prolonged periods (*E. folliculare*). True eczema probably never causes scarring, and the pigmentation left by it soon disappears.

Diagnosis.—*Locality* is an important factor; it is common wherever skin and mucous membrane join, wherever hair and sebaceous or sweat glands abound, and where the skin is soft, thin, or thrown into folds, *e. g.*, the flexures. The value of itching, especially in the vesicular and papular forms, or of burning, as diagnostic points, has been mentioned. Polymorphism, due to the simultaneous existence of various phases of the disease, is as marked a characteristic of eczema as of syphiloderma, and the same necessity arises for complete examination of every patient. Difficulties in diagnosis chiefly arise from the arrest of the morbid process in the earliest, or its persistence in the latest stages; in the former case evidences of vesication, in the latter of serous discharge, will seldom be wanting; even the scales of the most obstinate *E. squamosum* show dried gummy material on their deep surface.

It is of practical importance to differentiate true eczema from local dermatitis, the result of topical irritation. The salient points of contrast to eczema presented by a dermatitis are—it is local, and confined to the region directly affected by the irritant, the intensity is directly proportional to that of the irritant, and the further progress is at once arrested by removal of the irritant. A connecting link between dermatitis and eczema—thus conceived—has recently been recognized in the fact that a very large number of eczemas are secondary to the decomposition of sebum or sweat, secreted in excessive quantity and undergoing putrefactive changes—probably under the influence of specific micro-organisms, hitherto undetermined—as the result of which they become chemical irritants to the skin (*E. seborrhæicum*, *sweat eczema*). The point has an important bearing on treatment.

Differential Diagnosis.—Acute eczema is liable to be mistaken for erysipelas, local dermatitis, or miliaria rubra; papular eczema for lichen or multiform erythema; vesicular eczema for herpes or

bullous erythema; pustular eczema for scabies, impetigo, pustular syphiloderma, folliculitis, or tinea favosa; and squamous eczema for psoriasis, pityriasis rubra, lupus erythematosus, seborrhœa, and tinea tonsurans.

Prognosis.—Eczema is seldom dangerous to life. Children are frequently reduced to a very low state, but rarely die. Occasionally, in old persons suffering from chronic Bright's disease, the condition becomes universal, and death results. Acute eczema tends either to relapse at regular intervals after apparent recovery, or to become chronic with occasional acute exacerbations. The not infrequently observed alternation of eczematous attacks with bronchial catarrh or asthma and with gastric catarrh is the basis of the belief that the rapid cure of a skin disease may result in more dangerous affections of the internal organs from metastasis.

The *ætiology* of eczema is a problem of the greatest difficulty and complexity. Young children and old persons are specially liable to eczema. Men appear to be more frequently affected than women, probably because they are more exposed to the various causes of local dermatitis in the course of their occupations. An hereditary tendency to the disease certainly exists in the form of an inherent susceptibility to irritation by mechanical, thermic, or chemical agents, not noxious to healthy skins; thus the sun's rays, cold winds, soaps, or vaccination may cause eczema in one child only out of a number subjected to absolutely identical influences, no demonstrable morphological peculiarity of the skin being present.

The association of eczema in children with scrofula, dentition, improper feeding, or worms, in adults with rheumatism, gout, and "the gouty condition" (including lithiasis, oxaluria, renal inadequacy, senile glycosuria), with dyspepsia, chronic constipation, uterine disorders, and alcoholism, is so frequent as to suggest strongly a causal connection. This view is also strengthened by the markedly beneficial influence on the disease of remedial measures applied to those various concomitant conditions, but the essential nature of the connection is unknown, and it is probable that there is a mutual dependence on a common cause, rather than interdependence. There is no more

fertile obvious source of eczema than depressed conditions of the nervous system, such as result from worry, anxiety, overwork, neurasthenia, and anæmia (especially when attending overlactation); this fact, the severity of the itching, and the marked symmetry of the lesions all give color to the theory that changes in the central nervous system probably underlie all cases of true constitutional eczema. Treatment recently advocated in the form of counter-irritation over the spine, based on this theory, appears to be attended with decided success.

Treatment.—Predisposed persons do well to adopt certain general preventive measures. Rough woolen clothing, exposure to cold winds, sea air, or excessive heat, or to various noxious substances used in many trades, copious sweating, dirt, the frequent intermittent application of water, especially of salt water, and the use of irritating soaps or cosmetics are to be avoided. Proper dietary restrictions ought to be observed.

Acute eczema in the earlier stages is best treated by complete rest, liquid diet, saline aperients and diuretics, and locally by protective dusting powders (oxide or oleate of zinc, bismuth, prepared chalk, cimolite, salicylated starch); a few drops of antimonial wine are often useful in robust persons. When the discharge is profuse, and burning or itching severe, cold lead lotions (*e.g.*, liquor plumbi subacetatis dilutus), applied on soft linen rags and frequently renewed, are valuable. An excellent lotion, which combines the qualities of a cooling application and of a slightly greasy dressing, is made by adding a dram of liquor plumbi subacetatis to an ounce of fresh milk. Poultices and water dressings covered with oiled silk are specially injurious.

The treatment of chronic eczema is far more important and more difficult, nor will any severe or old-standing case recover without persistence. The diet ought generally to be of a simple and unstimulating description; salt meats, pastry, cheese, coffee, peppery condiments, strong wines, and malt liquors ought scrupulously to be avoided; in anæmic women and old men a glass of sound wine with meals is, however, often to be recommended. Milk, vegetables, white fish, stewed fruits, and farinaceous foods are generally suitable, as are alkaline table waters. Frequent washing

with soap and water is deleterious, especially if the water be "hard," as it produces maceration of the delicate cuticle. Water boiled with bran, barley, or oatmeal, and strained, is less noxious, and rice-milk and thin gruel are excellent cleansing and soothing substitutes for water. When soap becomes permissible, that with a super-fatty basis is to be strongly recommended. Sulphurous baths are sometimes of advantage in very chronic cases with dryness and thickening of the skin without much irritation.

The concomitant dyspeptic or other troubles must be treated according to their predominant symptoms. Attention to the regular action of the bowels appears to be of special importance, and that cod-liver oil is as valuable for the eczema of children as the various preparations of iron are for anæmic patients. Opium frequently aggravates the itching, and its use is to be avoided in favor of chloral or the bromides in children, henbane, or the tincture of hop in old persons. A dose of sulphate of quinine at bedtime is often effectual in producing a good night's rest.

The utility of arsenic is strictly limited; it is distinctly deleterious in the acute stages, when the disease is extensive or itching severe. Its effects are frequently strikingly beneficial in old-standing cases with much infiltration and dry scaling, and in young children, provided the digestive functions be in good order. The dose should be small at first, then cautiously increased. The liquor arsenicalis is the best preparation, and must always be largely diluted and given on a full stomach. Pitch pills or turpentine internally are sometimes useful in chronic cases if the general health be unimpaired.

The removal of decomposing and irritating matters from the surface of the skin by vigorous washing is a necessary preliminary to the successful treatment of all eczemas which depend upon the presence of such a condition. All cases resulting from seborrhœa and hyperidrosis—and they are numerous—must be treated thus, and the procedure repeated as often as the reaccumulation of sebum or sweat necessitates. The subsequent local treatment is the same as for other forms of eczema, and may be said to have for its objects: (1) the diminution of

hyperæmia and exudation, (2) the relief of itching and burning, (3) the stimulation of indolent and chronic patches.

These objects are attained by the use of lotions, ointments, and pastes; broadly speaking, lotions are most suitable for moist, ointment and pastes for dry surfaces. Lotions are also generally preferable for exposed parts, for children, and in warm weather; their method of application has been described. Solutions of the salts of lead and of borax (3 j ad ʒ iij), are those most generally useful for the more acutely hyperæmic and profusely discharging forms. Dilute solutions of carbolic acid (grs. v-xv ad ʒ j), liquor carbonis detergens (3 j- 3 ij ad ʒ viij), thymol or naphthol (grs. v-xx ad ʒ j with a little spirit), often relieve itching. The lead and milk lotion is useful for more chronic, slightly discharging surfaces, as are thick lotions containing protective soothing substances in suspension with mucilage or tragacanth, *e. g.*, the oxide (grs. x-xxx ad ʒ j), and carbonate of zinc (grs. xxx-xl ad ʒ j), subnitrate of bismuth (grs. v-xv ad ʒ j), and chalk; applied with a camel's hair brush, and allowed to dry on the part. Glycerine is apt to irritate, but may be used as a vehicle when slight stimulation is indicated, when lotions containing sulphur are also useful, especially for limited scaly patches. A valuable formula is: \mathcal{R} Sulphur. precip. grs. xx, ætheris m. xxx, spir. lavandulæ m. xx, glycerin. m. xv, aq. rosæ ad ʒ j. In the same circumstances Hutchinson's lotion (liq. carbonis detergens ʒ ijss, liq. plumbi subacetat. ʒ ss-ʒ j in a pint of warm water, to be applied with a sponge) is often of great service.

Ointments are the most generally useful applications; although often disagreeable, they soften and protect the skin, cool it by facilitating evaporation, and act with comparative rapidity, while their effects are durable. Failure to obtain a cure by them is often the result of an imperfect mode of employment rather than of faulty selection of the remedy. Crusts must first be removed by the application of cold starch poultices, soaking with olive oil or a solution of bicarbonate of soda (grs. xxx- 3 j ad ʒ j), then the exposed surface is dried with absorbent wool. The ointment must be smeared over the part, and pretty thickly and evenly spread over properly cut strips of soft linen, and applied like a loose band-

age, the edges overlapping. The "many-tailed" form of bandage is handy for the extremities. The whole should then be covered and fixed in position with a flannel roller. For the face, a flannel mask may be necessary, especially for children. Usually, one change of dressing daily suffices, but two changes in the twenty-four hours may be expedient if crust formation is rapid. The oxide and carbonate of zinc and lead, the subnitrate of bismuth, or the pure oleates of these metals, obtained by double decomposition, are the most generally useful remedies, made up with benzoated lard, vaseline, or lanolin, and the addition of salicylic acid (two per cent.) is often advantageous.

The following formulæ may all be recommended: (a) \mathcal{R} Ung. zinci oxidi; (b) Ung. zinci oleati, (c) \mathcal{R} Zinci carbonatis grs. xxx- 3 j, adipis benzoati ʒ j; (d) \mathcal{R} Emplastri plumbi ʒ x, olei olivæ Oj; heat and mix thoroughly, then add olei lavandulæ 3 ij; this was much used by Hebra. (e) \mathcal{R} Bismuthi subnitratis vel oleatis grs. x-xxx, adipis benzoati et vaselini aa ʒ ss. (f) \mathcal{R} Ung. zinci oxidi, vaselini albi aa ʒ iij, acidi salicylici 2-4 per cent.; this forms a specially useful ointment, to which starch may be added up to 50 per cent., according to the consistence desired. (g) \mathcal{R} Boracis grs. xx, adipis benzoati ʒ j. On obstinate pustular forms and old chronic patches mercurial ointments appear to have an "alterative" as well as a stimulant action and those of the subchloride, perchloride, ammonio-chloride, nitrate and red or yellow oxides, are all valuable preparations, which ought, however, generally to be diluted or combined with others. Vigorous washing with an alcoholic solution of soft soap (saponis mollis, alcohol rectific. aa ʒ vj) before the application of the ointment is a useful and painless stimulant measure in many of these cases. The various forms of "salve-muslin" are convenient for the continuous application of ointments. The zinc-ichthyol salve-muslin is specially useful in chronic, scaly eczema.

Pastes resemble ointments in their mode of application, but are only useful to scaly patches; they dry up, forming an adherent coating to the skin. A useful basis consists of equal parts of lanolin, vaselin, oxide of zinc and starch, with which tars, naphthol, resorcin, ichthyol or salicylic acid, in proper proportions,

can be conveniently combined. A generally useful application in subacute and chronic eczema is glycerine jelly, thus constituted : Glycerine 30 parts, gelatine 15, oxide of zinc 10, water 40, melted together ; a gelatinous mass is formed, which is liquefied when the vessel containing it is immersed in boiling water, and is applied to the skin with a stiff brush, a layer of cotton-wool being superimposed to form an impermeable but pliant coating, which is easily removed with warm water. It is advisable to diminish serous oozing by cold starch poultices containing 2 to 3 per cent. of boracic acid before applying the glycerine jelly.

The effect of tars upon old scaly patches is often beneficial, but so capricious that it is a wise rule to begin by applying them to a very limited region in order to test their effects. The liquor carbonis detergens may be conveniently incorporated with one of the foregoing ointments in the proportion of 3 j to ʒ ii j, and increased slowly if tolerated.

Finally, the most obstinate cases may be treated by caustic applications (tincture of iodine, saturated solutions of caustic potash or nitrate of silver) applied with caution, or by blisters, the thickened epidermis being removed afterward by rubbing with bran, and the exposed raw skin dressed with soothing applications. Patches of eczema ought never to be washed with ordinary soap and water, which has a destructive effect upon the young cuticle of healing patches. Oil, white of egg, oatmeal, and tepid water are the most appropriate substances for necessary cleansing, and it is advisable for eczematous persons to use only superfatty soaps.

The local varieties of eczema.

E. Capitis.—(1) In children : Usually diffuse, pustular, impetiginous, not itchy ; pediculi often present as a primary or secondary condition ; often of seborrhœic origin ; does not cause baldness nor broken hairs. *Treatment* : Removal of crusts by oil, and sometimes subsequent poultice ; diluted white precipitate or red oxide ointments (also destroy pediculi), olive oil and lime-water, equal parts, with carbolic acid grs. v ad ʒ j ; zinc ointment and lanolin, with salicylic acid grs. viij ad ʒ j. Systematic washing, followed by borax ointment grs. xx ad ʒ j.

(2) In adults : Usually chronic, dry, squamous, with much itching. *Treat-*

ment : Mild tarry ointments, oil of cade ʒ ss or more, with almond oil ʒ j, equal parts of soft soap, alcohol, and tar ; carbolic lotions, diluted red oxide ointment, ichthyol, with lanolin and vaseline 5 to 20 per cent.

E. Faciei.—(1) Acute : Common, resembles erysipelas, but temperature never much raised, swelling of eyelids, and lax parts marked, but not brawny, nor attended with same feeling of tension ; general symptoms much less severe. *Treatment* : Dusting powders and general, as already sketched.

(2) Chronic : (a) In children, associated with pustular E. capitis ; same treatment suitable.

(b) In adults, often erythematous, with much itching. Oleate of zinc 3 j ad ʒ j and weak carbolic lotions specially useful ; about eyebrows and angles of nose often seborrhœic. Treat as above.

E. Labiorum.—Often obstinate ; causes painful fissures ; must be differentiated from herpes and syphiloderma. *Treatment* : Emollients, glycerine, or painting with nitrate of silver or solution of caustic potash.

E. Palpebrarum (Tinea Tarsi).—Common in scrofulous children, and obstinate. *Treatment* : Yellow oxide of mercury ointment (grs. iv ad ʒ j) ; dilute citrine ointment, epilation, painting edge of everted lid with solution of caustic potash (grs. x ad ʒ j), and immediately afterward with dilute acetic acid.

E. Barbæ.—Resembles and may be complicated with sycosis, *i. e.*, folliculitis, but is more superficial ; unaccompanied by deep papules and tubercles ; spreads to or exists upon other parts ; must be carefully differentiated from tinea barbæ, *Treatment* must be vigorous and persistent ; remove crusts, cut beard close or shave carefully every two or three days, epilate loose hairs ; if acute, litharge plaster with olive oil, or ointments of zinc and bismuth ; if chronic, white precipitate or ichthyol ointments ; specially avoid poulticing.

E. Aurium.—Common, troublesome, often pustular, with crusting. *Treatment* : Remove crusts ; syringe often required ; mild mercurial ointments, mild tars or carbolic lotion, painting with nitrate of silver or caustic potash solution.

E. Genitalium.—(1) Acute : Common in men, the penis becomes immensely

swollen and œdematous, the scrotum excoriated and weeping. *Treatment* as for other acute eczemas.

(2) Chronic: Common in both sexes; itching most distressing, and scratching causes aggravation of condition; diabetes often present. *Treatment*: Prolonged hip bran baths, followed by dusting powders or borax lotions; carbolic acid, thymol, or naphthol lotions or ointments, mild mercurials or tars, painting with iodine or nitrate of silver after application of a handkerchief dipped in very warm water; mustard leaf over lumbar spine.

E. Ani.—Very troublesome; simulated by condylomata, especially in children; associated with chronic diarrhea, worms, varix, and fissure. *Treatment*: Careful cleansing of parts with warm water after each motion, regulation of bowels; vermicides; calomel ointment with vaseline; red oxide of mercury ointment; zinc ointment with liquor carbonis detergens; cocaine (5 per cent.) with lanolin, or in suppository; oleates of lead, zinc, or bismuth; thymol; painting with iodine or caustic potash.

E. Intertrigo.—Commonest in groins, inner surfaces of nates, below mammæ of obese women as result of contact of surfaces, uncleanness, or sweating. *Treatment*: Lint between surfaces, dusting powders; astringent lotions, *e.g.*, of sulphate of zinc, borax, acetate of lead; rest.

E. Mammæ.—Commonest in nursing primiparæ; at first vesicular, then squamous, with painful fissures and much crusting; is very obstinate. A similar condition, known as "Paget's disease," is accompanied by deep infiltration, and is cancerous in nature. *Treatment*: Nipple-guard; remove child altogether, or nurse only on healthy breast; begin with ointments of boracic acid, salicylic acid, or oleates: vigorous washing with spiritus saponis alkalinus: diachylon ointment, or painting with caustics; if completely rebellious, removal with knife.

E. Umbilici.—Resembles syphilitic disease of same part; is tractable. *Treatment*: Zinc ointment.

E. Crurum.—In old people as result of varicosity of veins, and not associated with eczema elsewhere; skin much infiltrated, red, scaly, with indolent ulcers. *Treatment*: Rest, limb elevated, methodical bandaging; if weeping, wash

with soft soap and alcohol; diachylon, zinc, bismuth, or mild mercurial ointments; lotions of perchloride of mercury, lead and milk, or calamine paint. Martin's bandage useful in some cases of ulcer, applied only during the day, and carefully washed at night. Its action, if beneficial, is obviously so in a few days; if not, had better be discontinued. Iodoform is useful as a local anæsthetic; when pain is intolerable at night, a compound soap pill is often valuable.

E. Manuum.—(1) Acute: Common; implicates whole of both hands, with much œdema of dorsum, or is most marked along edges of fingers where deep-seated vesicles abound; very liable to relapse at regular intervals; possibly identical with cheiropompholyx. *Treatment* as for acute eczema elsewhere.

(2) Chronic: Common about palms and knuckles; dry, with fissures; must be diagnosed from psoriasis and syphiloderma. *Treatment*: Stimulant; tars, mercurials, removal of epidermis by Unna's salicylic acid plaster renewed every two or three days, or by soaking in solution of liquor potassæ on rags for days, then dressing with soothing ointments; no washing; india-rubber gloves.

E. Unguium accompanies chronic E. manuum. Nails are rough, dull, brittle, and punctate. *Treatment*: Mercurials to roots; arsenic internally.

E. Plantarum.—Resembles E. palmarum.

J. J. PRINGLE.

Symptomatic Indications.—In simple eczema *rhus tox.* is usually the only remedy required, quickly relieving the itching and burning, also in chronic eczema with rheumatism, worse at night and at rest. *Arsenicum* is excellent in the dry form, with much itching, especially useful in eczema of the scrotum, anus, and vulva. Graphites in moist variety, when vesicles ooze a sticky fluid, does excellent service. *Viola tricolor* is useful in eczema impetiginodes, eczema capiti et faciei in scrofulous children, with exudation of yellow, viscous pus, and swollen glands. *Sulphur* is useful in chronic cases with much itching and tendency to spread. *Mercurius* for eczema impetiginodes in scrofulous children and in eczema rubrum. Vesicular eruptions on the face and extremities, with oozing of watery fluid, worse from cold, will often yield to *dulcamara*.

ELECTRICITY is used in medical practice for its physical properties, in the investigation of disease, and as a therapeutical agent.

For the purpose of investigating the electrical excitability of nerves and muscles, two batteries are required—viz., a continuous current battery of about twenty to thirty cells, and a faradic or interrupted current battery. The continuous current battery should be provided with a *dial collector*, by which additional cells may be gradually added to the circuit, and a *commutator*, or mechanical arrangement for reversing the direction of the current. A *galvanometer* is also necessary in order to gauge the strength of the current. It may either be attached to the battery, or independent of it but included in the circuit. It is only by its use that any certainty can be arrived at that the same current strength has been used to produce similar reactions in muscles the condition of which has to be compared. This cannot be decided by the number of cells it is found necessary to employ to produce contractions in corresponding muscles of opposite limbs, because the resistance may be different, as is often the case in a diseased and a healthy limb. No practical means has yet been devised for measuring the interrupted current. We must therefore compare contractions produced by its agency with those produced in a corresponding muscle in a healthy subject. The operator should always graduate the interrupted current by the strength which will produce contraction of one of his own muscles. The most useful muscles for this purpose are those composing the ball of the thumb. Experience gained from the frequent habit of making electrical examinations will teach an operator what corresponding current ought to produce a contraction in any particular muscle that has to be tested. The strength of current given by each faradic battery also varies, so that when using an unknown battery it is the more essential that an operator should first test its effects on his own muscles.

For testing the contractile property of muscle, the primary coil is the better, as the secondary produces a current of higher tension (or, possessing a greater electromotive force), and is therefore more painful; but the secondary current

is to be preferred for testing electro-sensibility.

The limbs to be examined and compared should be placed in the same position. When it is wished to ascertain the condition of the muscles, the skin over them should be moistened with salt and water.

For the continuous current a pad should be placed on an indifferent part of the body, and the electrode applied to the muscle the condition of which it is required to ascertain; it should be made alternately negative and positive by means of a commutator, and the contractions produced compared. Then the contractions produced on the affected limb should be compared with those produced on the healthy side; or, if both limbs be affected, a current registering 2 milliamperes on a galvanometer ought to produce a contraction.

The average resistance offered by the human body, under these circumstances, may be taken to be about 1000 ohms; the resistance of individuals varies considerably, chiefly due to the condition of the skin. More cells will be required with one individual to register 2 milliamperes on a galvanometer than with another. For all practical purposes the resistance of corresponding limbs in the same individual may be taken as equal, although this is not always the case. If a very accurate examination and report be required, it is first necessary to discover the relative resistances of the two limbs. This can be ascertained by the help of a galvanometer. If twelve cells of a battery applied to a limb make a galvanometer register 2 milliamperes, and the same number of cells from the same battery applied to the corresponding limb do not register so much, there is a difference of resistance, the latter limb offering an increased resistance.

In examining for faradic contractility, it is best to remove the pad from the indifferent part of the body, and attach another smaller-surfaced electrode with a handle to the rheophore. If the pad be retained on an indifferent part of the body, an interrupted current is so diffused, and so many muscles are thrown into a state of contraction, that no reliable diagnostic information can be obtained. Therefore it is best to apply one electrode to the trunk of a nerve, and the other to the individual mus-

cles supplied by the branches of that nerve.

When it is desired only to influence the skin in testing the electro-sensibility of a part, one moist electrode should be placed on an indifferent part of the body, and the other, a dry one, such as a metallic brush, applied lightly to the part to be tested, the skin also being allowed to remain dry.

The chief *use of electricity in diagnosis* is to help in distinguishing cerebral from spinal or peripheral lesions. The current from a constant current battery always flows from the positive to the negative pole, and is called a descending current. When the polarity of the electrodes is reversed for the purposes of diagnosis, it is assumed that the current flows in the reverse direction, and it is then called an ascending current. The positive pole is called the *anode*, and the negative the *cathode*. In the reactions of healthy muscle to the continuous current a stronger contraction is produced on closing a descending current than on closing an ascending current; or, in other words, a stronger contraction is produced in a muscle when the electrode applied to it is negative than when it is positive—*i. e.*, a cathodal closure contraction is stronger than an anodal closure contraction. This is expressed by the formula $C.C.C. > A.C.C.$

The reverse of this reaction occurs in the "reaction of degeneration," and, as far as electrical diagnosis is concerned, it is the chief point that can be elicited by the use of the continuous current. Erb's definition of the reaction of degeneration" is: "A diminution and loss of faradic excitability in both nerves and muscles, while the galvanic excitability of the latter remains unimpaired, is sometimes notably increased, and always undergoes definite qualitative modifications." In some affections the galvanic irritability of nerves and muscles is increased, but the reactions may be qualitatively normal.

The normal polar reactions of nerves occur in the following order:

- C.C.C. . Cathodal closure contraction.
- A.O.C. . Anodal opening contraction.
- A.C.C. . Anodal closure contraction.
- C.O.C. . Cathodal opening contraction.

In the human subject, where it is impossible to operate on the exposed nerve, the A.C.C. and A.O.C. are about the

same in force. The chief practical fact is that *in health* the C.C.C. exceeds the A.C.C., and the A.O.C. the C.O.C. In the early stages of some paralysis the galvanic irritability is very often increased. By paralysing the ends of the nerves with curare, the muscle can be made to contract independently of nerve excitation, but the purely muscular contraction is more wavy and prolonged than when the innervation is intact. The interrupted current is of greater use in electro-diagnosis. When interruptions take place more frequently than ten times in a second, a tonic contraction of healthy muscle is produced, provided a current of sufficient strength be used. When the motor cells at the origin of the nerves, or the nerves themselves anywhere in the course of their distribution, are impaired or destroyed, then the faradic contractility of the muscles they supply is either modified or lost.

Greater use has lately been made of electricity as a therapeutical agent.

The knowledge of *catelectrotonus* and *anelectrotonus* naturally leads to the use of the negative pole in the treatment of diseased conditions, which are thought to be due to a decreased nervous excitability, and to that of the positive pole for its calming effect when increased nerve excitation is believed to be present, as in many forms of neuralgia, and often with the most satisfactory results. But catelectrotonus and anelectrotonus, as far as is known, are only transitory physiological effects of the current, whereas their application to abnormal nervous conditions is often followed by permanent results in the shape of improvement or cure, from which it is inferred that some permanent molecular change has taken place in the nerve.

Other properties are possessed by electricity which may explain many of the phenomena observed to follow its use in the treatment of disease, such as its physical action in the encouragement or retardation of *osmosis*, according to the direction of the current; its chemical properties, on which are dependent what has been called its *catalytic* or *cataphoric* effects, and also electrolysis; and its stimulant, refreshing, and mechanical effects. The latter is a property chiefly exerted by the interrupted current.

Statical electricity.—The use of statical electricity has of late years been re-

vived, especially by Charcot at the Salpêtrière, and is the most valuable form of electricity for the treatment of some affections, especially those of an hysterical nature.

Statical electricity is administered in several ways. First, by *insulation*, or what may be called a dry electric bath. This is carried out by placing the patient on an insulated couch or chair, and charging him from a frictional electric machine; equilibrium is allowed slowly to reestablish itself through the atmosphere. This treatment is said to produce perspiration and encourage and increase all the usual secretions of the body. A second method is to take *sparks* from a patient who has been previously charged, or by presenting the part of the patient it is wished to influence to a condenser already charged. A third method is by *shocks*. This is only suited for local application, and consists of discharging a Leyden jar through the part of the patient to be treated; *e. g.*, through the pelvis for amenorrhea.

Galvanism.—The batteries used for diagnostic purposes may also be employed for the treatment of many affections which can be relieved by galvanism or faradism. In the use of galvanism two methods are followed—one, the “stable,” in which both electrodes are kept perfectly stationary, the current passing evenly between the two points; the other, the “mobile,” in which one electrode, usually the negative, is moved over the limb or part it is wished to influence. In both cases the skin should be previously moistened with salt water. The best form of electrodes are carbon or metal disks covered with chamois leather. In either method of administering galvanism it is often convenient to have one electrode placed on an indifferent part of the body. The best electrode for this purpose is an oval plate of some pliable metal, such as tin, covered with a layer of amadou to retain moisture, the whole being inclosed in a loose cover of washleather or flannel, having a waterproof back to protect the patient's clothes. When galvanizing the arms this plate electrode can be slipped beneath the collar to the back of the neck; when the legs are treated it can be applied to the lower part of the dorsal spine and the patient allowed to lie upon it. The greatest chemical and thermal action takes place about the negative electrode, and for this reason it is usually chosen as the movable one.

What is called “central galvanization” consists in applying the negative electrode in succession to the chief nervous centers—viz.: to the brain, spinal cord, and sympathetic in the neck—the other electrode being placed on the epigastrium or some other remote part of the body. This method of electrization is generally employed when it is sought to influence the whole nervous system, as in states of great nervous depression, or exhaustion after long illness, or in cases of nervous insomnia. Other special affections—such as neuralgias—which are treated by galvanism are often better relieved by applying the positive pole to the painful area. On the other hand, sciatica is more successfully treated by the negative pole, the current used being as strong as the patient can bear.

Faradism.—Faradism is, generally speaking, of less use as a therapeutic agent. It is of greatest service in certain forms of paralysis, as it helps to exercise the muscles, and thus to maintain and promote their nutrition while repair may be taking place at the seat of the disease. In some forms of neuralgia, also, it is found more effectual than galvanism. It probably relieves pain by the production of nerve vibrations. When used for the general conditions of the system, it is either employed in the electric bath, or by what is termed “general faradization,” one electrode being placed on an indifferent part of the body, or the feet are placed on a metallic plate, while the whole surface of the body is sponged with the other electrode.

Electricity is often of service in those affections which come equally under the care of the physician and the surgeon, such as incontinence of urine, cystitis, and neuralgia after injuries.

W. E. STEAVENSON.

The faradic current has been successfully used in the treatment of ague, amenorrhea, anæsthesia, aphonia, asphyxia, debility, constipation, paralysis, impotence, muscular atrophy, prolapsus ani, prolapsus uteri, uterine inertia, muscular rheumatism, arthritic rheumatism, strabismus, suspended respiration, etc.

ELECTRICITY, SURGICAL APPLICATIONS OF.—*Producing the electrical current.*—The galvanic current is obtained from some form or other of “cell” or “element.” This

depends for its construction on the fact that when two dissimilar metals, or a metal and carbon, are immersed in a corrosive fluid, and either touch at one point or are united by a connecting-wire, an electrical current is established in the "circuit," which is the term used to express the combination of metals, fluid, and connection. One such arrangement is called a *galvanic cell* or *galvanic element*, while a number of cells coupled together form a *battery* or *pile*.

The metal more easily attacked by the fluid is corroded, while bubbles of hydrogen gas form on the other. The current is said to begin at the corroding metal, pass through the fluid to the other metal or carbon, thence through the latter, and back to the first metal by the point of junction or by the connecting-wire. The outer portion of the current, *i. e.*, that which flows along the connecting-wire, is that which is used for medical and other purposes. The points of attachment of the connecting-wire to the metals are known as the *poles* of the cell. That pole *toward* which the current flows in the outer part of the circuit is called the negative (−) pole, while the other *from* which it comes is called the positive (+) pole. Metals have been arranged in order, according to the ease with which they are attacked. Thus, in dilute sulphuric acid, the order would be amalgamated zinc, ordinary zinc, iron, tin, lead, copper, silver, platinum, and carbon. The further apart the metals are in the series, the greater the difference in their "potential": *i. e.*, the greater the tendency for a current to flow from the one to the other in a "cell."

Electro-motive force is the magnitude of the cause which produces the electric flow. It will, of course, vary with the metals chosen, and with the fluid in which they are immersed. Amalgamated zinc is generally chosen for the negative pole metal or *negative* plate; copper, silver pure or platinized, or carbon, for the other or *positive* plate.

As the cell works, a layer of hydrogen gas tends to gather on the positive plate, a process which is called *polarization*, and which is important because its effect is to interfere with the original current by sending one in the reverse direction. Polarization is a frequent cause of disorder in batteries. To obviate it (1) the positive plate is made rough, so that the

hydrogen may form air-bells and escape by rising to the surface. (2) Some substance, which absorbs hydrogen by uniting with it, is interposed between the two plates: *e. g.*, binoxide of manganese in the Leclanché cell.

The electro-motive force is always the same for the combination of any two metals immersed in a given fluid to form a cell, however large or however small the surface of metal exposed to that fluid be. It has been likened to the "head" of water, which is always the same for a given height to which a quantity of water may be raised, however any other conditions as to size of pipe, etc., may vary. The electro-motive forces of a number of cells can be superposed by coupling the cells together *in series*; *i. e.*, connecting the positive plate of one cell to the negative of the next, and so on; thus multiplying the electro-motive force by the number of cells employed.

The flow of electricity is always more or less resisted, both within the cell and there especially in the corroding fluid, which acts as a conductor; and also outside the cell in the wire or other conductor which unites the two poles. The resistance, like that of a pipe to the flow of water through it, is in inverse proportion to the cross-section of the conductor, and in direct proportion to its length. Thus, the smaller the cross-section of the conductor, and the longer it is, the greater will be the resistance which it offers to a current of electricity, and *vice versa*. Hence, the larger the "plates" of a cell, the greater the cross-section of the fluid conductor between them, and so the less the "internal" resistance of the cell—a factor which can be still further diminished by bringing the "plates" nearer together. When the cells of a battery are united, not "in series," but *in surface*, *i. e.*, with all the positive poles and all the negative poles joined to one another, the electro-motive force remains as that of a single cell, but the internal resistance is diminished just as if the plates of a single cell had been enlarged as many times as there are cells in the battery. In such a case, any one of the coupled together positive poles, and any one of the coupled together negative poles, will serve as the positive and negative pole of the battery. When desired, the cells may be united "in surface" into groups of so many cells; the electro-motive

force will then be multiplied by the number of groups, while the internal resistance will be diminished in proportion to the number of cells in each group. Thus, a battery of 30 cells may either be arranged entirely "in series," entirely "in surface," or into groups, say into two groups of fifteen cells each, into three groups of ten each, and so on.

The current strength (c) of a cell or battery; according to Ohm's law, varies directly with the total electro-motive force (E), and inversely with the total resistance [internal (ir), and external (er)], and is usually expressed thus :

$$c = \frac{E}{er + ir}$$

When the electro-motive force is multiplied, say 10 times, by coupling together 10 cells in series, the internal resistance, which belongs to each cell, is also multiplied to the same extent; but when the external resistance to be encountered by the current is very much greater than the internal resistance of the cell, this increased internal resistance may be neglected in comparison to the gain in electro-motive force attained by multiplying the cells in series. Hence, in passing currents of electricity through the human body, where the "external" resistance is enormous, the cells of a battery must be multiplied in number and arranged in series. On the other hand, when external resistance is comparatively slight, as in electrolysis of aneurisms, or of vascular tumors, or in the galvano-cautery wire, advantage is gained by diminishing the internal resistance; and this, as we have seen, is to be attained by increasing the size of the plates of the cells, or arranging the cells of a battery into groups, where like poles are united. Hence, for ordinary surgical electrolysis operations, or galvano-cautery work, as well as for the incandescent lamp of the cystoscope, a few large cells, or a few large groups of small cells are what are needed. For electrolysis of uterine fibroid tumors by Apostoli's method, great electro-motive force, and consequently a large number of cells, in series, are needed.

In order to compare the strength of various currents, certain standards have been agreed upon by electricians. These are expressed as volts, ohms, ampères, and milliampères.

A volt is the unit of electro-motive force. The electro-motive force of a single Daniell's cell is about 1 volt.

An ohm is the unit of resistance to electric currents. It is the resistance of a column of mercury about 1 meter long and 1 square millimeter in section.

An ampère, the unit of currents, is that which 1 volt produces in a conductor of 1 ohm resistance.

A milliampère is the thousandth part of an ampère. Milliampères are the standards usually referred to, when currents for medical or surgical purposes are spoken of.

A galvanometer is an instrument used to measure the current which flows in any circuit. By its means we are enabled to distinguish between the theoretical power of a battery and the actual current which at any given moment it is able to send through a conductor in the face of resistance. Its construction depends upon the fact that a finely poised magnetic needle, if surrounded by a coil of wire, is deflected from its position, pointing north, when an electric current flows through the coil of wire. The stronger the current, the greater the deflection. By careful experiment, the degrees of deflection can be marked as equivalent to so many milliampères. Except for the electrolysis of superficial tumors (as afterward explained), this instrument should be interposed in the circuit whenever the continuous current is applied for any purpose to the human body, as by its use alone is any approximation possible to the dosage of electricity employed. A perfectly accurate measurement of the amount of electricity which passes through the tissues does not seem attainable, owing to polarization within the body and other sources of loss, which cannot be correctly estimated.

Electrodes are the terminals, connected with each pole of the cell or battery, which are applied to the body. They may be in the form of tubes holding a piece of sponge, or of variously shaped and sized pieces of carbon, covered with wash-leather. The larger the electrode, the more diffuse the current which it transmits, and *vice versa*. Since the epidermis, when *dry*, is an extremely bad conductor, electrodes applied to the skin must be thoroughly moistened with water, plain, acidulated, or with a small quantity of common salt dissolved

in it. For ordinary electrolysis, the electrodes should be in the form of needles insulated with vulcanite to within half-an-inch of their points.

Rheophores are the two connecting-wires between the poles of the battery and the electrodes. They are generally made of copper wire, and are insulated with guttapercha or with silk. Sometimes they are differently colored, so that a glance may tell to which pole they belong.

A **rheostat** is an instrument employed to resist a current of electricity in a given and known way. Rheostats are made so that a known number of ohms' resistance may be interposed in a current. They are used as a means of gradually altering a current, since it will become either stronger or weaker as less or more resistance is interposed. A steadier current also is obtained from a number of cells strongly resisted than from a few cells with little or no resistance.

Induced or faradic current.—This depends upon certain physical laws by which (1) when a current of electricity from a cell or battery flowing along a coil of wire is suddenly interrupted, an instantaneous reverse current is at once "induced," and runs through the wire in the opposite direction to the first. (2) When a second coil of wire is placed outside the first, and when in the latter a current is alternately allowed to flow and is interrupted, sudden currents are "induced" and run through the second coil in the reverse direction to those in the first or inner coil. The intensity of the induced currents in the second coil increases with the number of turns of wire which this coil contains and with its proximity to the first coil. In the faradic apparatus a special mechanism is provided for automatically and rapidly making and breaking the first current. By adjusting the rheophores the induced current from the first, or both currents from the second coil, may be passed through the electrodes. When the rheophores are attached to the first coil, only the induced current passes through them—for reasons that we need not stop to discuss. The current thus utilized is, therefore, rapidly interrupted in one direction. When, however, the rheophores are connected with the outer or second coil, both currents—*i. e.*, those in opposite directions—are passed through the electrodes.

For this reason (and also because these currents are generally intensified by numerous turns in the second coil) the physiological efforts produced by the currents from it are greater than those produced by the first coil.

Electro-diagnosis is based upon variations which, in certain diseases of the nervous or muscular system, occur in the kind and extent of response of muscles to stimulus, applied by electricity either to the nerve alone or to the nerve and muscle together.

Electro-Therapeutics.—In many cases of partial muscular paralysis, such as that from infantile paralysis, nerve lesion, or which follows long disuse from rheumatism, joint disease, or fracture, the application of electricity may, with advantage, be combined with massage and hot and cold douching.

Caution.—When any lesion of the brain or spinal cord has caused the paralysis, no electrical treatment should be employed until all central inflammation has subsided, because it has been found that peripheral stimuli to the nerves are transmitted in a greater or less degree to the center, and so are apt to aggravate existing inflammation there.

Selection of the form of current suitable for each particular case is greatly a matter of experience, but the general indication has been to *always select that current which produces the greatest number of contractions with the least amount of pain.* In order to do this, begin with "the rapidly interrupted faradic, or the rapidly interrupted chemical current, and always when these fail to elicit response the slowly reversed chemical current, which, if necessary, may be increased in strength until the patient can no longer bear the pain." The rapid interruptions are made automatically by the interrupting apparatus; the slow interruptions and the reversal of the chemical current must be made by the operator's hand working the special mechanism provided for the purpose in the batteries as now sent out for medical purposes. Experience has shown that during the continuous passage of a current of electricity of moderate strength through a motor nerve, or through a nerve and muscle, no appreciable effect is produced; but that when the current is suddenly interrupted, or suddenly allowed to pass again, a sudden contraction of the muscle takes place.

This explains why a rapidly interrupted current produces more contraction of muscle than the same current flowing continuously. Further, it has been found that a "descending" current—*i. e.*, where the negative pole is applied nearer to the periphery than the positive pole—produces a greater effect than an "ascending" current, when the circuit is completed or closed—*i. e.*, when the current begins to flow; but that, on the other hand, an ascending current produces a greater effect than a "descending" current when the current is suddenly interrupted. Also, it has been found that an alternately reversed current produces a greater effect than a current (even though interrupted) which flows always in the same direction. Hence the rules given above. Although it is probably not the actual contraction produced which is beneficial to an impaired muscle, still it has been found in practice that the currents which elicit contractions, as above stated, are those from which greatest benefit is obtained—while strong stimuli, which have ceased to elicit contractions, should be given up, as they have been found to do more harm than good. In many cases, the first signs of returning motility are slight voluntary contractions, even when electrical stimuli are powerless to produce any.

Duration of application.—This will depend on the number of muscles to be stimulated, and on their condition. The weaker they are, the shorter time should they be treated with electricity. Fatigue of the muscle is always deleterious, and should be avoided. It is usual to stimulate for a few seconds each muscle of an affected group in succession. No one muscle should have more than five minutes in all at the outside, and generally less. The sitting, which should only last for from ten to twenty minutes, may be repeated daily, or once or twice a week, according to circumstances.

Motor points.—On the skin, over all superficial muscles, there exists a special spot which yields the maximum of contraction, when an electrode, conveying a given current, is applied to it. These spots are called the "*motor points*" of those muscles, which respond to the stimulus thus applied. They should always be utilized in the application of electricity to muscles.

Mode of application.—For the *galvanic* current, one electrode, of large size,

and for preference the anode (positive), should be placed against the patient's sternum or back, while the other electrode is pressed against the part to be stimulated. The size of the latter electrode will vary according to the concentration of stimulus required: thus, a single fine nerve, or the motor point of a small muscle, will require a small electrode firmly pressed down, and larger areas will need larger electrodes, but somewhat stronger currents.

For the *faradic* current, one electrode (either will do) is usually placed over the main nerve supplying the muscle, while the other is applied over its motive point.

Electrolysis is the term applied to the decomposition of water, or other fluid or soft solid medium, by the passage of a strong current of electricity through it. The medium decomposed is known as the *electrolyte*, and when this happens to be water, hydrogen gas is found to gather round the negative pole, and oxygen round the positive pole. When the electrolyte is an organic fluid, such as blood, small quantities of strong alkali are found round the negative pole, and small quantities of strong acid round the positive pole. These minute quantities of acids and alkalies produce their characteristic effects upon the tissues, but have never been found carried into the general circulation. It is to this, their local action, especially that of the negative pole, that J. Duncan attributes the benefit of electrolysis for vascular tumors and goiter, while the destructive effect of the negative pole has also been recommended for the dissolution of urethral and other strictures.

The cases in ordinary practice for which electrolysis is best suited, are: subcutaneous *nævi* on exposed parts of the body, where therefore a scar is undesirable, cirroid aneurisms, and intra-thoracic sacculated aneurisms, not amenable to other treatment. The same authority has also obtained good results in many cases of goiter.

The methods employed are similar in the above cases. The battery should consist of from three to six large cells. Duncan generally uses from 40 to 80 milliamperes of current, but since he advises the operator to be guided by the touch as the process proceeds rather than by the amount of current passing, he does not consider the galvanometer of any use except perhaps for sacculated aneu-

risms, where palpation is more difficult.

The needles should be insulated to within half an inch of their point with vulcanite, and both should be thrust into the tumor or aneurism. Although the positive-pole needle, if made of steel, will be attacked by the acids which it sets free, the resulting salts are non-poisonous and the needle can be easily resharpened, so that this effect can be neglected. However, unassailable needles of gold or platinum can be used for the positive pole.

Mode of procedure, say for a nævus, cirroid aneurism, or goiter. The patient, especially if a child, is to be anæsthetized. The skin over and round the nævus is first cleansed and purified. The needles, unattached to the battery as yet, are then thrust through the skin an inch or two from the nævus, and are pushed subcutaneously into its substance, so that at the first sitting the deeper parts are chiefly attacked. As soon as the needles are placed in position they are connected with the battery, and the process begins. Soon a soft coagulum and crepitation from bubbles of hydrogen gas are perceptible round the negative-pole needle, while a firm hard coagulum is felt to form more slowly round the positive-pole needle. The latter is allowed to remain for the most part in one place, while the negative needle is moved from place to place as the desired effect is produced in each. During these subcutaneous alterations in position, the non-insulated part of the needle must not be allowed to reach the aperture in the skin. An entire coagulation to about the size of a walnut is sufficient for any single sitting. Care should be taken to prevent the cauterizing effect from penetrating the skin to the surface. From twenty to thirty minutes is sufficient for one sitting. To obviate bleeding from the needle-punctures, the current should be maintained while they are being slowly withdrawn, so that a coagulum may block their track. Either needle, as soon as its non-insulated part reaches the skin, should be entirely withdrawn, and its aperture at once covered with collodion and wool. The other needle having been withdrawn and its aperture similarly dealt with, the whole of the surface of the part electrolyzed should be covered with cotton-wool and collodion, and be left alone for a fortnight or three weeks.

The method of Dr. R. L. Watson, for the

removal of nævi, moles, fibrous growths, superfluous hair, is to puncture the skin at the base of the growth with two common needles as electrodes, one on either side. The current is then allowed to pass for about five minutes or until it has produced its proper effect. In from seven to eight days with small growths, and a correspondingly longer time with larger ones, the excrescence drops off, leaving an open sore which rapidly heals.

For the *galvano-cautery platinum wire point or loop*, a battery like that for electrolysis is required. Platinum is selected because it can be heated and cooled again any number of times without becoming oxidized, and because its fusing-point is so high. A current too strong to pass easily is sent through the wire, and heats it in proportion to the resistance which the wire, in virtue of small cross-section, offers. With either loop or point, a non-conducting handle is supplied, provided with a trigger, which can be pressed with the forefinger so as to turn on or off the current. For lighting the interior of the bladder or urethra, with the endoscope or urethroscope, small incandescent lamps with carbon filaments are employed.

ELECTRIC STROKE (*Lightning stroke*).—A person exposed to an electric current of high tension, or to the full force of the lightning stroke, is usually killed on the spot. It is not with such cases, but with injuries short of a fatal result, that we have to deal. The effects of electric shock are local and general, and the severity of each bears no relation to the other. The chief local injuries are burns, varying from slight burns of the first degree to deep wounds, and, though rarely, mutilations of limbs or of other parts, and fractures of the skull. Small perforated wounds with charred edges are occasionally produced on the legs or soles of the feet, where the current has passed from the body. Curious arborescent zigzag lines on the skin sometimes mark its course. The clothes are usually torn at the point at which the current enters; and in a remarkable case, recorded by Mr. Wilks, they were almost completely torn off, and much rent. The person is rendered at once insensible, and, on recovering consciousness after a short or often considerable time, finds that he is suffering with some disturbance of the special senses, as

blindness, deafness, loss of taste or smell, or with paralysis and insensibility of some part of the body, the lower extremities being more commonly affected. Sometimes there is cerebral disturbance. The paralysis usually passes off gradually, and sensibility returns; even lesions of special senses may be recovered from.

In fatal cases the rigor mortis is extreme; and the blood generally, but not invariably, remains fluid.

The treatment consists in maintaining vitality by warmth to the surface, stimulants, and artificial respiration. Burns should be treated in the usual manner.

ELEPHANTIASIS ARABUM (Tropical Big Leg) is a chronic hypertrophic disease of the skin and subcutaneous connective tissue, accompanied by œdematous swelling and induration, by pigmentation and papillary outgrowths.

The lower extremities and genitalia are the commonest seats of the disease, but the hands and arms not infrequently suffer also; at first the condition is usually one-sided. Recurrent attacks of erysipelatous inflammation, followed by more or less permanent enlargement of the affected member, first attract attention. During these the adjacent lymphatic glands are enlarged, and the lymphatic vessels show themselves as red lines or knotty cords. At first the skin pits on pressure; afterward it becomes dense, indurated, and warty from the outgrowth of hypertrophied papillæ; dirt accumulates in the folds, dilated surface lymphatics rupture and discharge, maceration and irritation of the mass ensue, causing crusts, fissures, and ulcers. Pain is not usually severe, but the usefulness of the limb becomes impaired from its weight and size. Scrotal and labial elephantiasis may reach huge proportions, and the genital apertures become buried and inaccessible.

Although generally a tropical disease, sporadic cases occasionally occur in temperate zones. The condition is essentially due to blocking of the lymphatic channels. In temperate climates recurrent erysipelas or eczema, persistent phlegmasia dolens, or anything causing permanent lymphatic-blocking may produce the disease.

Treatment.—In the early inflammatory stages the limb should be kept at perfect

rest, cooling lotions used, and general antiphlogistic measures adopted. When permanent enlargement is established, firm bandaging with an elastic bandage from below upward ought to be maintained, the limb being elevated. Massage in the direction of the lymph stream would probably be of service. Galvanism and the compression or ligation of the main artery to the affected part have been recommended. Finally, free removal of the parts with the knife may be necessary.

J. J. PRINGLE.

Symptomatic Indications.—*Arsenicum* is the principal reliance in the treatment and should be persistently tried. In the ulcerative stage, *hydrastis*, internally and locally, has been successful. *Mercurius* when syphilitic symptoms have been present, coppery hue under the scales, has given good results. *Antimonium crud.* is also recommended when there are foul-smelling pus-secreting sores, with gastric derangement.

ELEPHANTIASIS TELEANGIECTODES.—Is closely related to elephantiasis Arabum, but differs from it in that it may arise without any previous inflammation and is usually congenital.

Treatment.—Is identical with that suggested for elephantiasis Arabum.

EMBOLISM is the blocking of a vessel, usually an artery, by a substance or particle of matter circulating in the blood. Emboli have many sources of origin, which are here named in their relative order of frequency.

(1) Thrombi, from the cavities of the heart, *en bloc* or in fragments. Occasionally a shower of embolic particles is discharged into the circulation owing to a clot having undergone central softening and rupture. (2) Thrombi (or portions of them) detached from the veins, especially those of the lower extremities and the iliac veins. (3) Fragments of vegetations from the valves, aneurismal clots, and atheromatous detritus. (4) Malignant growths which have perforated the vessels. (5) Parasites. (6) Fat molecules, pigment granules, and micro-organisms.

In most cases arterial branches are the seat of impaction. Capillaries may sometimes be blocked, and occasionally the portal vein or its branches.

When an embolus is impacted in an artery, thrombosis occurs above and be-

low, as far as the first large collateral vessel. If the embolus be impacted at the bifurcation of a vessel, the blocking may be incomplete. The clinical differences between the blocking of an artery by thrombosis and by embolism are that the onset of symptoms in the latter is sudden, whereas, in the former it is usually slow. Moreover, owing to the sudden obstruction of the circulation in embolism, the immediate and remote results are more severe, because degenerative changes in the tissues commence before the collateral circulation is established.

The organs in which the results of embolism are especially marked are those having arteries with a terminal distribution. When an embolus is impacted in an artery of the lungs, spleen, kidneys, or brain, a wedge-shaped portion of tissue corresponding to its distribution is deprived of blood, and, as the obstructed vessel has no anastomosis, there is no possibility of a collateral circulation being established. The portion of tissue thus deprived of blood loses its functions and undergoes degenerative changes. There is an afflux of blood to the vessels in the immediate neighborhood, causing a well-marked zone of hyperæmia. Unless the embolus obstruct a large artery, it is not of much importance if the affected organ have only a single function, but in the brain, where every portion of the cortex is differentiated to some particular function, blocking of a vessel may cause irreparable loss of power.

The term *infarct*, although implying an infiltration of a part, is used indifferently whether the wedge-shaped area become filled with blood or remain permanently anæmic. In the latter event it is called a *primary white infarct*. This is seen especially in embolism of the vessels of the brain and of the *arteria centralis retinæ*. The changes which occur in the tissues deprived of blood are first coagulative necrosis and subsequently fatty degeneration.

Secondary white infarcts arise from the red infarcts by absorption of the pigment.

Red infarcts, often termed *hemorrhagic*, have an appearance on section like damson cheese; the wedge-shaped area of tissue is so swollen by exudation of blood from the vessels that its base projects from the organ as a rounded

prominence. The explanation of the occurrence of *red* infarcts on the surface of certain organs having terminal arteries is that these organs are invested with a capsule, which has a distinct source of blood supply. When an area is deprived of blood by embolism, these small vessels slowly, by small anastomoses, pour blood into the vessels of the anæmic area, which blood escapes (under arterial pressure) from the vessel into the tissue, until the swelling prevents further entrance.

Changes which occur in infarcts.—The red infarcts undergo decolorization, from changes in the pigment, becoming first brown, then yellow, finally white: if the infarct be small, it becomes completely converted into fibrous tissue, leaving a scar. If it be a large infarct, the central portions often undergo softening. They may eventually dry up, and leave a depressed scar, an appearance frequently seen on the surface of the kidney.

Infective emboli occur in pyæmia and ulcerative endocarditis. The particles which form the embolus consist of or contain micrococci; these may lead to a suppurative inflammation of the area of infarction, followed by the formation of metastatic abscesses, especially in the former disease.

Capillary embolism occurs in pyæmia, from the obstruction of capillaries by micrococci; in malaria, by pigment granules; and fat embolism of the pulmonary capillaries has been met with in cases of osteo-myelitis, fracture, contusion, and diabetic coma.

Some of the principal clinical results of embolism may be summarized as follows: Hemiplegia, aphasia, and hemipopia, from blocking of the middle cerebral artery or its branches; and blindness, from embolism of the *arteria centralis retinæ*.

Occasionally a large clot detached from the right heart, or more frequently from the iliac or femoral veins, blocks the pulmonary artery to such an extent as to give rise to sudden death from asphyxia. Embolism of branches of the pulmonary artery is not uncommon in heart disease, and is followed by *pulmonary apoplexy*.

The coronary arteries or their branches may be the seat of embolism, and sudden death may occur from paralysis of the heart, or it may terminate in degenerative

changes of a portion of the myocardium. Embolism of the spleen is not attended with any evident symptoms beyond pain, tenderness, and some swelling of the organ. When branches of the renal artery are blocked by emboli, blood may appear in considerable quantities in the urine.

Embolism of the main artery of a limb, except in old people with degenerated vessels and a feeble circulation, is rarely followed by gangrene, but in young people it frequently gives rise to aneurism.

F. W. MOTT.

EMMETROPIA.—See REFRACTION.

EMETICS are substances which produce vomiting. They do this either by their effect on the stomach, or by acting on the vomiting center in the medulla oblongata. Emetics are termed local or general according to their mode of action.

To the former class belong large draughts of tepid water, alone or in combination with mustard ($\frac{3}{4}$ ss) or salt ($\frac{3}{4}$ j), sulphate of zinc (grs. xxx) or sulphate of copper (grs. v-x), or carbonate of ammonium (grs. xxx).

To the latter group belong apomorphine, ipecacuanha (grs. xxx of the powder or $\frac{3}{4}$ j of the vinum ipecac.), and tartar emetic (grs. iij) or $\frac{3}{4}$ j of the vinum antimonialis. Apomorphine may be used hypodermically (gr. $\frac{1}{8}$): the others are administered by the mouth. Emesis may also be induced by irritation of the fauces with a feather.

Emetics are employed when it is desirable to empty the stomach of its contents, as in some cases of poisoning and of indigestion, or to promote the expulsion of mucus from the air passages, as in bronchitis or broncho-pneumonia—an effect produced by the mechanical compression of the lungs which occurs in the act of vomiting.

EMMENAGOGUES are agents having the power of producing menstruation.

In the strict sense of the word, there is no such thing as an emmenagogue. The only way in which treatment can produce menstruation is by removing conditions which prevent it. Thus iron, by removing anæmia; cod-liver oil, quinine, and other tonics, fresh air, exercise, sea air and sea-bathing, by improving nutrition, may re-establish suspended menstruation.

When, in consequence of cold or shock, menstruation has been arrested, we may promote dilatation of the vessels of the pelvic region, and so favor free circulation through this vascular area, and consequent renewal of healthy function, by warm hip-baths and hot poultices to the lower abdomen. If the patient be married, the effect of the menstrual loss may be obtained by the application of leeches to the cervix uteri; and the relief to pelvic congestion so given will favor natural menstruation at the next period. Hot foot-baths, to which mustard may be added, and the administration of a small quantity of hot dilute alcohol at bedtime, are well-known domestic remedies. Many drugs have been recommended—aloes, apiol, permanganate of potash, black hellebore, and cantharides—but there is none from which any effect on menstruation can be predicted.

G. E. HERMAN.

EMPHYSEMA OF THE LUNGS

is a condition in which the infundibular cavities and alveoli are dilated and the alveolar walls atrophied, the result being that the elasticity of the air vesicles is lost, and they are no longer able either to aerate the blood or to expel the contained air.

Symptoms.—More or less constant dyspnoea, increased by exertion, and accompanied by a feeling of oppression across the front of the chest. As emphysema almost always occurs as a complication of some other affection, the dyspnoea is not invariably of the same character, but, as a rule, it is marked by a very prolonged expiratory effort, attended by a certain amount of wheezing. The cough which is present in emphysema associated with bronchitis is peculiar, consisting of a succession of short “hacks” interrupting a greatly prolonged expiratory effort. As many as twenty or thirty such coughs may sometimes be counted with one expiration; the patient then takes a deep breath, and again begins a series as long as the former. This may continue till he is fairly exhausted. Emphysema does not, in the early stages, affect the general nutrition, but emaciation almost invariably occurs sooner or later, coupled with the distressed and rather anxious look which is common to most cases of prolonged dyspnoea.

Physical signs.—On inspection, the

antero-posterior diameter of the chest is seen to be increased, the sternum is arched with the convexity forward, and the angle of Ludovici is prominent; the natural curve of the spine in the dorsal region is more marked, the shoulders are rounded, the super-clavicular fossæ obliterated, and the chest, as a whole, is "barrel-shaped." The heart is displaced downward, and partly from this cause, and partly from the hypertrophy and dilatation of its right cavities, there is pulsation in the epigastrium. A line of distended venules is often seen just above the margin of the costal arch, forming the so-called "emphysematous girdle."

When the patient takes a deep inspiration, the chest is raised *en masse*, but there is little or no true expansion, the increase in the thoracic space being effected by the descent of the diaphragm. The vocal fremitus is usually diminished, the percussion note is hyper-resonant, and the normal areas of cardiac and hepatic dullness may be completely obliterated. On auscultation, if the change be general throughout the lungs, the inspiratory sound is feeble and the expiratory sound prolonged, and, if bronchitis be present, accompanied by wheezing. Should, however, the margins only of the lungs be affected, the inspiratory sound may be harsh. Fine crackling râles are often audible at the base posteriorly. The above description applies to a case of emphysema as ordinarily observed in association with chronic bronchitis—"large-lunged emphysema." In another form met with in aged persons the chest is small, the lungs being shrunken instead of enlarged, a change probably due to a process of chronic atrophy complicated by a certain amount of emphysema. This is termed "small-lunged emphysema." In this latter variety the emphysema is often complicated with pleuritic adhesions, from which in the more common form the lungs are generally free.

Another distinct affection, known as *interlobular emphysema*, is occasionally met with in children, and also in adults after injury to the chest. Strings of bubble-like prominences are seen on the surface of the lung, and correspond in direction with the interlobular septa. They may also occur in groups, giving an appearance of fine froth on the visceral pleura. This condition, when not the re-

sult of direct injury, is due to the rupture of air vesicles and escape of air beneath the pleura, or to the entrance of air into the mediastinum from the opening up of the deep cervical fascia, as sometimes happens in the operation of tracheotomy. When once the air has obtained entrance into the mediastinum, it is drawn during inspiration, and forced by violent expiratory efforts, along the sides of the bronchi, and so reaches the surface of the lung.

For *effects* of emphysema upon the heart and other organs see CHRONIC BRONCHITIS; they include hypertrophy and dilatation of the right ventricle and auricle, followed in the later stages by incompetence of the tricuspid valve, distention of the venous system generally, passive congestion of the kidneys and liver, gastric catarrh, albuminuria, and dropsy.

Morbid anatomy.—On opening the chest the lungs do not collapse, but may be seen completely filling the thoracic space and overlapping the heart. They are of a pale-gray tint, pigmented, and usually free from pleural adhesions. They have a soft, downy feel, and pit upon pressure. The margins generally show the most advanced changes, it being here that the large "bullæ," are usually found. On inverting the lung, the base will be seen to form a deep cup, from the distention of its edges. The bases are usually congested and œdematous, scattered areas of collapse being often present. On examination with a hand lens, the dilatation of the alveoli will be well seen, the lung presenting a delicate spongy appearance. Fatty degeneration of the alveolar walls is occasionally found.

Emphysema frequently occurs as a compensatory change when any portion of the lung has undergone contraction from disease; hence it almost invariably accompanies phthisis in the stage of arrest, and may completely mask the signs of the original lesion. In doubtful cases, therefore, the sputa should always be examined for bacilli. The change may affect the neighboring alveoli only, or, if the contracted area be considerable, may be present throughout a whole lobe. When collapse of the whole of one lung occurs as result of pleural effusion, or when a large area is destroyed in phthisis, the enlargement of the opposite lung is probably partly a true hypertrophy, and in part due to emphysema. It is cer-

tainly accompanied by an increase in functional activity, whereas the condition of emphysema implies a lessening of function.

When simply dilated without rupture, a condition not infrequently met with in children, it is probable that the vesicles may regain their normal size, but in advanced stages the change is permanent.

Etiology.—The condition may arise from a congenital defect in the development of the elastic tissue of the lung, and it is certain that the affection sometimes appears in several members of a family, but probably they have then been alike exposed to the exciting causes. These are mainly such as give rise to sudden increase in pressure of the air within the lungs. In the act of coughing, strain is put upon the walls of the vesicles, the glottis being partially closed during a violent expiratory effort. If this be frequently repeated, dilatation of the alveoli follows, and may proceed to such an extent that the finer partitions become atrophied and break down, the alveoli coalescing to form spaces, often of considerable size, which are termed “bullæ.” Whooping-cough in early life, and in later life the chronic cough which accompanies bronchitis and phthisis, are the most common causes of the disease. Any act of straining which involves muscular effort while the breath is held, such as laborious work, lifting heavy weights, the act of parturition, and perhaps even of defecation, tends in the same direction. Expiratory dyspnoea, from whatever cause, and especially that of spasmodic asthma, is also liable to set up emphysema. Occupations such as glassblowing and the playing of wind instruments conduce directly to it; and in any laborious calling where persons are obliged to undertake great exertion when they are more or less “out of breath,” the same change may occur. The longer the patients are exposed to the influences which produce increased pressure of air within the lungs the more widespread the mischief.

Treatment.—Prevent as far as possible any increase of the affection. If it be due to any definite exciting cause, such as playing a wind instrument, the indication is clear; if it complicate chronic bronchitis, the patient must avoid as far as possible anything which may give rise to catarrh of the respiratory passages. Overexertion of any kind must be

avoided, although active out-door exercise should be insisted on, but it is of especial importance to restrain patients from allowing themselves to get “out of breath.” Any sport entailing occasional excessive exertion should be forbidden, and hill walking must only be undertaken in moderation, and at a slow pace. The tricycle affords an excellent means of exercise. Relief has in some cases been given by means of exhalation into rarefied air. The residual air which the diminished expiratory power is not sufficient to expel is thus drawn out of the vesicles, and for the time relieves their hyperdistention. See also the article on CHRONIC BRONCHITIS.

E. CLIFFORD BEALE.

Symptomatic Indications.—The principal remedy is *arsenicum*, which is especially useful when the emphysema is connected with the recession of rash, or when slight bronchorrhea, with glairy, white-of-egg expectoration is present, also in asthma with transitory emphysema. *Arsenicum* should be persistently continued. *Lobelia* allays the dyspnoea which accompanies capillary bronchitis in emphysema, and is excellent for pseudo-asthmatic attacks. *Bromine* is useful for emphysema after inflammation of the lungs, with gasping for breath, wheezing, spasmodic closure of the glottis, sense of pressure in the stomach. *Antimonium tart.* for the bronchial catarrh, with difficult expiration. *Phosphorus* when dyspnoea is partly due to cardiac weakness.

EMPYEMA.—An empyema is a collection of pus within the pleural cavity. In some cases the fluid is purulent from the first, but more frequently the effusion is primarily serous.

Symptoms.—The expression is anxious, and there is often a marked degree of wasting and general pallor. The temperature is high and fluctuating, and of the hectic type. Rigors and sweating are often present, but there may be complete absence of fever when the case first comes under observation. There is usually increased frequency of the pulse and respiration, and, in addition to the above, there are the special symptoms of pleuritic effusion, (see PLEURISY). A rise of temperature over the surface of skin covering the dull area has been observed, but this is not always found. (Œdema of the affected side of the chest is present in some cases,

but has been also noted when the fluid proved to be serous. The collection of pus may be limited by pleural adhesion to a very small area, a condition often difficult of diagnosis, and particularly so when the empyema is situated between the base of the lung and the diaphragm.

If the fluid be allowed to remain, spontaneous rupture through the chest walls, or "pointing" of the pleural abscess, may occur, generally about the fifth interspace in the nipple line. The contents of an empyema may also burrow through the subcutaneous tissues to distant parts, ultimately either appearing on the surface as a pointing abscess or discharging into some cavity. A neglected empyema, however, more often discharges through the lung than in either of the above-mentioned ways. The chief dangers to be feared in cases of empyema are the occurrence of cerebral abscess, acute tuberculosis, and, after operation or spontaneous rupture, of albuminoid disease.

After the removal of the pus the lung may in recent cases expand to a considerable extent; other changes which aid in obliterating the cavity are the contraction of the affected side of the chest, the displacement of the mediastinum, enlargement of the opposite lung, and the upward movement of the diaphragm. Ultimately the process of closure is completed by the growth of granulation tissue within the empyemal sac.

Diagnosis.—The positive diagnosis can only be made by means of the exploring syringe, which should always be used whenever the presence of pus is suspected. In a few rare instances a general pulsation, synchronous with that of the heart, has been felt over the whole area of a large empyema, and has led to a mistaken diagnosis of aneurism. On the withdrawal of a few ounces of fluid, the pulsation may cease altogether, owing to the relief of tension. In rapid and acute effusions the shreds of lymph and leucocytes tend to gravitate to the lower parts of the pleural cavity, and if the exploring needle be introduced in any of the lower intercostal spaces, a turbid—almost purulent—fluid is withdrawn, and may give rise to the false impression that the whole chest is full of pus. In any case of doubt, therefore, a second exploration should be made at a higher level.

Ætiology.—The condition is most common in children, but may occur at any age

as a sequel of acute pleurisy, especially when the latter affection is a complication of septic inflammation elsewhere, or occurs in the course of the infective fevers, and especially small-pox. In the subjects of malarial poisoning, also, a serous effusion is very apt to become purulent, and an acute tubercular pleurisy may also result in empyema.

Treatment.—If an empyema be discovered by the use of the aspirator, no harm can be done by withdrawing as much of the pus as will flow through the needle, and in some cases in children a cure has thus effected. If the diagnosis be made by the use of an exploring syringe, it is seldom advisable to proceed to paracentesis, as aspiration is usually followed by a rapid reaccumulation of the fluid. A free incision through an intercostal space, followed by the insertion of a drainage-tube, is then necessary. The exact site to be chosen for the opening must be determined by the circumstances of the case. It is usually best to select a spot about two interspaces above the lower level of the dull area, as, if the opening be made at the lowest point, a long sinus may remain after the chest has contracted, and there may be great difficulty in getting it to heal, whereas the choice of the higher site ensures the opening being opposite to that part of the cavity which is usually the last to close. The sixth or seventh interspace in the mid-axillary line is generally the most convenient region in which to open the pleura.

It is in the first place of great importance to secure free drainage for the pus, and to prevent the access of septic air to the cavity. Washing out the sac with warm aseptic solutions (*e. g.*, corrosive sublimate, 1–2000) is often recommended, but not quite free from danger, as in several cases severe shock, and in a few sudden death, has occurred during its performance—results possibly due to the fact that insufficient provision was made for the free exit of the fluid injected. If this be done, and care be taken not to inject the fluid faster than it can escape, the proceeding is probably free from risk. In children, and in adults when the intercostal spaces are narrow, it is generally advisable to remove a portion of a rib at the time of opening the empyema, and, should there be much caseous-looking material or curdy pus within the cavity, or a thick membrane on its walls, it should either be

washed out by inserting the nozzle of the irrigator beneath it, or scraped away by means of a sharp spoon guided by the finger. "Perflation," or blowing purified air into the sac, has been recommended with the same object, but is a less efficient measure and not free from risk. The injection with a syringe of an ounce or rather more of iodoform emulsion (iodoform 10 per cent., glycerine 70 per cent., water 20 per cent.), after scraping the interior of the sac, has been found of service in some cases. An aseptic condition of the sac may also be secured by placing the patient in a warm-water bath to which some antiseptic solution has been added, the water flowing in and out with the respiratory movements.

If, in spite of long-continued free drainage, and the occurrence of all possible compensatory changes, such as contraction of the chest, displacement of the mediastinum and diaphragm, and some expansion of the lung, the empyema still remains, it may be necessary to remove longer pieces of several ribs, or even the greater part of one side of the thorax with the thickened pleura, in order to secure the complete obliteration of the cavity. This latter operation is a very severe proceeding, and should only be performed when life is threatened from the weakening effect of prolonged suppuration and the supervention of albuminoid disease. In one recorded case 54 inches of bone were thus removed—an average of 6 inches for each rib.

The possibility must always be borne in mind that two or more localized empyemata may exist in the same chest. Hence, if relief to the symptoms be not given by free evacuation of the pus, the chest must be carefully examined for a second collection. If found, it must be promptly emptied by the same means. Cases of pyo-pneumothorax not of tubercular origin, or empyema ruptured into the lung, are generally best treated upon the lines here laid down.

In the after-treatment of cases of empyema in which free drainage has been established, attention must be directed toward the maintenance of the general health, which will certainly suffer from the exhausting effect of prolonged suppuration. For this purpose, iron, quinine, and cod-liver oil are the best remedies. Burgundy or port wine may also be allowed. Gentle gymnastic movements of

the chest may be useful to promote the re-expansion of the lung and the growth of muscles wasted from disuse, but should not be attempted until at least three weeks after the closure of the wound.

E. CLIFFORD BEALE.

Symptomatic Indications.—*Calcium sulphide* is useful both to prevent the formation of pus and to promote its absorption. *Cinchona* is valuable for the hectic fever from the drain of the pus.

ENCEPHALITIS.—See BRAIN, INFLAMMATION OF.

ENCEPHALOID.—See CANCER.

ENDEMIC.—A disease is said to be endemic when it affects a particular locality or district, and results from local conditions there existing. Malarial fever is one of the most characteristic examples of an endemic disease.

ENDOMETRITIS.—Inflammation of the uterine mucous membrane.

Although commonly spoken of as a morbid condition existing by itself, disease of the mucous membrane is usually accompanied by changes in the muscular tissue beneath, and disease of the muscular tissue of the uterus by change in the mucous membrane. When endometritis is spoken of it is meant that the affection of the mucous membrane is the chief morbid condition present, and not that it is the only one.

Endometritis may affect the cervix or the body of the uterus.

(1) **Cervical endometritis**, leading to the production of the condition variously known as "erosion," or "ulceration," or "granular degeneration" of the cervix, is one of the commonest morbid conditions to which the uterus is subject. The granular erosion is always accompanied by inflammation of the mucous membrane. Catarrh of the cervix may occur alone, but its symptoms are then insignificant. The erosion presents different appearances. The *simple* erosion either appears as a ring around the os uteri or as a patch on its anterior or posterior lip, which has lost its smoothness, and is of a deeper red than the healthy tissue. The *granular* erosion is a patch, similar in situation, which looks to the naked eye like a granulating ulcer. In the *papillary* or coxcomb erosion there are projecting soft papillary growths. The *cystic* erosion is

that in which, beside the granular or papillary condition, hard, shot-like lumps, of the size of a hemp-seed or of a pea, but sometimes larger, are felt in the tissue, from which, when cut into, thickened secretion, either glairy or purulent, flows. Sometimes these cysts hang down into the cervical canal. In this condition they have been given the name of *ovula Nabothi*. These are all different stages of the same morbid condition.

Symptoms.—By the formation of new glands the secreting surface of the cervix is increased, and leucorrhœa results. In chronic cases this is the only symptom. In recent cases there is often vascularity of the whole cervix, which becomes swollen and club-shaped rather than conical, and the canal is dilated. In such, beside leucorrhœa, pain in the back and ovarian regions, menstrual pain, and slightly increased menstrual flow are also present. But the disease is never more than a minor disorder. It is often accompanied by disturbance of the general health, such as loss of appetite, dyspepsia, and nervous symptoms; but there is quite as much reason to think that the condition of health leads to the production of the erosion as that the erosion disturbs the general health. The truth is that the general condition and that of the cervix react on each other.

Prognosis.—If recent it is curable, but if chronic probably incurable.

Pathology.—The affected part, which in health is covered by several layers of squamous epithelium, now has only a single layer of cylindrical epithelium. There is a formation of gland tissue, the size and number of the newly formed glands varying with the advance of the change. There is also proliferation of the connective tissue between the glands. The intervening processes form the granulations or papillary outgrowths which are seen by the eye. Sometimes the mouths of the glands become closed and their secretion is retained, the result being the formation of the cysts above mentioned.

Ætiology.—The chief cause of inflammation of the cervix is injury in parturition. Cold, retroflexion, gonorrhœa, ill-adjusted pessaries, and morbid sexual excitement may also give rise to the condition. Though rare, it is sometimes met with in the virgin.

Treatment.—Administration twice

daily of a hot vaginal douche (112° F.) for five or ten minutes at a time. Use, once or twice daily, plugs of cotton-wool soaked in glycerin, or, preferably, of a glycerin pessary (gelatin gr. xx, glycerin ad 3 ij), or, if there be pain and the secretion purulent, a boric acid pessary (as above, with gr. xx of boric acid). Once in from five to seven days the cervix should be cauterized. A speculum having been passed, adherent secretion should be wiped away from the cervix with a mop of absorbent wool in the grasp of a speculum forceps; the cervical canal should then be cleaned with cotton-wool wrapped round a probe, and a solution of carbolic acid 7 parts, water 1 part, applied to the eroded vaginal portion with a piece of wool held by the forceps, and to the cervical canal with a probe. Some of the carbolic acid will flow into the upper part of the vagina, but this is of no consequence; care must, however, be taken to mop it up before withdrawing the speculum, as, if any reach the vulva, it will cause much pain. Before applying the caustic, any cysts that are seen should be punctured and their contents let out. Tonics and laxatives should be prescribed, and alcohol forbidden.

In a recent case cure may be expected in about six weeks. If after two months' treatment the local condition be unaltered, cauterization should be given up. If the mode of cauterization above described seem unproductive of benefit, a zinc-alum point may once only be placed in the cervical canal and left there. If the cervix be lacerated and everted, and if, after the cervix has been once or twice restored to a healthy condition, relapse takes place, the lacerations should be repaired by Emmett's operation, and the cervix restored to its natural shape. If the cervix be much elongated and thickened, amputation of the vaginal portion is the best treatment.

(2) **Endometritis of the Body of the Uterus.**—**Acute endometritis** is of rare occurrence apart from other disease, of which it may be either the cause or consequence.

It occurs in the course of certain acute diseases—small-pox, enteric fever, typhus, cholera, phosphorus poisoning, and measles. In these the symptoms caused by the endometritis are at the time quite overshadowed by the general condition of which it is one of the results. It may

leave behind fungous or purulent endometritis.

It may be a result of retention and decomposition of ovuline structures. In this case, if there be nothing more than endometritis, there will be simply a copious offensive purulent discharge.

Treatment consists in the removal of what is retained, and in washing out the uterine cavity with 1-2000 corrosive sublimate solution. It may be associated with septicæmia, or with uterine phlebitis, or pyæmia, or peritonitis, in which case it will be of little importance as compared with the other far graver conditions present.

Endometritis may be a result of gonorrhea. This, although it may protract the disease, does not materially alter the symptoms, unless the fallopian tubes become involved, in which case the endometritis sinks into relative insignificance, both as regards danger and as a cause of suffering.

It may result also from the decomposition of retained menstrual fluid after most of it has been let out. This is to be prevented by attention to antiseptic details.

It is believed that endometritis may arise from chill during menstruation, slight attacks of perimetritis coming on in such circumstances being attributed to endometritis extending along the tube. It may result from sexual excesses. Such cases are marked simply by hemorrhage and sanious discharge, without physical signs, and get well with rest in bed and avoidance of the cause.

Fungous or hemorrhagic endometritis occurs in two forms—(1) *chronic hyperplastic* endometritis, in which the body of the uterus is slightly enlarged and its cavity expanded. The lining membrane is hypertrophied, lying in thick folds, which are soft and easily detached. The structure is normal, except that it is more vascular; the glands may be dilated, and there is a round-celled infiltration. In (2) the *polypoid* form there are distinct circumscribed outgrowths, which may be composed of glandular tissue or of granulation tissue, or chiefly of vessels.

Symptoms and diagnosis.—The important symptoms are irregular and rather profuse hemorrhages, and in the intervals a thin rusty or pink discharge. Pain is slight. The disease is important on account of the resulting anæmia. On vaginal examination, nothing abnormal is

perceived. On bimanual examination, the uterus is found slightly enlarged. The introduction of the sound produces hemorrhage and reveals slight elongation of the cavity. With these symptoms and signs, the proper course is to dilate the cervical canal with Hegar's dilators, and explore the uterine cavity with the finger. Then either the thickened, readily detachable mucous membrane or the polypoid growths will be felt.

Ætiology.—Fungous endometritis is often a sequela of labor or abortion, or acute disease. It may occur in the virgin. It is more common near the climacteric, and has been attributed to a morbid influence exerted by diseased ovaries.

Treatment.—Scrape away the diseased lining membrane with a blunt curette, then cauterize the interior of the uterus with nitric acid or with 1-6 solution of perchloride of iron. This will at least stop the symptoms for some months. Relapse may occur, especially in the hyperplastic form, but cure may eventually be expected.

Chronic purulent endometritis is seen in old women, often in association with closure of the cervical canal. The body of the uterus is dilated and thinned. If there be free exit for the discharge, there is little pain, and the purulent discharge is the chief symptom. If the canal be closed, on opening it pus will escape. The chief importance of this disease is that it gives rise to a suspicion that cancer is present, and it may be necessary to explore the uterine cavity in order to establish the diagnosis.

Treatment.—If uncomplicated, the purulent discharge can be stopped by maintaining free patency of the cervical canal, and injecting 3j-3ij of a 3ss ad ʒj solution of silver nitrate into the uterine cavity. This may be repeated in four to seven days, if necessary.

G. E. HERMAN.

Symptomatic Indications.—*Ustilago maydis* is efficient in hypertrophy of the uterus from chronic congestion; oozing of dark blood: *arsenicum* is one of the most important remedies when menorrhagia is a prominent symptom; *arsenicum iod.* when the discharge is corrosive; ulceration of the os, with frequent and profuse hemorrhage. *Ergot* in chronic metritis; putrescent discharge, gives good results; should be persistently continued. *Belladonna* in hyperæmic states of the

uterus is the principal medicine, especially when dragging, heavy pain in the uterine region, disappearing when lying down, is present. *Sepia* is invaluable for venous congestion, with scanty menses; stretching pains in neck of uterus; bearing down pain. *Sabina*, in arterial congestion, with tendency to hemorrhage.

ENEMA.—A fluid injected into the rectum. Clyster is the old name.

The most common use of enemata is to open the bowels. For this purpose simple water or soap and water (Oj-ij) generally suffices, but olive oil ($\frac{z}{3}$ iv) or castor oil ($\frac{z}{3}$ j) may be added; in cases of intussusception of infants milk has been advantageously used. Astringent enemata are often employed to check diarrhea, 2 ounces of starch solution with $\frac{1}{2}$ drachm of laudanum being the most efficacious.

Sometimes it is necessary to feed patients by the bowel. Nutrient enemata are usually made of strong beef-tea ($\frac{z}{3}$ iij-iv) with brandy and yolk of eggs, or peptonized milk may be substituted for the beef-tea; a nutrient enema should not exceed 6 ounces. It is important to wash out the rectum carefully before each nutrient enema. Enemata of salt and water, or of infusion of quassia, are serviceable against thread-worms; 2 to 4 ounces of fluid may be injected for this purpose. The enema opii is useful in painful affections of rectum or bladder.

ENTERALGIA.—See COLIC.

ENTERIC FEVER.—See TYPHOID FEVER.

ENTERITIS.—See ULCERATIVE COLLITIS.

ENTROCELE.—Entro-vaginal hernia. A descent of a portion of the small intestines into the pelvis, producing an enlargement in the wall of the vagina, usually into the recto-vaginal pouch, giving rise to a sense of fullness with pain. The hernia is generally the result of straining during labor. The diagnosis is usually not difficult, and is to be made from the presence of a swelling in the vagina, elastic, tense but not giving the sensation of a fluid. The important point is to differentiate from other forms of swelling as hematocele, pelvic deposit, dislocated ovary, etc. To the practiced

touch the peculiar feeling of an air sac is sufficient, but a fine aspirator may be used in doubtful cases.

The *prognosis* is not good as to cure.

Treatment.—The patient should be put in the knee-shoulder position and the hernia reduced by pressing upward. Following the reduction perfect rest should be enjoined, with astringent vaginal injections.

ENTROPION.—See EYELIDS, DISEASES OF.

ENURESIS (Incontinence of Urine).—Involuntary micturition either during the night only, or both by day and night, is a frequent and troublesome affection of childhood. It may exist from birth, but more commonly commences about the third or fourth year, or not till the seventh. When it takes the form of dribbling both by day and night, it may in some measures be due to indolence and indifference, but when nocturnal only, such a causation is doubtful. The condition is almost equally common in the sexes.

Setting aside such obvious causes as malformation of the bladder or ureters, and stone in the bladder or kidneys, it has been found to be due to the presence of ascarides, rectal polypi, vulvitis, a contracted orifice of the urethra, spasmodic stricture, phimosis, or adherent prepuce; and in girls, to vascular growths at the orifice of the urethra. Sometimes the urine is too acid or too alkaline, while in certain cases disease elsewhere (*e. g.*, morbus coxæ) has appeared to act as an exciting cause.

Sometimes no cause can be found, and in such cases there are good reasons for regarding the condition as analogous to somnambulism, or even to epilepsy, a further reason for this view being that it is sometimes hereditary, and may occur in families where epilepsy or some neurotic taint is inherited. Some subjects of the affection are of deficient intellect, the condition being very common among idiots; but, it often affects unusually precocious children. It has been said that the incontinence is due to lying in too luxurious a bed, but this can hardly have much effect, as it is very common among the children of the poor and in children the subjects of general debility. The child may dream that he is in a proper

place for micturition; more probably, however, the dream follows on the act of micturition. The discharge of urine may take place every night, or several times during the night, or only at intervals. In recent cases some cause will generally be found, often a gastro-enteritis; subsequently, however, it becomes a habit, and is continued after the cause has ceased. The total quantity of urine may be increased, which has given rise to the suggestion that in some cases diabetes may have been present.

Pathology.—Obscure; the bladder seems to be unduly excitable, and the contractile power of its muscular coats is in excess. When the incontinence occurs by day as well as by night, it is to be presumed there is, in addition, atony of the sphincter. On the other hand, the center in the lumbar enlargement may be at fault, as the result of some local or general want of tone in the nervous system. Such a constitutional state, it has been pointed out, is occasionally met with an association with rheumatism. It is highly probable that in some boys, the conditions which give rise to nocturnal incontinence are analogous to those which, at a later age, produce seminal emissions, for priapism is occasionally found, and some subjects have in after-life suffered unduly from nocturnal pollutions or have been addicted to masturbation.

Spontaneous recovery takes place in many instances at the period of second dentition or at puberty. The complaint is said to be more inveterate in girls than in boys, possibly because in them the causes are not so well understood.

Treatment.—Punishment should never be resorted to unless there be good reason for suspecting that the act is the result of carelessness, for fear is only likely to make matters worse, and may cause impairment of the general health. All sources of local irritation should be removed or treated. Attention should be paid to the diet, and to the amount of fluid that the child is allowed, none being given for two hours before bedtime. The child should always be made to micturate immediately before getting into bed, and should be awakened and taken out of bed once or twice during the night to pass water, and each time thoroughly aroused. The patient should not be allowed to sleep on the back; to prevent this a blister may be applied over

the sacrum, or a brush or some hard substance be tied to the pelvis. It is a good plan to raise the foot of the bed on bricks, so that the pelvis may be lower than the feet; the urine as it collects in the bladder will then gravitate to the fundus and not to the neck, and the reflex act of micturition is less likely to be set up. Sponging the back and loins with cold water and wrapping the feet in cold wet towels have been recommended.

If the urine be too acid, the allowance of meat should be reduced, and bicarbonate of potash or liquor potassæ administered internally; if too alkaline, phosphoric acid should be given, as it is very desirable to keep the urine as nearly neutral and as non-irritating as possible. In recent cases give perchloride of iron and *nux vomica*, while in the more chronic cases belladonna usually gives the best results. Small doses of the tincture or extract should be administered at midday and in the evening, the dose being gradually increased until some physiological effects are obtained, when it may be diminished. The drug should be continued for some weeks after apparent cure has resulted. In certain cases, especially when the incontinence is both diurnal and nocturnal, strychnine sometimes answers better. Belladonna increases arterial tension, and acts partly on the vesical center and partly by paralyzing the muscles of the bladder. Ergot, bromide of potassium, benzoic acid, digitalis, borax, and chloral hydrate have also been found of service. The passage of a sound or the application of a 10-grain solution of nitrate of silver to the urethra once a week has occasionally proved beneficial. It is useless to attempt to occlude the urethra by mechanical means. Galvanism may be tried, the positive pole being applied to the back, and the negative indiscriminately to the perineum, scrotum, and hypogastrium; or a shock from an induced current may be given.

G. E. HERMAN.

Symptomatic Indications.—In children the best remedy is *belladonna*, especially when the disease is due to irritability of the bladder, although it frequently fails. *Nux vomica* does good service when the incontinence is due to atony of the bladder. *Acid benzoic* is useful when there is intensified urinous odor with deep color of the urine. *Acid nitric* is beneficial when the urine is

fetid, or purulent. *Cantharis* is useful for incontinence of adults, even when paralytic, and has proved successful with children. *Gelsemium*, for incontinence of elderly people from weak sphincter; *Plantago* when from the same cause in children.

EPIDEMIC is a qualifying term used in medicine to signify that the disease to which is applied affects, during a limited period or periods, a large proportion of the members of a community, nation, or nations.

Though it ought not to be understood as involving any ætiological theory, it is frequently used as an equivalent for "contagious," "infectious," or "communicable," owing to the fact that such diseases have all, with possibly a few unimportant exceptions, been known to occur in an epidemic form. It may be said of every epidemic disease the history of which is well known (with the exception of influenza), that it may be proved to exist always among some community or communities. Thus, Asiatic cholera is never absent from the delta of the Ganges; enteric fever is never absent from Great Britain.

When a disease is constantly present it is termed *endemic*, and it is assumed that special demological or climatological conditions exist which favor the development of the disease. It would appear that at irregular intervals these favoring circumstances become intensified within the endemic area, and are also brought into existence beyond its borders. When the disease prevails in succession in a very large number of countries the term *pandemic* is used: thus in 1889-90 there was a pandemic prevalence of influenza.

The causes which favor each one of the epidemic diseases vary, but it is now almost universally admitted of all the epidemic diseases that the most essential condition is the pre-existence of a case, or cases, and that such diseases have a specific origin; further, modern observations render it in the highest degree probable, that the essential condition is the transference, either directly or mediately, of a *materies morbi* from the sick to the healthy, and that other conditions, social or climatological, operate only by favoring this transference.

Measles, scarlet fever, and smallpox are typical examples of the epidemic dis-

eases commonly communicated directly from the sick to the healthy; enteric fever and cholera, of diseases in which the connection between the earlier and the later case is commonly mediate (water, food); but epidemic diseases cannot be classified on this basis, owing to the numerous exceptions in both directions.

The degree to which an epidemic disease which has appeared in a community will prevail may be in certain cases to some extent foretold. As yellow fever, is checked and finally extinguished by cold weather, in the case of epidemic diseases, one attack of which confers complete or partial immunity, the number of susceptible individuals may be known or inferred from the extent of previous epidemics, or, in the case of smallpox, from the proportion of persons efficiently re-vaccinated. In the case of epidemic diseases, such as enteric fever, which are commonly water-born, the condition of the water-supply and general sanitary state will enable a forecast to be made. The mortality from a disease and the severity of the cases vary remarkably in different epidemics. It has been supposed that certain epidemic diseases stand in some causal connection with each other. For example, it has been asserted that the epidemic prevalence of cholera is always heralded by an increase of the number of cases of diarrhea and "bowel complaint," and that a prevalence of whooping-cough is preceded by a prevalence of measles.

DAWSON WILLIAMS.

EPHEMERA, PUERPERAL.—See PUERPERAL EPHEMERA.

EPIDIDYMITIS.—See TESTICLE, DISEASES OF.

EPILEPSY.—A sudden attack involving loss of consciousness with or without convulsions.

Epilepsy occurs in two forms: (1) *petit mal*—i.e., loss of consciousness without convulsions; (2) *haut mal*, or loss of consciousness with convulsions, which are usually general. Another manifestation of the disease is an *epileptiform seizure*, in which localized convulsions occur without loss of consciousness.

As epileptiform seizures are most frequently associated with cerebral tumors, See BRAIN, TUMORS OF.

Symptoms.—The attack may begin suddenly with loss of consciousness; or the patient may experience various sensations before the fit, called the *aura*, or *warning*. The *aura* must be considered as much a part of the fit as the subsequent convulsions. The word “aura” was originally used to denote the feeling which some epileptics describe as that of a current of air passing up the limb. This aura, or warning, although referred to the periphery of the body, is really the expression of some discharge taking place in the area of the cerebral cortex in which this particular part of the periphery is represented, and by means of a definite aura, such as tingling in the great toe or the thumb, we are enabled to localize the particular part of the cortex in which the discharge is taking place. The extent and duration of the aura—*i.e.*, the amount of the fit of which the patient is conscious—is determined by the point of time at which unconsciousness ensues; this varies in different cases, and even for different fits in the same individual. An aura occurs in about one-half of the cases, and its duration varies from a few seconds before consciousness is lost to an hour or even a day.

An aura may take the form of (1) a feeling of malaise, headache, tremors and starting of all the limbs, which may last for a whole day before consciousness is lost.

(2) Unilateral sensations in the face, tongue, arm, or leg, either sensory, as tingling, numbness, pain, which may be followed by motor symptoms in the part affected, or the motor symptoms may be primary. The sensory symptoms usually precede the motor, and most often affect the extremity of the limbs. The patient feels a numbness or tingling in the hand or foot; this runs up the limb, and is followed by a contraction of the fingers or toes (usually flexion), and then by flexion of the elbow or knee; or, after tingling is felt in the face, the corner of the mouth is retracted. The motor symptoms may be felt without the sensory tingling, but it is not common for the latter to follow the motor symptoms. Sometimes the patient feels his head being turned toward the same side as the affected limbs.

(3) Epigastric sensations. The patient experiences curious feelings, such as coldness, burning, numbness, or a feeling

of weight, which begins either in the abdomen, often at the epigastrium, or in the left side of the chest, and passes upward along the left side to the throat or head. The aura follows the course of the pneumogastric nerve, and causes palpitation of the heart, dyspnœa, and a feeling of choking; it is sometimes described as if the intestines were being “wound up.”

(4) Psychical, a peculiar dreamy state. Some idea comes into the patient’s mind, or there is a sense of something horrible and of great terror.

(5) Vertigo, or a sense of giddiness. The patient feels he is turning round, or objects seem to revolve round him, or both patient and objects appear to revolve at the same time and usually in the same direction; sometimes there is the feeling as of falling down a hole or over a cliff.

(6) Special sense auræ may be (*a*) visual, including loss of sight, pain referred to the eyeball, the appearance of bright or colored lights, or of distinct images, of people or views; (*b*) auditory, as noises in the ears, buzzing, humming, ringing of bells, or distinct tunes; (*c*) olfactory; (*d*) gustatory, usually of an unpleasant nature.

In a typical severe epileptic fit the patient, with or without a warning, suddenly loses consciousness, falls down, possibly into a fire, often hurting himself severely, sometimes cutting the head or sustaining severe blows; at the same time he often gives “the epileptic cry”—a wild, unearthly scream or yell, which is probably produced by a sudden expulsion of air through the contracted larynx by the tonic expiratory movement of the thorax. *Tonic* spasm, either of the muscles of both sides of the body or of one side only then occurs. In the majority of cases one side of the body is affected before the other; the head and eyes are turned to one side; the corner of the mouth of the same side is retracted; the fingers are flexed in the interosseal position; the elbow is flexed and the arm adducted. The leg of the same side is also affected, the toes as a rule being extended, while the knee and hip are flexed; the trunk is often rotated to the side to which the head and eyes turn. The same muscles of the opposite side are subsequently involved, though to a less degree, but if the attack begin on both sides at once, the muscles of both

sides will be simultaneously involved. This is not so common, and in the great majority of cases, one side will be affected before the other.

The tonic condition lasts only a few seconds, and, its exact character is therefore very difficult to analyse. It gradually merges into the *clonic* stage, the initial tonic contractions passing into intermittent clonic spasms. The spasms of the side primarily affected are the first to assume the clonic character. The head and eyes and the corner of the mouth are rapidly jerked toward one side; the fingers are spasmodically flexed; the elbow presents a series of flexions; and the whole leg is drawn up and jerked. The opposite side of the body is then affected by the clonic spasm in a similar way either synchronously with its fellow or a few seconds later. Both sides then contract simultaneously, and the whole body is thrown into violent clonic contractions, the muscles of the abdomen and trunk being affected as well as those of the limbs and head. In this stage the pupils are widely dilated and do not react to light, and the conjunctiva has lost its reflex. The tongue is usually bitten, from being thrust out between the teeth and caught by the lower jaw in clonic spasms. Urine and occasionally fæces are voided unconsciously, and very rarely, semen is said to be ejected. The face, which in the tonic state may have been pale or unaltered, becomes intensely cyanotic during the clonic condition; the pulse, perhaps feeble at the commencement of the attacks, becomes rapid and stronger in the clonic stage, but, does not cease altogether as the fit begins, and stoppage of the heart's action cannot, therefore, be considered as the same cause of an epileptic fit.

The excursions of the clonic spasm gradually become slower and longer and at last cease, muscular relaxation occurring first on the side primarily affected. The patient now lies in a comatose state, with loud, rapid, stertorous breathing; the face is intensely cyanotic, but becomes less so as breathing is re-established; the limbs are quite flaccid and paralyzed, or they may become slightly rigid; the pupils are widely dilated and insensible to light, and the conjunctival reflex is absent. If the fit begin with turning of the eyes to one side, it is frequently observed, immediately *after* all clonic spasm has

ceased, that both eyes are turned conjugately to the opposite side, so that we have here a deviation due to paralysis of the muscles most involved in the fit. This condition lasts for about three minutes, and then the eyes roll from side to side and the pupils oscillate, alternately contracting and dilating.

The knee-jerk may be absent after a very severe fit, but more often it is excessive, and ankle clonus can be obtained for from three to five minutes after clonic movements have ceased; it is often more marked on the side on which the initial tonic spasm occurred. Gradually the plantar reflex, which is at first absent, and the conjunctival reflex return, the pupils become smaller and react to light, and the patient shows signs of uneasiness and may make some incoherent remark, but more often relapses into sleep, on awaking from which he complains of headache and malaise. Before completely recovering consciousness the patient may perform various automatic acts of which he has no recollection.

In some cases mental derangement is present directly after the fit, attended with acts of violence; or there may be extreme irritability, lasting for some hours or days. The general mental condition of epileptics is frequently very defective.

Minor Attacks (Petit Mal).—These are slight attacks of loss of consciousness without any convulsion. There may be no aura, or the patient may experience a slight feeling of giddiness or faintness, or a sudden start of the whole body, or some mental idea. He suddenly stops in the midst of a conversation, looks strange, the eyes become fixed or vacant, he drops anything he may have in his hands, becomes flushed or pale in the face, or the color of the face does not alter at all. If standing at the time, the patient rarely falls; if sitting, he may merely lean back in his chair. Urine is frequently passed involuntarily. The attack only lasts a few seconds, consciousness then returns, and the patient goes on speaking as if nothing had happened. The reflex action of the pupils and conjunctiva is quite abolished during the attack. Slight twitching of the face is occasionally noticed, but nothing approaching to a convulsion. Immediately after one of these attacks patients are very liable to perform automatic actions, such as beginning to undress themselves, taking

things out of a cupboard, or going into shops and making absurd requests.

The *diagnosis* of an epileptic fit, and especially of petit mal, has to be made from attacks of *syncope*. In the latter the loss of consciousness is distinctly associated with weakness of the heart's action; the onset is not so sudden, the attack usually lasts longer, is often brought on by some obvious cause, as a hot room or an unpleasant sight, and is unattended by involuntary micturition. In *auditory vertigo*, or Menière's disease, there is usually deafness to sounds conducted through the bones of the head as well as through the air, also noises in the ears, and frequently vomiting, but rarely loss of consciousness.

Hysterical fits differ in that the patient falls more gradually; screaming occurs while convulsions are taking place; the convulsions are purposive, as fighting and biting other people; the limbs are very rigid; there may be opisthotonus and squinting; the tongue is held between the teeth, but is not bitten; there is absence of involuntary micturition, and the pupils and conjunctiva usually react to stimuli. The duration of these attacks may be half an hour or more, and the patient may recover quite suddenly; whereas, epileptic fits rarely last more than a few minutes, and are, as a rule, followed by sleep or headache. A pinch of snuff is often a useful diagnostic test, producing a reflex sneeze in hysterical cases, but not in epileptics.

Malingering must not be overlooked.

In *convulsions* due to uræmia, albumen is present in the urine, a condition which is not found in ordinary epilepsy.

The *prognosis as regards life* is not unfavorable, as patients very rarely die in a fit, but if not carefully watched, the danger to life is very serious from falling or from suffocation in bed or while eating. As regards *cessation of the fits*, it may be stated that this rarely occurs spontaneously, and that about one-tenth of the cases are not improved by any treatment. The prognosis is the more favorable when the fits begin after the age of twenty and are inherited, and when there is an aura, and less so when the fits occur very frequently, when the major occur in association with minor fits, and when there are marked mental changes.

Pathology.—Although some convulsive seizures may be due to disease or changes

in the medulla, nearly all true attacks of epilepsy have their origin in "discharges" of energy from the cells of the gray matter of the cerebrum, especially those of the cortex, which may be called the seat of convulsions. How the discharge is produced is not evident, but it is assumed that the nerve cells of the cortex are charged reservoirs of energy, and that in epilepsy the resisting power to this discharge is diminished. The resistance being overcome, the discharge spreads from the starting-point along the lines of least resistance in the cortex, and, by exciting other cells in the neighborhood, produces the phenomenon of an epileptic fit. In an attack of petit mal the discharge is limited to the highest centers, and does not usually involve the motor centers.

Ætiology.—*Predisposing Causes*.—Females are liable to this disease rather more than males, the proportion being 6 to 5.

Heredity has a very decided influence. Different observers give from 28 to 35 per cent. as the frequency with which some form of nervous disease exists in the family. This is most frequently epilepsy, several members of a family often suffering. Insanity and chorea are also met with.

Age.—The age at which epilepsy is most likely to make its first appearance is important. A great many cases begin in infancy at the teething period, during the first eighteen months. The fits then either persist, or recur after an interval, possibly at the second dentition or at puberty. The period of second dentition, at seven years, is also a predisposing age, but the time when epilepsy is most prone to occur is the age of puberty, fourteen to sixteen. No age up to seventy is exempt, but it is uncommon for it to appear after the age of forty.

Exciting Causes.—In many cases no distinct cause can be made out. In 37 per cent. some reliable cause may be found, the most frequent being a fright, immediately or a few hours after which the fit may occur. Traumatic causes, especially blows on the head, are not uncommon, the fit occurring immediately or shortly after the blow. Ascarides frequently produce epilepsy. Acute specific fevers (especially scarlet fever), asphyxia, pregnancy, and masturbation are accredited as causes, but the influence of the

last was formerly much overrated; it is more probably the result rather than the cause of the disease. Severe mental anxiety or worry is also a cause.

Treatment.—The drugs which have most effect are the bromides of potassium, sodium, and ammonium. It is best to administer one salt at a time, and not a combination; if one lose its effect, another may be tried with advantage. The bromide of potassium is most commonly used, but the ammonium salt certainly seems to produce less depression and less tendency to bromism.

The *time* of administration of the drug and the *dose* are important. If the fits occur at various times, gr. xv–xx should be given three times a day before meals; if the fits only occur at night, or in the early morning, gr. xl–3 j should be given at bed-time; while, if the attacks come on in the morning while dressing, gr. xl should be taken on awakening, and the patient stay in bed for an hour after.

With the same daily dose it is well to vary the mode of administration—*i. e.*, to give 3 j either in two doses of grs. xxx night and morning, or in three doses of gr. xx. Another plan of administering the drug is to begin with a small dose (*e. g.*, gr. xv.), and to gradually increase it until the fits cease. It is important not to omit the bromide too soon. The dose which has stopped the fits should be persevered with for a whole year, and very gradually diminished for another year, if no fits occur, when the patient may cease to take the drug. Even then, however, its complete withdrawal may be followed by a return of the attacks.

The induction of BROMISM (*q. v.*), a condition produced by long use of the drug, in which the patient is very stupid and languid, and ACNE (*q. v.*), are the chief obstacles to prolonged courses of bromine. The former disappears only on leaving off the drug, but the latter can, in most cases, be kept down by the addition of liq. arsenicalis m. iij–v.

When a bromide salt alone fails to check the fits it may be combined with tinct. belladonnæ (v–xv), digitalis, especially if there be any cardiac lesion; extr. cannabis indicæ gr. ss. or liq. morphinæ m. v and upward. Iron is said to do harm, but is certainly useful in anæmic subjects. Borax (gr. xv–xxx) three times a day has stopped the fits when bromide has failed.

Counter-irritation, in the form of a blister, or a seton in the nape of the neck, has a marked effect in stopping the attacks in some cases. If there be a definite aura, beginning in the hand or foot, and treatment by drugs has no effect, it would be quite justifiable to trephine over the center for the movements of this particular part, and remove, under antiseptic precautions, the part of the motor cortex stimulation of which gives rise to the initial spasm of the fit, as has been done by Horsley; but before having recourse to operative procedure, the patient should undergo a thorough course of iodide of potassium, even if there be no history of syphilis. A blister round the wrist, or a ligature suddenly applied, will often stop a fit beginning in the hand. Epileptics should be careful not to eat indigestible food, and the bowels should be kept well open, as neglect of these two precautions is very liable to bring on a fit. The mind should be occupied, but not overtaxed.

C. E. BEEVOR.

Symptomatic Indications.—*Amyl nitrite* inhaled when the face is pale at the commencement of an attack may ward off the fit, or *glonoinum* may be used for the same purpose. *Belladonna* is useful in chronic epilepsy, especially in young and sanguine patients, in recent cases will frequently ward off an attack. *Ignatia* is useful in convulsions unattended with cerebral congestion, and in recent epilepsy in children, especially when from emotional causes, *arsenicum* in convulsions depending upon irritation of the abdominal ganglia, with symptoms of mental derangement will frequently do good service. *Cuprum* is useful in violent convulsions recurring at short intervals, with foaming at the mouth.

Nux vomica is valuable for clonic and tonic spasms, with cries, opisthotonus, convulsive twitching of the limbs, particularly when they are the result of chagrin, or mortification. See CONVULSIONS.

EPIPHORA.—See LACHRYMAL APPARATUS, DISEASES OF.

EPIPADIAS.—See PENIS, DISEASES OF.

EPISTAXIS (Bleeding from the Nose) may occur spontaneously or result from injury. When spontaneous, the possibility of hemorrhagic diathesis should be remembered.

Epistaxis commonly occurs in young people about the age of puberty without any assignable cause, and is believed by some to occur vicariously for menstruation. In conditions associated with much venous congestion, such as heart disease and cirrhosis of the liver, it is of frequent occurrence; also in diseases of the blood, as scurvy and purpura hemorrhagica, when it may prove most formidable. Epistaxis is common in the early stages of enteric fever and in diphtheria, and is then sometimes of diagnostic value. It is often met in whooping-cough, and may aid the diagnosis in a doubtful case.

Treatment.—Cold externally to the nose and forehead, and syringing the nostrils with iced water and tincture of the perchloride of iron, should be the first means tried, and, if they fail, the nares may be plugged. India-rubber bags, which are inserted empty and then filled with air or water are efficient. Gallic acid in 10-grain doses, or spirits of turpentine in 15-minim doses, may be administered internally.

Symptomatic Indications.—In plethoric persons *aconite* may be used with excellent results, especially when from arterial excitement or from passion. When from traumatism *arnica* is of great benefit. In congestive conditions, the blood flowing freely, *belladonna* does good service. In persons of a hemorrhagic diathesis, dark, fluid blood, frequent, venous hemorrhage, *hamamelis* is very beneficial. *Ergota* is useful for epistaxis during fevers, with weakness, blueness of the skin, cold sweat. Hemorrhage of dark, stringy blood yields to *crocus*. Vicarious bleeding at menstrual period to *pulsatilla*.

EPITHELIOMA.—See CANCER.

EPULIS.—A term applied to fibrous, sarcomatous, and cancerous tumors of the gums. Most are fibro-myeloid; the less of the myeloid structure, the more innocent the growth.

Symptoms.—Non-cancerous epulis: a fleshy, red tumor of the gum; teeth loosened, and pushed forward; size variable; sometimes ulceration. Cancerous epulis has the special marks of malignancy, rapid growth, excavated ulcer, etc.

Treatment.—Removal of tumor and attached alveoli with cutting pliers—and small saw. Neither fibrous nor myeloid

epulis usually returns if the bone from which it springs be removed.

C. B. KEETLEY.

EQUINIA MITIS.—A pustular eruption, produced by the contagion of matter from a horse affected with “the grease,” is characteristic of this disease. Grease in horses is a specific inflammation of the sebaceous glands of the skin in or about the heels. There is first a catarrh from these glands, and the secretion which flows gives forth a very loathsome smell. The catarrh gradually passes to ulceration, giving rise to unhealthy sores—deep, raw, and excessively tender cracks or fissures, with an offensive discharge.

The catarrhal discharge is the most virulent, and produces a pustular eruption on the skin of man very similar to ecthyma, elevated above the skin, and with a red, purple, tumid base, attended with febrile symptoms, with very marked depression and tremors, much foulness of tongue, rapid pulse, and alternate heats and chills. The eruption becomes pustular in about eight days—the pus being watery and abnormal. In ten or twelve days the eruptions die away, and scabs form, which, falling off, leave well-defined scars.

Treatment.—Frequent purgation with aloes, combined with ammonia, and such moist local applications as tend to relieve pain, give the greatest relief to the constitutional symptoms. Tonics and stimulating treatment are required to aid convalescence.

WILLIAM AITKEN.

ERGOTISM.—Ergot is a fungoid growth which attacks the ear of rye and to a less extent wheat, barley, and oats. Meal prepared from rye so affected gives rise to a train of symptoms known as ergotism.

The *symptoms* at first are of an irritant character, and include vomiting, purging and colic; giddiness, headache, formication and itching of the skin, and sometimes affections of sight or hearing. Hematuria and jaundice also occur. There are, however, two chief effects, referable to the nervous and circulatory systems respectively, which persist after these symptoms have ceased. The first consists of severe cramps affecting chiefly the legs, and leading to tonic contraction and fixation of the affected muscles—the spasmodic form of

the affection, which sometimes ends in general convulsions and death. The other, the gangrenous form, affects the extremities, the fingers, toes, nose, and ears, the usual sequence of event being coldness, pallor, discoloration, lividity, and gangrene of the part. Gradually a line of demarcation forms, and the necrosed part goes through all the stages of dry gangrene.

Treatment.—Removal of the cause is the first aim and, while the irritant symptoms last, vomiting should be encouraged or induced. The spasmodic form might be combated by careful massage and the internal use of bromide of potassium or opiates. Gangrene if only threatening is best treated by the continuous current used as in Raynaud's disease; at a later stage the treatment should be conducted in accordance with the rules of surgery.

Symptomatic Indications.—*Nux vomica* or *camphor* are useful in the early stage, as is *solanum nig.*, which is regarded as specific. In the later stage, when gangrene has set in, *arsenicum* is the most potent medicine.

ERYSIPELAS.—An acute, specific, febrile disease, characterized by a special form of inflammatory skin eruption, which spreads by the lymphatics.

The term is unfortunately applied loosely to many other diseases accompanied by an erythematous blush (simple lymphangitis, various erythemata), and also to certain conditions of phlegmonous and diffuse cellular inflammation which may complicate erysipelas, but are due to a different virus—viz., the microbe of septicæmia.

The essential nature of erysipelas has been satisfactorily established by the researches of Koch and Fehleisen, who have isolated the specific streptococci and reproduced the disease in animals by inoculation. In appearance these streptococci closely resemble the pyogenic micrococci, but they grow and conduct themselves differently in various cultivating media, and their inoculation produces a different train of symptoms.

Much discussion has arisen as to whether the disease ought to be classed as "local" or "general." As regards point of entrance, it must be considered "local." On the other hand, it corresponds with other "general" diseases in requiring a certain incubation period for

the development of its manifestations and in their "general" or constitutional character.

Equally artificial is the distinction, formerly recognized between "medical" and "surgical" erysipelas, the latter occurring in connection with traumatism, the former without obvious breach of surface. "Medical" erysipelas, occurring in the great majority of cases upon the face, has its point of origin in the mucous membranes of the nose, mouth, or eyes, where erosions can be demonstrated, and that it spreads thence to the skin. In the few remaining cases where actual breach of continuity cannot be demonstrated, there is strong presumptive evidence of its occurrence.

Symptoms and Course.—During the period of incubation, which varies from a few hours to three or four days, there is generally enlargement and tenderness of the lymphatic glands corresponding to the region about to be affected. The disease is ushered in either by a rigor or a sense of chilliness, with malaise, nausea, or vomiting, pains in the limbs, and a sudden rise of temperature to 103° or 104° F. Some burning or pricking sensation may attract attention to the skin, or the mucous membrane of the throat, mouth, or nose may be found to be sore, swollen, or congested.

Wherever the skin is involved it is swollen, infiltrated and pits on pressure; it is glazed, hot, and of a vivid red color, which becomes paler on pressure. The margin of the patch is always raised and well defined, either uniform or tongued "zigzag." It extends rapidly or slowly, its extension being modified by the natural lines of cleavage of the skin; in regions where the skin is tightly stretched or firmly bound down, its minimum is noted—*e.g.*, the chin, occipital region, over Poupart's ligament and over joints. On the contrary, regions where the subcutaneous tissue is lax—*e.g.*, the eyelids and scrotum—become enormously swollen.

As the disease progresses increased local heat, pain, and tension are complained of; fine vesication (often only perceptible with a magnifying glass) occurs over the surface of the patch, which becomes more and more brawny and of a deeper yellowish-red color. Sometimes large blebs form by the coalescence of vesicles; they may burst and

some scabbing ensue, but extensive supuration is rare. In exceptional cases patches of the disease may show themselves at a distance from the original one, but, as a rule, the extension of the eruption is continuous. The temperature generally reaches its maximum in the first two or three days, and seldom exceeds 104° or 105°, but may reach 107° F.; it persists throughout the disease, with marked morning remissions, till the beginning of recovery, when it suddenly—or more rarely, gradually—falls, and copious sweats often occur. The pulse, at first full and bounding, tends to become small, weak, frequently irregular and dichrotic in severe cases. During the febrile period the urine is concentrated, high colored, loaded with urates and uric acid; albumen is often present in considerable quantity, or even blood and casts. The tongue is at first moist and coated; afterward it tends to become dry and brown. The bowels are generally confined, but in severe cases diarrhea is apt to set in, and must be regarded as a sign of evil omen, accompanied as it frequently is by collapse, hyperpyrexia, jactitation, muttering delirium, and other “typhoid” symptoms.

Duration is indefinite, and cannot be predicted in any given case; it usually, however, stops between the fifth and twenty-first day, when the rash ceasing to spread, fades and subsides at its margin, and thence over the patch. Recrudescences and even distinct relapses are, however, of frequent occurrence. In this way the disease may last for six or eight weeks.

Marked desquamation always ensues, either branny or in large flakes, like those of *exfoliative dermatitis* or *scarlatina*. When the scalp has been affected temporary baldness results, and in other regions chronic abscesses, situated deeply in the skin, or suppuration of lymphatic glands, may render recovery tedious. Even without these sequelæ patients often remain a long time in a remarkably debilitated condition. Death rarely occurs, but it may result from high temperature, pneumonia, pleurisy, peritonitis, or meningitis, or in cases where the neck is involved from extension to the larynx.

Prognosis.—Grave in very young and old persons, in those suffering from renal disease, in chronic alcoholics, and in women in the puerperal state.

Differential diagnosis.—From eczema and erythema by the rigors, fever and other constitutional symptoms, the character of the spreading margin, and the uniformity of the lesions. The frequent supervention of erysipelas on a patch of eczema must not be forgotten. In young persons acute necrosis with phlegmon may closely simulate erysipelas.

Erysipelas of the face is the commonest local form; it may start from any catarrhal, erosive or ulcerative condition of the nasal, ocular, buccal or aural mucous membranes, whether primary or secondary to diseases of deeper parts (*e.g.*, necrosis of nasal or maxillary bones, diseases of teeth, otitis media with perforation). Œdematous swelling of the eyelids and consequent disfigurement are very marked, while the lips, nose and ears become thickened hard and brawny; large vesicles and blebs often form. Extension from the eyelids to the cellular tissue of the orbits produces fixation of the eye-balls, often sloughing, and inflammation or atrophy of the optic nerves from pressure upon them, or, more rarely, thrombosis of the ophthalmic veins.

When the *scalp* is involved, headache is almost always a prominent symptom, with delirium and insomnia. If the temperature remain high, these cerebral symptoms become intensified, tremors, mania, and coma often occurring. They are referable to hyperpyrexia, as post-mortem experience demonstrates the extreme rarity of meningitis, cerebral abscess, phlebitis, or other metastatic processes, to which they were formerly considered to be due.

Erysipelas of the genitals in males generally arises from a fistulous opening; the œdema and pain are often considerable, and gangrene of the parts over which the urine trickles is by no means infrequent. In females the vulva is often similarly affected from neglect of ordinary cleanliness.

Erysipelas of the trunk is of traumatic or surgical origin in the great preponderance of cases, but in infants it is apt to be set up round the umbilicus (*E. neonatorum*). Formerly the condition was considered as necessarily fatal, but this is not always the case, although the prognosis is grave. The disease spreads like erysipelas in adults, but has a special tendency to relapse, and is apt to cause sloughing or to leave a diffuse, doughy

condition of the skin very like "œdema neonatorum." If a fatal result ensue, it is generally due to extension to the peritoneum or pleura, to pneumonia or diarrhea. In young children erysipelas may also start from erosions of the anus or genitals, or from vaccination or circumcision wounds.

Recurrent Erysipelas (*pseudoerysipelas*) is a common and generally misunderstood disorder which, although not identical with true erysipelas, is briefly mentioned here. It occurs at any age, but with special frequency in children and in those who are strumous. In adult life, females appear to be more frequently affected than males. It attacks the face exclusively, especially the nose, upper lip, and adjacent part of the cheeks; sometimes the lower lip, chin, and forehead are also involved. There is some local rise of temperature, and an erythematous blush, with ill-defined margin and some swelling. No constitutional symptoms of gravity are present. The attack generally lasts four or five days, occasionally longer.

After subsidence of the erythema, the swelling persists, and it increases with every recurrence of the condition, which may take place at frequent intervals and without obvious cause. Finally, the parts, owing to blocking of lymphatics, become hypertrophied and firm to the touch, a physiognomy often described as characteristic of struma being thereby produced. The disease is never infectious or epidemic, and is rebellious to treatment, which seems to have no influence in averting recurrence. It may be mistaken in adults for acne rosacea or urticaria gigantea.

Ætiology and Pathology.—The immediate cause of true erysipelas is a specific streptococcus, but various conditions appear to favor its development or augment its virulence, and these may be considered as predisposing causes. Among them may be mentioned unsanitary surroundings—*e. g.*, over-crowding, dirt, defective drainage, and deficient ventilation. Recent improvements in sanitary science and its practical applications, and the adoption of various antiseptic precautions in surgical practice, have immensely reduced the frequency and mortality of erysipelas, which was formerly the scourge of hospitals. It still, however, exists, and occurs in small epidemics,

which are specially frequent during the prevalence of east winds, or of cold, damp weather. In the presence of an epidemic, persons suffering from renal, cardiac, or hepatic disease, or dropsy from whatever cause arising, are particularly liable to be attacked, as are chronic alcoholics, women in the puerperal state, and all those who are poorly fed and clothed.

The erythematous blush so common over œdematous limbs, especially after puncture with Southey's tubes, when unaccompanied by constitutional symptoms and unconnected with the existence of an epidemic, must not be considered as erysipelas: it is a simple lymphangitis.

The period of incubation, accompanied by enlargement of glands and preceding the appearance of the characteristic rash, constitutes a point of resemblance to the acute specific fevers, from which, on the other hand, erysipelas differs in the irregularity of its course and in its marked tendency to recur in persons once attacked. The latter point, however, is one of daily diminishing importance as regards the nosological position of erysipelas, the opinion that "recurrent erysipelas" (*pseudo-erysipelas*, recurrent lymphangitis) is a separate disease receiving more and more support.

When true erysipelas is established it is locally infective, and spreads by the lymphatic spaces and vessels, which are found to be crammed with streptococci in chains, especially at and immediately outside the spreading margin of the disease; the cocci are never found in the blood-vessels. As the skin congestion disappears within a few hours after death, the other microscopical appearances are ill-defined and by no means characteristic. The subcutaneous tissue can generally be observed to be infiltrated with leucocytes, and its meshes are wide from serous infiltration.

A patient suffering from erysipelas ought to be at once isolated, especially in hospital practice, and the same precautions against the spread of the disease adopted as in the case of the acute specific fevers. The sick-room must be light, airy, and cool. Absolute rest must be enjoyed. The diet nutritious and easily digestible. Solids are to be interdicted; milk, beef-tea, chicken-broth, meat extracts, and eggs are specially suitable.

Stimulants may be withheld, as a rule, in mild cases, but should be administered

freely if the pulse become feeble or any of the previously described bad symptoms show themselves. During the febrile period brandy or whisky is to be preferred; if these cause sickness or increase thirst, champagne may be substituted. During convalescence, port wine, Burgundy and sound claret are preferable. For headache and insomnia, chloral and the bromides are to be preferred to opium and hyoscyamus. When diarrhea is a prominent symptom, opium is, however, often the only drug which arrests it.

If the temperature be excessive and "head symptoms" prominent, no remedy is so valuable as the cold bath at 80° F. for fifteen or twenty minutes. This may be repeated at intervals of three or four hours if the temperature rise again to 104°. At the beginning of an attack a purgative is generally serviceable.

Ringer recommends the tincture of aconite in the very earliest stage, in doses of $\frac{1}{2}$ to 1 minim every fifteen minutes for an hour or two until the skin is moist and the temperature falls, and at longer intervals afterward. The treatment, however, is not unattended with danger. The tincture of the perchloride of iron, administered in large doses of 30 to 60 minims every four hours, is still regarded by many as exercising some specific influence on the disease. A considerable proportion of cases seem to do well on this treatment, and the disagreeable effects which might be expected are seldom noted; but, on the other hand, in most cases the progress of the disease is in no wise arrested by it, and large doses of sulphate of quinine (gr. v-x every six hours) are certainly equally efficacious, and exert an additional beneficial influence upon temperature. Antipyrin, antifebrin, and other similar drugs, may be used with the same object.

Painting the erysipelatous patch and the skin around it with collodion, solutions of nitrate of silver (gr. xv-3 j ad 3 j), tincture of iodine, or solutions of perchloride or persulphate of iron, with a view to arresting its extension, is a mode of treatment often adopted, but of dubious utility. The injection of a 2 or 3 per cent. solution of carbolic acid at various points around the raised margin perhaps merits further trial. The protection from the air afforded by repeated dusting with flour or salicylated

starch is certainly as efficacious and affords a pleasant sensation of coolness. Cold lead lotion may sometimes be used with benefit, but if there be much swelling and infiltration it is apt to cause or expedite gangrene; the same remark applies with increased force to the application of poultices. When gangrene appears imminent, minute linear incisions or scarifications seem occasionally to ward it off.

J. J. PRINGLE.

Symptomatic Indications.—Administered in the beginning, *aconite* will frequently cut short an attack, especially when attended with febrile reaction, acts well in both idiopathic and traumatic erysipelas. *Belladonna* is specific for the disease when attended with congestive headache, delirium; the skin of the affected part is bright red and shining without vesicles, also in phlegmonous erysipelas of various parts. *Rhus tox.* is very valuable in the simple vesicular form with œdema, purplish color of the skin. *Apis mel.* is indicated for the non-vesicular form with acute œdema, burning, stinging pain; especially useful in erysipelas of the scalp. *Arsenicum* may be required for malignant form, with extensive swelling of inflamed part; excessive burning; tendency to gangrene; also when attended with much prostration.

ERYTHEMA.—Any inflammatory hyperæmia of the skin which disappears upon pressure. In this sense it may be due to any local irritant, and constitute the first stage of any dermatitis. The eruptions of scarlatina, measles, rôtheln, typhus, enteric fever, and dengue are morphologically erythemata, as are many MEDICINAL RASHES (*q. v.*), also the early rose rash of syphilis and those rashes which occasionally occur at the onset of variola and vaccinia, or in the course of diphtheria, tuberculosis, puerperal fever, and septicæmia. A vivid, punctiform eruption (*E. scarlatiniforme*), attended with high temperature, often occurs after injuries or surgical operations, and is followed by desquamation. All the preceding may be classified together as "symptomatic" erythemata.

Idiopathic erythema occurs in two distinct forms—(1) *E. congestivum* (*vel hyperæmicum*), in which the morbid process is confined to mere congestion of the skin; (2) *E. exudativum*, in which infil-

tration of the skin is a marked feature.

(1) **Erythema congestivum.**—(a) *E. roseola* consists in the development of congestive patches of a delicate rose color, scarcely, if at all, raised above the level of the surrounding skin, varying in size from that of a split pea to a finger-nail, and either diffused over the whole surface of the body or in figured groups. The condition is common in young children in association with digestive derangements, and its onset may be accompanied by pyrexia and constitutional disturbance so considerable as to render its diagnosis from the exanthemata a matter of difficulty, in which case it is advisable to act as if the disease were contagious. Occasionally relapses occur. *Treatment* directed to the digestive disturbances is generally rapidly efficacious.

(b) *Chronic, symmetrical, congestive mottling of the skin* is a condition closely allied to the preceding. It affects young adults, especially females; is chronic, and may, in exceptional cases, cause considerable disfigurement. The extensor surfaces of the hands, wrists, arms, and legs, sometimes also the cheeks, are mottled with dull bluish maculæ, due to the transudation of hemoglobin. They do not disappear on pressure, and give the skin a marbled appearance, which is intensified by exposure to cold. No subjective symptoms are complained of.

Treatment has no influence on the condition, which tends to slow spontaneous recovery.

(2) **Erythema exudativum** is a definite and interesting disorder, with two important subdivisions. It may be defined as an acute, or sub-acute, non-contagious, inflammatory disease, characterized by the development of symmetrically distributed, raised, erythematous patches, usually discrete, varying greatly in form and size, accompanied by slight transudation of hemoglobin or by copious hemorrhage into the skin, occasionally terminating as vesicles or blebs, and specially liable to relapse. Constitutional symptoms of a rheumatic type are frequently present, but itching and pain are seldom prominent features.

It is probably a vaso-motor neurosis of central origin. The local changes consist in inflammatory dilatation of the vessels of the papillæ with exudation or hemorrhage into the papillæ, the rete

mucosum and more superficial layers of the skin, proportional in amount to the intensity of the process.

(a) *Erythema multiforme (vel polymorphe)* is common in young adults of either sex, especially in spring and autumn, and is apt to relapse at the same seasons. Exposure to the sun or to sea air may cause a first attack or determine an attack in a person previously affected; the rheumatic habit decidedly predisposes to its occurrence, and it often appears in the course of acute rheumatism or gonorrhea, and in connection with various disorders of the female generative organs.

A certain amount of malaise with gastric disturbance and fever may precede by some hours or days, or may usher in the appearance of the eruption, which almost invariably occurs on the backs of the hands and feet. The forearms and legs, the vicinity of painful joints—in rheumatic cases—are usually next involved. The trunk and face, even the mucous membrane of the mouth, throat, nostrils and eyes, are affected in severe cases. The lesions consist of flat or slightly convex papules, sharply defined, deep red or purplish in color, varying in size from a pin's head to a four-penny piece, or larger; on pressure, the red tint disappears, but a brownish stain remains. The neighboring lymphatics and glands often inflame. Such is the commonest form—*E. papulatum*. If the papules coalesce to form larger plateaux, the condition is described as *E. tuberculatum*. Soon the center of each papule or tubercle becomes sunken and bluish, slight desquamation occurs and the process tends to recovery, the average duration of each papule being from eight to ten days. Abundant hemorrhage may occur into the papules, bringing the condition into close affinity with that elsewhere described as PELIOSIS RHEUMATIC (*q.v.*).

Frequently, shrinking and desquamation occur in the center of the papules, which continue to extend at the periphery by a raised margin. They form rings (*E. circinatum*, *E. annulare*), which may wander over the entire body, intersecting each other to form elaborate figures with crescentic edges (*E. gyratum*). Occasionally new rings develop concentrically round older ones, and the forms thus produced, as well as the

varieties of color due to the different ages of the lesions, explain the designation, *E. iris*, applied to them. The occurrence of vesication is not uncommon, and represents the most aggravated type of the disease, *E. vesiculosum*, in which the inflammatory phenomena are so rapid and severe as to result in the transudation of serum in quantity sufficient to penetrate the rete mucosum and raise the epidermis in the form of small vesicles or even of large blebs. These are invariably surrounded by a bright red areola or raised base, and are intermingled with patches which do not vesicate. (Vesication affecting the periphery of patches of *E. iris* give rise to the condition erroneously termed "herpes" iris.)

If the amount of fluid be small it may be absorbed and a disk of epidermis separate in the form of a scale from each subsiding vesicle. Even when large blebs are formed (*E. bullosum*), pustulation seldom occurs, but thick, yellow crusts result from their rupture, and excoriated patches are left which invariably heal without scarring.

A severe first attack seldom lasts longer than four weeks, but cases tend to become more severe with each recurrence. When the mucous membranes are affected, the patient's condition is a very pitiable one, and occasionally hematuria has been observed. Erythema vesiculosum cannot be separated by hard-and-fast lines from a group of diseases elsewhere considered. See HYDROA.

Differential diagnosis.—*E. papulatum* may be mistaken for rōtheln, urticaria, papular eczema, or lichen; *E. iris* for tinea circinata; *E. vesiculosum* for variola, herpes zoster, scabies, or impetigo; *E. bullosum* for pemphigus or hydroa.

Treatment has little influence on the course of the disease. Special attention ought to be paid to the state of the bowels. Salicylic acid and salicylates are useful if rheumatic symptoms predominate; quinine is by some thought to be serviceable in preventing recurrences, and iodide of potassium (gr. xxx or more in twenty-four hours), has been found efficacious in arresting the disease. Locally, dusting powders, or lotions containing calamine or acetate of lead, are more generally applicable than ointments.

In obstinate cases rest in bed ought to be enjoined.

(b) *Erythema nodosum* is occasionally associated with *E. multiforme* as a further development of *E. tuberculatum*, but generally exists as a distinct disease possessing features of its own sufficiently characteristic to warrant separate description. It chiefly occurs in children and weakly young women, and is often accompanied by symptoms not clinically distinguished from those of sub-acute rheumatism, including insidious cardiac mischief. Multiple, raised, rosy patches, round or oval in the direction of the limb, from $\frac{1}{2}$ to 3 inches in diameter, suddenly develop along both tibiæ, and often along the ulnar side of the forearms. They are exquisitely tender, tense, and shining; they rarely vesicate, and although their appearance suggests imminent suppuration, they never suppurate. Finally, they become deep purple, subside to the general level of the skin, and undergo the changes in color characteristic of bruises. The disease usually last two or three weeks, and does not intend to relapse; it may be confounded with bruises and syphilitic nodes.

Treatment consists in absolute rest in bed with protection from pressure, and in the administration of salicylates, quinine, and iron, according to circumstances. The heart should be carefully watched. Painting with collodion relieves pain.

J. J. PRINGLE.

Symptomatic Indications.—*Belladonna* is the most generally useful remedy in simple erythema, particularly of the face and upper part of the body, as *cinchona* is in erythema nodosum. *Rhus tox.* has also considerable power over both erythema nodosum and the vesicular form. *Aconite* is useful when the eruption is attended with febrile symptoms.

ESCHAROTICS are substances which destroy the tissues with which they come into contact; they resemble caustics in their action, but are more powerful. The part that is destroyed is gradually separated from the healthy tissues by a zone of inflammation, and is called a slough. The chief escharotics are the actual and electric cautery, sulphuric and nitric acids, potash, lime, acid nitrate of mercury, chromic acid, and the chlorides of zinc and antimony.

ESSENTIAL PARALYSIS.—See INFANTILE PARALYSIS.

ESTHIOMENE.—See VULVA, LUPUS OF.

EXANTHEMA, an eruption. “The exanthemata” is the term used to include all the eruptive fevers. They are scarlet fever, measles, rōtheln, smallpox, chicken-pox, typhus fever, enteric fever, and erysipelas.

EXCISION OF JOINTS.—The indications and the conditions of success vary with each joint. Objects of excision may be: 1, to merely expedite recovery; 2, to restore motion to an ankylosed joint; or, 3, one of the various purposes for which amputation is done. Hence the choice often lies between excision and amputation. Life is always to be considered before limb. Excision involves a larger wound and greater strain on the constitution; hence it is bad for tuberculous and cachectic people. Much depends on the particular joint. Excision safer than amputation at shoulder and hip. Danger equal for the two operations at the elbow; at knee excision is far more dangerous than amputation. At elbow and wrist excision is, of course, far preferable to amputation, because it leaves the hand. At knee, amputation is generally to be preferred, because of the great danger of excision. Excision of ankle is often a good operation; but, if the tarsal bones are diseased, there is great danger of recurrence, and removal of too much bone would leave too weak a foot.

Operation.—Instruments—knives, lion forceps, saws (Butcher’s saw, keyhole saw, chain-saw, etc.), chisels, cutting pliers, rasping instruments for scraping off periosteum, retractors, directors, excision-directors. Esmarch’s bandage generally used. The following six directions are wise. 1. Make incision sufficiently free, and parallel to important parts, so as not to divide them; 2, economize length of bone by use of gouge; 3, leave epiphyseal cartilage in children; 4, don’t open medullary canal in adults; 5, keep periosteum; 6, don’t confound new bone or bone softened by inflammation, but otherwise healthy, with diseased bone, etc. The process of repair after excision is entirely analogous to the process of repair after compound fractures.

Ankle-joints, Excision of.—Disease

should be limited to ends of leg-bones and to astragalus.

Operation.—Incisions two, one internal, along edge of inner malleolus; the other, external, along posterior border of lower two inches of fibula, around outer malleolus as far forward on outer side of foot as within one inch of base of fifth metatarsal bone. Saw and nip off inner malleolus through inner incision. Dissect soft parts sufficiently away, pulling peronei tendons backward and downward, and keeping close to bone to avoid posterior tibial artery. Cut off outer malleolus; push tibia out of external wound, and saw off its articular surface. Next remove part or whole of astragalus according to its condition. Dress the wound and place the limb on a firm splint.

Result.—Generally good. Often a movable joint. Fatally 1 in $5\frac{1}{2}$, success greatest when disease is of traumatic origin.

Elbow, excision of.—In this joint, excision, if practicable, always preferred to amputation. A matter of opinion whether in mere suppurative, synovial disease, the results of excision or of natural cure, are the best; but in necrosis excision should be done.

Operation.—Use a strong knife and ordinary saw. Longitudinal incision 5 inches long, right down to bone, with its center opposite inner border of olecranon. Then with scalpel separate soft parts from bones, proceeding carefully between olecranon and internal condyle, and guarding ulnar nerve with nail of left thumb. Divide lateral ligaments, push end of humerus out of wound and saw it off freely. Then project ulna and radius, grasp olecranon with lion forceps, and saw both bones at level of neck of radius. Sometimes orbicular ligament can be preserved with advantage. Some do whole operation subperiosteal with aid of rasps, Subperiosteal resection of doubtful advantage.

Results.—In good cases, a strong joint with all its natural movements.

After-treatment.—Hinged split. One contrived to permit supination and pronation useful. In a week’s time, flex the elbow to a right angle. When wound is nearly healed use passive motions.

Hip-Joint, excision of.—*Operation.*—Incision, free semi-lunar with convexity backward over posterior border of great trochanter and down to bone. Follow

neck of bone to head, open capsule, and let assistant, by adducting, rotating inward and pushing upward, project head of femur out of wound. Ligamentum teres may have to be divided. Joint very rarely found dislocated. If femur be diseased, saw below trochanter. Chain-saw useful. If acetabulum only be diseased, saw through neck of femur and gouge acetabulum, or cut it with pliers. Pelvic fascia thoroughly separates acetabulum from pelvis. Acetabular disease requires freer incisions.

After-treatment.—Plaster apparatus; long splints with iron interruption; mere extension by weight and pulleys; Sayre's wire breeches. In dressing the wound a stretcher with a hole opposite the hip is useful. For heavy adults a stretcher contrived to slip easily, piecemeal, under the patient, and to leave the hips exposed, is very useful. The stretcher being slipped under the patient, is lifted up and placed with its two ends on two chairs beside the bed. A dressing-pan being placed on the floor, the wound can be syringed if necessary, and dressed; while, in the meantime, the bed-sheets are changed or smoothed.

Prognosis.—Many cases die, but probably not one-third of these perish actually from the operation. Without interference some of the successful cases would have perished of the original disease.

Knee, excision of.—Amputation almost always preferred for injury.

Operation.—Nearly transverse incision below patella from back of one condyle to back of other, and dividing ligamentum patellæ. Throw up soft parts from patella and front of lower end of femur. Divide lateral ligaments on the condyles. Retract soft parts and project femur. Saw through condyles below the epiphysial cartilage in children. Proceed very carefully, both in separating soft parts from back of condyles and in making the last cuts with the saw, or popliteal artery may be wounded. Now push end of tibia upward and forward, and saw it off close to articular surface in case of children. Make saw-cuts through the two bones so to correspond that limb may be straight. If they do not fit in this way after first sections, other sections must be made. Carefully secure all the bleeding vessels.

After-treatment.—Put apparatus on at once. Some fixed contrivance, like a combination of anterior iron splint with par-

affined or plaster of Paris bandage is the best. Or an iron back splint with foot-piece and interrupted side splint. Do not disturb limb for first few days. Recovery and repair are very slow, average eight months. Some surgeons leave patella. Ankylosis should be osseous. An outward bend of the limb is a common misfortune after this excision.

Excision of os calcis.—Lines of incision: 1. Along upper border of os calcis from inner side of tendo Achillis to a little in front of calcaneo-cuboid articulation; this should divide the tendo Achillis. 2. Across sole of foot, from anterior end of first incision. Disarticulate from cuboid first, and from astragalus afterward. Beware of wounding posterior tibial vessels. A very useful foot results and prognosis is excellent.

Excision of scapula.—For necrosis, caries, and morbid growth may be partial or entire. A crucial or T-shaped incision. Hemorrhage is occasionally very serious. In removing the entire bone, divide the muscles attached to posterior border at an early stage of the operation, and leave the subscapular vessels till last. Tie the vessels as the operation proceeds.

Prognosis.—Danger not so great as might be expected.

Excision of Shoulder.—Done for gunshot wounds and compound dislocations, and occasionally may be justifiable in cases of bone-disease or innocent tumor. But, in cases of bone-disease, the cure by natural ankylosis affords a perfectly satisfactory result, which is not improved upon by excision.

Operation.—Incision. Longitudinal form just outside coracoid process downward and outward for five inches, right down to bone. Open capsule and divide muscles attached to tubercles of humerus, rotating outward while cutting internal rotator (sub-scapularis), and *vice versa*. Arm should at same time be brought across chest. Pull tendon of biceps aside. Operator himself now seizes upper arm in his left hand and pushes head of humerus out of wound. Clean soft parts from line of saw-cut. Saw. If, upon opening the joint, amputation is judged expedient, make a circular incision at the lower end of the longitudinal one, and disarticulate. Excision may be performed with a flap incision, raising the deltoid. Glenoid cavity rarely removed.

Prognosis.—Very good. Useful limb.

Fatality : of fifty cases, in seventeen the glenoid cavity was interfered with, and in thirty-three the head of the humerus only was touched ; of the seventeen, seven died ; of the thirty-three, only one died. But in military surgery, one in four died.

Excision of tarsal bones.—The astragalus may be removed very well by incisions similar to those given for excision of the ankle-joint. Its excision gives excellent results. Excision of the smaller tarsal bones is often by no means a good substitute for amputation. See EXCISION OF OS CALCIS.

Excision of wrist.—Lister's method. Its description includes at least twelve directions, besides the application of Es-march's bandage. 1. Make first incision (two are required) from dorsum of base of second metacarpal bone upward as far as base of styloid process of radius, always internal to extensor secundi inter-nodii policis. 2. On the thumb side of this incision separate the soft parts from the bones, carefully because of *radial artery*. At the same time divide the extensor carpi radialis brevis. 3. Sever trapezium from rest of carpus with cutting pliers. 4. Clean soft parts from bones on ulnar side of incision. 5. Make ulnar incision near anterior edge of ulna, and extending from two inches above styloid process to middle of fifth metacarpal bone. 6. Raise all the soft tissues completely from the dorsal surface of the carpus ; then, of course, the two wounds communicate. In doing this the exterior carpi ul-naris should be severed from its insertion. 7. Clean anterior aspect of carpus and ulna, cutting off pisi-form bone and hook of unciform bone, so as to leave them attached to the soft parts. Do not go so far forward as to wound deep palmar arch. 8. Divide ligaments and remove carpal bones (except trapezium) with forceps. 9. Clean and saw off ends of ulna and radius. All cartilage of radio-ulnar joint should be removed. 10. Cut off bases of metacarpals so far as they are covered with cartilage. 11. Take away trapezium and base of first metacarpal bone. 12. Cut off cartilage of pisiform and leave the rest, and the hook of the unciform, unless they be diseased. The operation may be shortly summed up thus : The whole carpus except the pisiform and the hook of the unciform, and also the adjacent cartilage-covered parts of the radius, ulna, and metacarpal bones are

removed piece by piece, in the order found most convenient, through two longitudinal incisions, one ulnar and palmar, the other dorsal and radial.

Result.—Very useful hand.

After-treatment.—Important. Large lump of cork under palm of hand. Flat wood palmar splint. Regular passive motion from the first encouragement to active motion. C. B. KEETLEY.

EXERCISE, by which in the present connection is to be understood only muscular exercise, has long been generally recognized as a valuable preservative of health ; it is also a therapeutic agent of the first importance in certain diseases and cachectic states.

Exercise may be *general*, calling into action the greater number of the limb and trunk muscles ; or *special*, being limited to certain muscles or groups of muscles. General muscular exercise has a remarkable effect upon the principal functions of the body.

Respiration.—The number of respirations and the quantity of air inspired in a given time are increased : the amount of air inspired when walking at a very slow pace (two miles an hour) is doubled, as compared with standing ; when walking at four miles an hour it is trebled. The amount of oxygen absorbed and of carbonic acid (CO_2) eliminated are also increased ; during a day of moderate physical exercise the oxidation of carbon is about 40 per cent. greater than on a day of rest.

Circulation.—The force and frequency of the heart's action are increased during exercise, and the arterial blood pressure rises. After cessation of exercise this rise in pressure continues for a short time, but the rapidity of the heart's action falls below the rate of rest. The normal healthy range is an increase of about twenty beats during and a decrease of ten after moderate exercise.

Skin.—The excretion of water, in the form of sweat, is greatly increased. The quantity so lost, instead of being about half or two-thirds of the amount of urinary water, is equal to and may be even double the total secretion from the kidneys. The loss of chlorides and (fatty) acids is also considerable. As the result of active exercise the total amount of water in the body, and especially of that in the blood, is decreased.

Urine.—The amount of urinary water and chlorides is decreased. The total nitrogenous constituents of the urine (urea, uric acid and creatin) are slightly decreased during the period of exercise and are increased during a succeeding period of rest, the increase during rest being probably slightly greater than the decrease during exercise, so that the eventual result is a small increase in the amount of nitrogenous loss.

Muscular System.—Regular, constant exercise causes an increase in the density as well as in the bulk of muscle; there is an actual storage of nitrogenous tissue, the additional amount of nitrogenous food ingested more than compensating for the loss above mentioned. Excessive exertion leads to muscular exhaustion, diminished irritability and finally to degeneration, so that an over-used muscle decreases in bulk.

Digestive System.—Exercise increases the appetite, especially for fat (rather than starchy foods) and for meat. Digestion is also more rapid, and the circulation through the liver is said to be better. The total weight of fæces is decreased. The amount of water ingested is increased, and a considerable proportion is stored up in the body, partially or wholly restoring that lost during exercise.

Nutrition.—An increased elimination of carbon, probably largely due to oxidation of fats in association with the changes necessary for muscular contraction, and a storage of nitrogen in the albuminous constituents of the muscles are the main results of constant, regular, moderate exercise. The increased elimination of water is only after a time balanced by absorption, and apparently the total amount may thus be permanently diminished.

The effects of general exercise on health: (1) In cases of disease due to (a) want of exercise, (b) excessive exercise, (c) exercise without ventilation; (2) In cases of disease curable or relieved by exercise.

(a) *Deficient exercise*, by lessening oxidation and diminishing the efficiency of the circulation, lowers metabolism; the muscular system wastes, while fat and water increase; the muscles become smaller, more flabby, paler, and the heart shares in these changes, so that subsequent exertion favors dilatation. De-

ficient exercise produces a lowering of pulmonary nutrition, which favors the onset of tuberculosis; it lessens appetite, enfeebles digestive power, and favors chronic constipation.

(b) *Excessive exercise* produces more immediate results. The amount of exercise which ought to be taken cannot be precisely defined; the only rule is to stop when exercise of moderate severity has produced a distinct sense of fatigue. A laborer's daily work is about 300 foot-tons; a walk of 9 miles is an amount of work equal to 150 foot-tons; the amount of work done by a man weighing $11\frac{1}{2}$ stone in walking 10 miles is nearly 190 foot-tons, while the amount done by a man weighing $15\frac{1}{2}$ stone is nearly 260 foot-tons, though the sense of fatigue in both may be the same.

Exercise may be excessive in amount or velocity; to row a mile in an eight-oared racing boat in seven minutes is an amount of work equal to only $18\frac{1}{2}$ foot-tons, though an untrained man may easily exhaust himself by the effort. A due appreciation of this point is essential if exercise is to be safely used as a therapeutic agent.

Severe exercise produces very laborious respiration with occasional sighing; if still persevered in, hemoptysis may occur. If exercise be too long continued, the slowing of the heart during rest may be attended by intermittence or replaced by palpitation. Over-exertion when frequently repeated, produces cardiac hypertrophy, valvular disease, atheroma of vessels, and may even lead to rupture of the heart. Very great increase (120-140) in the rapidity of the pulse, or a disturbance of the rhythm of the heart during exercise, is an indication that it is excessive in amount or velocity.

The sense of fatigue is localized in some part of the nervous apparatus, and, if resisted, may be replaced by sleeplessness when sleep is desired. Tea favors this insomnia, and alcohol diminishes the excretion of pulmonary carbonic acid, so that both those beverages should be eschewed. The more rapidly work is done the more exhausting is it, and the greater is the strain on the muscular organs (heart and voluntary muscles).

(c) Since the amount of CO_2 expired is greatly increased by exercise, the air of a closed room is rapidly vitiated, and head-

ache, loss of appetite and, in time, impaired general nutrition are produced in persons who take exercise in ill-ventilated workshops or gymnasia.

(2) The use of exercise in *chronic cardiac disease* has been reduced to a system by Oertel. In cases of fatty heart with general obesity, in enlargement of the heart from gout and in chronic mitral disease, especially when the latter is associated with dropsy, renal disturbance, bronchial congestion or catarrh, the treatment is very effectual, but should be combined with diminution in the amount of fluid and of fat and carbohydrates ingested. The patient is required to walk a certain distance up a path with a gentle rising gradient; the occurrence of dyspnoea on exertion, which may be at first very pronounced, is not considered a contra-indication for the treatment. The distance, and therefore also the height, are increased daily as the dyspnoea diminished. Increased heart action thus caused, favors the production or restoration of compensatory hypertrophy; the increased force and rapidity of respiration favors the circulation through the lungs and the emptying of the right side of the heart; and all these causes combine to accelerate the venous circulation. It is said that the tension of the arterial walls relaxes, so that, though the arterial pressure is higher, the arteries are fuller, and that this only occurs in climbing, not in exercise on the flat.

Regulated exercise is of value in cases of *chronic bronchitis* occurring in obese, indolent persons, and operates in the same way as in chronic heart disease. In phthisis in a quiescent state and limited to the apex of one lung, it acts by improving nutrition and favoring full expansion of the lung as well as the process of repair.

In *atonic dyspepsia* general exercise has a tonic effect, increasing appetite and digestive power; in dyspepsia associated with plethora, hepatic tenderness, and constipation, it favors the hepatic circulation by unloading the right side of the heart and diminishing the tendency to constipation.

In certain *cachectic conditions* outdoor exercise is a powerful remedy—especially in scrofula, the “tubercular diathesis,” and rickets. It is also of great service in some forms of anæmia, but in chlorosis the amount of exercise taken should be

very moderate; indeed, chlorotic patients often recover most rapidly when kept completely at rest for a time.

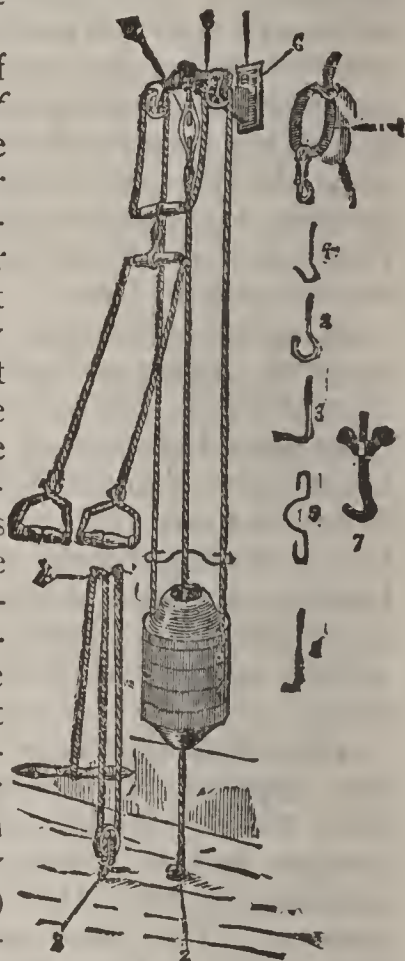
The exercise of *special groups of muscles* is of use in paralysis or paresis from disease, injury or disuse. (1) It may be voluntary where the patient retains some power over the muscles, and performs movements which bring the muscles into action; these movements may be performed against a certain resistance exercised by the hand of an attendant or by a machine. (2) It may be involuntary, the muscles being stimulated by electricity (see MASSAGE).

Regulated exercise and the exercise of special groups of muscles is often best obtained by means of suitable apparatus. (See cut.) The Home Exerciser (D. L. Dowd, New York) is well adapted to this purpose, as the exercise can be graded to suit each case and to the particular groups of muscles, as desired.

DAWSON WILLIAMS.

EXOPHTHALMIC GOITER (Graves's Disease; Basedow's Disease.)—A group of symptoms chiefly met with in women, of which palpitation, prominence of the eyes, and enlargement of the thyroid are the most important.

Symptoms.—The onset is usually gradual and insidious, but in a few instances the disease has suddenly appeared after great mental emotion. Palpitation is usually the first symptom noticed. The cardiac phenomena are the most constant and important, and of these palpitations breathlessness and throbbing of the vessels in the neck are the chief outward signs; the heart's action is greatly increased in frequency, the pulse being rarely under 90 and often over 120; the



cardiac impulse can be perceived over a large area, but there is no true heaving impulse. An anæmic murmur is frequently heard over the base of the heart.

The enlargement of the thyroid is often preceded or accompanied by a sense of fullness, constriction, or choking in the throat. The enlargement, though sometimes considerable, never approaches that seen in ordinary goiter; nor is the hardness so often found in the latter affection ever present. But, though the swelling is never very great or very hard, the trachea may be compressed even to a fatal degree.

Exophthalmos, when well-marked, may always be known by the fact that, owing partly to the great protrusion of the eyes and partly to the retraction of the upper lid, a rim of sclerotic can be seen above and below the cornea; when present in a high degree, it gives the patient a peculiar and savage aspect. Sometimes the protrusion is so extreme that one or both eyes may become spontaneously dislocated. Another and more serious danger from the extreme proptosis is ulceration of the cornea, owing to the inability of the lids to close over the eye. This may result in complete loss of sight.

Gräfe's lid-sign consists in the fact that the upper lid does not follow the downward movement of the eye with the perfect harmony seen in health. If the patient look down slowly it will be noticed that the upper lid, instead of following the movement in the usual way, does so in a hesitating and jerky manner, so that an unusual amount of the sclerotic above the cornea is disclosed during the process.

Another sign is the apparent widening of the palpebral aperture, associated with, and probably dependent upon, retraction of the upper lid; it is known as Stellwag's sign, and is not always present; with it there has been noticed a diminished frequency of winking.

It is almost the rule for these patients to suffer from profuse perspiration, often accompanied by a sense of heat; the sweating is general over the whole body, the skin being found moist even in those situations where it is habitually dry. This symptom is sometimes the one of which most complaint is made. Emaciation is usually a prominent feature, and the subjects are generally anæmic, while

nervousness, irritability, change of temper, loss of appetite and digestive disturbances are among the chief premonitory symptoms, and persist after the affection is well established.

In a few instances the disease has run a rapid course, and death has occurred in six weeks, being due presumably to the emaciation and exhaustion. As a general rule the course is very slow, and in a large number of cases more or less complete recovery ultimately occurs. Marked emaciation, profuse sweating and diarrhea, and uncontrollable vomiting are symptoms which indicate that the case will probably terminate fatally. Epistaxis is among the later phenomena, but it is not necessarily of bad augury; the eyes may recede and the thyroid diminish in size before death occurs. In a small percentage of cases the patient becomes temporarily or permanently insane.

Diagnosis.—A well-marked case could hardly be mistaken for any other condition, nor could there be much hesitation when palpitation and a rapid pulse coincided with either exophthalmos or enlargements of the thyroid. If the cardiac phenomena, sweating, tremors, and nervousness be present, a diagnosis of the disease would be justified.

The presence of a vasomotor center in the medulla oblongata is an established fact, and it is probable that in its immediate neighborhood there is a center regulating the sweat glands, and there is good reason to believe that there is also close by a center for regulating the heat of the body. A lesion of the medulla which caused paralysis of these centers would be capable of giving rise to all the phenomena of the disease except those referable to the heart, and, inasmuch as the center for the pneumogastric nerve is quite close, it is a fair assumption that it too might be paralyzed, and the frequency of the heart's action be thus explained. It is probable, therefore, that functional disturbance of that portion of the medulla in which these centers are situated is the actual cause of the disease.

Ætiology.—The disease is much more common in women, but is occasionally met with in men, when it presents the same features. It may appear from the time of puberty up to middle life, but is commonest in young women from seventeen to twenty-five. Fright, mental shock, anxiety, and worry are among

the exciting causes in a large proportion of the cases, while inherited neurotic tendencies are also frequently present. In some instances the disease has appeared to run in families. In a certain proportion of cases rheumatism will be found among the antecedents.

Treatment.—Quiet and freedom from excitement are essential features in the treatment of this disorder; occasionally it will be necessary to confine the patient to bed. Fresh air and a nourishing diet without stimulants are next in importance. Digitalis alone or in combination with iron, iron by itself, belladonna, iodine, arsenic, and bromide of potassium all have their supporters, and have all seemed to do good. The continuous current has in the hands of some appeared to exert a beneficial effect; the poles should be applied behind and a little below the angle of the jaw on each side, or the negative pole to the nape of the neck and the positive pole to the thyroid or eyes. When the proptosis is extreme, ice should be applied to the forehead and to the nape of the neck, and the lids may be stitched together to protect the cornea from ulceration. Ice may also be applied to the thyroid when its enlargement is very great; and, when there is a dangerous pressure on the trachea, the isthmus may be divided, after which the thyroid will probably shrink; but if the symptoms are not relieved, tracheotomy should be performed. JOHN ABERCROMBIE.

Symptomatic Indications.—*Belladonna* is a specific in this disease. *Ferrum* may occasionally be useful when there is much anæmia.

EXPECTORANTS promote the discharge of the secretions from the air passages. They increase the quantity of the sputum, or make its expulsion easier, either by altering its chemical constitution or by increasing the expulsive power.

They may be classified, according to their influence over the circulation, into *stimulant* and *depressant* expectorants. To the former class belong squills, senega, benzoic acid, benzoate of ammonia, the balsams of Tolu and Peru, tar, and the vapor of chlorine, iodine, ammonia, creosote, and carbolic acid. In the depressant group are ipecacuanha, antimony, iodide of potassium, and the alkaline chlorides. Carbonate of ammonium,

strychnine and belladonna increase the respiratory movements or stimulate the respiratory center.

EXPECTORATION.—In health the secretion of the respiratory mucous membrane is removed by the action of its ciliated epithelium, but when the amount of this fluid is increased ciliary movement is no longer sufficient, cough is excited in a reflex manner, and the secretions are expectorated. Cough consists in a sudden forcible expiration, combined with a momentary closure of the glottis, the effect of which is to discharge the contents of the trachea and larynx into the mouth, and to propel the secretions in the bronchi toward the trachea.

The excessive products of the pharyngeal mucous membrane are got rid of by the process of "hawking." The sputum or matter expectorated may be derived from any part of the respiratory passages, from the pharynx to the pulmonary alveoli. Owing to the wide distribution of mucous glands throughout this tract, the expectoration always contains mucin in varying quantities. The sputum is described as mucous, muco-purulent, or purulent according as it is transparent, semi-opaque, or resembles the contents of an abscess. Mucous and muco-purulent sputa are generally thick and tenacious, as distinguished from the purulent variety, which is less viscid. At times mucous expectoration may be thin and watery. Sputum from the larynx and trachea and from the larger and medium-sized bronchi is frothy, whereas that derived from the bronchioles and pulmonary vesicles is always more solid, and contains fewer air bubbles.

The secretion of the pharynx is seldom much aerated, and is particularly tough, owing to evaporation being favored by the continuous and forcible air current to which the pharynx is exposed.

Mucous secretion consists mainly of water with small quantities of mucin and saline matter. In bronchitis and in all conditions where the sputa are purulent, a small amount of albumin escapes from the blood vessels and is discharged in the expectoration.

Muco-purulent and purulent sputa often present a mummular appearance, which has been regarded by some writers as pathognomonic of the presence of cavities in the lung; but this is a mis-

take, for the same appearances may be presented by the expectoration of chronic bronchitis without excavation or bronchial dilatation. The presence of carbon in any quantity gives the secretions a gray or blackish color. Fibrinous casts of the bronchial tubes are found in the sputum of plastic or croupous bronchitis.

Blood may be expectorated with the sputum in the shape of streaks or clots, or it may be intimately mixed with the secretions. In the latter case the sputum has a rusty, brick-dust, prune-juice, or florid color, according to circumstances which cannot be considered here. Pure blood may be coughed up when hemorrhage is profuse and sudden. Various adventitious matters may be voided with the expectoration: hydatid cysts, diphtheritic membrane, portions of new growths of the larynx, pulmonary calculi, carbon in different forms, dust of all kinds (iron, siliceous, etc.), vegetable and animal fibers, fragments of necrotic lung tissue, crystalloid products of chemical change, and numerous varieties of micro-organisms. Many of these foreign substances can be recognized with the naked eye; others require the use of the microscope for their detection. In certain morbid states of the bronchi (bronchiectasis, putrid bronchitis), in pulmonary gangrene and in certain cases of abscess and excavation of the lung, putrefactive decomposition of the secretions occurs with the formation of volatile fatty acids (butyric, valerianic, etc.), also of leucin tyrosin, sulphuretted hydrogen, and other products, which impart a terribly offensive odor to the sputum and breath.

Microscopical examination.—Much information may be obtained by examining the sputum like any other liquid—*e. g.*, urine—without any special preparation. A small quantity of the sputum is transferred to an object-glass, and a cover-glass is gently pressed on the specimen so as to spread it out in a thin layer. Mucous sputum consists of a transparent amorphous mucin basis, in which a few epithelial cells of various sizes and shapes are generally recognizable. These cells are squamous, spheroidal, columnar, or columnar-ciliated according to the part from which they are derived. When the expectoration is muco-purulent or purulent, pus corpuscles, granular matter, and frequently small oil globules are discovered. Pigmentary granules, mostly con-

sisting of carbon, are very commonly present in the sputum of persons living in towns or a smoky atmosphere. Fine needles or fatty acids, and crystals of cholesterin, leucin, and tyrosin may be detected when putrefactive processes are at work. Blood corpuscles are met with in various conditions.

Curschmann's spirals.—The small, thick pellets expectorated toward the close of an asthmatic paroxysm are often found to contain spiral threads of mucin arranged like a corkscrew. At times a central thread can be seen within the spiral coil. These objects, which can often be recognized with the naked eye, are believed to represent casts of the bronchioles, and Curschmann considers that they indicate the existence of an exudative bronchiolitis, which, according to his view, is the lesion on which asthma depends. Subsequent investigation has shown that the spirals are sometimes present in cases of simple bronchitis and pneumonia.

Charcot-Leyden crystals.—Pointed octahedral crystals, insoluble in ether and alcohol, but soluble in acids and alkalies, were found by Leyden in the sputum in cases of asthma, and were believed by him to have a causal relation to the attack. The crystals appear to be analogous to Charcot's crystals, which are seen in the spermatic fluid and elsewhere.

Lung tissue.—If the small, opaque, shreddy particles frequently seen in phthisical sputum be teased out with needles in a drop of water, the characteristic curled, branching, elastic fibers can often be detected. At times, where excavation is proceeding rapidly, the elastic tissue presents traces of an alveolar arrangement, but more often scattered individual fibers are observed. A little practice is needed to recognize lung tissue with certainty, as adventitious threads of cotton and other materials are easily mistaken for elastic fibers. Lung tissue may also be discovered by boiling the sputum with an equal volume of a solution of caustic soda (20 grains to the ounce) for a few minutes, and allowing the fluid to stand in a tall conical glass for twenty-four hours, when the fragments of elastic tissue sink to the bottom and can be detected in the sediment. The discovery of elastic tissue in the expectoration is a certain sign of the existence of destructive disease of the lung, whether ulcerative or

gangrenous, but it does not enable us to distinguish the nature of the disease more precisely.

Phthisis (tubercular), being by far the commonest of all the destructive pulmonary affections, is usually indicated when elastic fibers are found in the sputum, but at the same time the presence of gangrene or of ulceration depending upon cirrhosis or bronchiectasis cannot be excluded.

Small portions of laryngeal new growths are occasionally coughed up, and may be examined in the fresh state, or they may be embedded in celloidin and cut into fine sections in the usual way. The investigation of the expectoration for "cancer cells" seldom yields trustworthy results.

Micro-organisms.—Microbes of various descriptions may be discovered in the sputum. At present there are only two varieties—the tubercle bacillus and the actinomyces or ray fungus—which possess undisputed clinical significance.

Tubercle bacillus.—This microbe may be detected in the following manner: The sputum is poured into a flat glass dish and examined against a dark background. A small quantity of the thickest and most opaque part is removed with a clean platinum loop or scalpel, and transferred to a freshly cleaned cover-glass; a second cover-glass is then placed on the first, and the two glasses are gently pressed together so as to spread out the sputum in as thin and even a layer as possible. The cover-slips are then separated and allowed to dry, after which they are picked up with forceps and passed three times through a Bunsen flame to coagulate the albumin. The preparations are then ready for staining.

The following reagents are required to complete the process:

1. A solution of fuchsin, either (a) Ehrlich's solution—saturated alcoholic solution of fuchsin 11 c.c.; saturated watery solution of aniline oil 100 c.c. (this solution is apt to undergo decomposition and should be freshly prepared every fortnight); or (b) Ziehl's solution—saturated alcoholic solution of fuchsin 10 c.c.; 5 per cent. watery solution of carbolic acid 100 c.c. (this solution is much more stable, and may be preserved for months).

2. A concentrated watery solution of methylene blue.

3. A solution of nitric acid—commercial nitric acid 1 part, water 2 parts.

Method of staining.—The staining fluids must be filtered each time they are used. The cover-glass is now placed with the sputum downward in a watch-glass or small glass capsule containing the fuchsin solution, and the staining fluid is heated on a sand bath or over a spirit-lamp till it begins to boil. The flame is then removed, and the preparation is allowed to remain about five minutes longer in the hot solution. The cover-slip is next removed with forceps, and immersed for two or three seconds in the nitric acid solution, when the red color of the fuchsin changes to a brownish gray. The glass is then washed for five or six seconds in a gentle stream of water flowing from a tap, when the red color reappears. Finally, the preparation is stained in some of the methylene blue solution in the cold for a few minutes, washed again in water, and allowed to dry. The cover-glass is then mounted in Canada balsam dissolved in benzol or xylol, and is ready for examination.

When the staining is satisfactory and the bacilli are numerous, the microbes can be recognized with a magnifying power of from 200 to 300; but when they are scarce, and in all doubtful cases, a sub-stage condenser and a $\frac{1}{2}$ oil immersion lens are indispensable.

The tubercle bacilli by this method of staining appear as delicate rods of a red or crimson color, the pus corpuscles and other micro-organisms being stained blue. The staining of the tubercle bacillus may either be uniform or the organism may seem to be indistinctly beaded, an appearance which has been attributed to the presence of spores.

The discovery of bacilli with these staining reactions in the sputum is a positive proof of tuberculosis of some part of the respiratory tract. Tubercular ulceration of the larynx, pharynx, or trachea may furnish some of the microbes, but the great mass of the bacilli comes from the lungs.

When the results of examination are negative, mistakes are very liable to be made, and until the sputum has been repeatedly examined we are not warranted in asserting that tuberculosis is absent. The sputum expelled on waking in the morning is most likely to contain the

tubercle bacilli, as it represents the collection of some hours.

The number of bacilli found in the sputum is not necessarily a measure of the activity or extent of the disease, it is mainly a question of discharge. When tubercle bacilli are numerous, the existence of pulmonary excavation is almost certain.

Actinomyces.—These organisms have been detected in the sputum in actinomycosis of the lung. The characteristic clubs can easily be recognized with an oil immersion lens without the application of any stain, if the small yellow specks or granules be first sought out with the naked eye or with a low power. (See ACTINOMYCOSIS.) PERCY KIDD.

EXTRA-UTERINE GESTATION.

—Pregnancy elsewhere than in the body of the uterus.

Causes.—Conditions which prevent the ovum from getting to the uterus, but do not prevent the spermatozoa from getting to the ovum. Among these are inflammation of the fallopian tube, leading to shedding of the ciliated epithelium, which should both aid the movement of the ovum to the uterus and prevent the spermatozoa from traveling along the tube; tumors, or adhesions, partially blocking the tube or rendering it tortuous; emotional disturbances or traumatic influences acting about the time of conception, and perhaps causing some spasmodic contraction of the tube. It frequently occurs after a long period of sterility, being a result of conditions which often altogether prevent normal pregnancy. Extra-uterine gestation is more frequent in multiparæ, and occurs with disproportionate frequency in twin pregnancies.

Anatomy.—The most common seat is in the fallopian tube. Cases of abdominal pregnancy are met with in which no history pointing to previous rupture of a tubal cyst can be obtained, and therefore it is inferred that the pregnancy was primarily abdominal. It may be in that part of the tube which traverses the uterine wall. This is called tubo-uterine or interstitial pregnancy.

Course.—In tubal pregnancy no decidua exists in the tube. As the pregnancy goes on, the chorionic villi become inserted into the mucous membrane of the tube; the growing ovum gradually

expands the tube. Hypertrophy of its muscular fibers takes place analogous to that of the uterus in pregnancy, but less in degree. From the expansion of the tube, the muscular bundles become stretched and separated. Usually between the fifth and thirteenth week the tube ruptures, about the eighth week being the usual period. The ordinary mechanism of rupture is, that slight separation of some chorionic villi takes place, causing hemorrhage between the ovum and the containing tube, and the distention caused by this effusion of blood bursts the tube.

Several events may now happen. (1) The blood, poured out between the chorion and the inclosing tube, may extensively separate the chorion (as in abortion) before rupture takes place. The separation may be so considerable as to destroy the life of the embryo. In this case after rupture has taken place, the effused blood, the fetus, and its membranes will be absorbed, and natural cure result. (2) The chorionic villi may not be separated to such an extent as to destroy the vitality of the embryo. In this case the first hemorrhage, which is commonly slight, may be followed by renewed attacks of hemorrhage, one of which may at length kill the patient. (3) The rupture may have taken place on the side of the tube which is between the folds of the broad ligament. In this case the blood will be extravasated into the cellular tissue of the broad ligament, and death from hemorrhage is not so likely to happen. If the fetus be not killed by the separation of chorionic vessels, it may go on developing under the peritoneum, raising the membrane as it grows; and in this situation it may reach full term. This is called sub-peritoneo-pelvic gestation. (4) Both fetus and mother may survive even though the rupture take place into the peritoneal cavity, and the pregnancy go on to term. This is called secondary abdominal pregnancy. In such a case the chorionic villi, as they grow and become aggregated together to form the placenta, may attach themselves to almost any part of the peritoneum. The placenta has been found attached to the stomach, small intestine, large intestine, mesentery, omentum, anterior or posterior abdominal wall, uterus, and broad ligament; and it has been seen within the

tube, and even within the uterus, while the fetus was outside. Wherever the placenta is attached, it produces a great increase in the size and number of the vessels of the part.

While the fetus is growing outside the uterus undergoes a development the same in kind, but less in degree, as that which occurs in uterine pregnancy. It becomes enlarged, its walls thickened, its cavity lengthened, and a decidua thicker and larger than the menstrual decidua is formed within it. At some period in the course of pregnancy—sometimes early, sometimes not until near the end—this decidua is expelled.

When full term is reached, the child dies, and the liquor amnii is usually absorbed. (1) The child may be retained in the abdomen unchanged for an indefinite period, or (2), without detriment to the mother's health, it may become converted into adipocere (rare). (3) The membranes may undergo calcareous degeneration so that the fetus becomes contained in a stony case, and there may be in time some deposit of calcareous matter in the superficial parts of the fetus itself. This change is called the formation of a "lithopædion." It is very slow in progress. (4) The fetus may become shriveled and mummified. (5) It may suppurate. The soft parts are disintegrated, the bones separated from one another, and at a variable periods (on the average about six months, and generally within two years) after the death of the child the abscess bursts. It opens most often into the large intestine; next often externally through the abdominal walls; least often into the bladder or vagina. Through this opening, if the patient survive, first the pus and then the fetal bones are gradually eliminated. This is a very tedious process, lasting, if unassisted by art, two or three years, or even longer.

Symptoms, diagnosis and treatment:

1. Before rupture. — The reported cases are few. In almost every case in which the nature of the disease has been shown by operation or by autopsy, rupture had taken place. The diagnosis has never yet been made and confirmed before rupture. A few cases have been cured before rupture by operation, but in them it was not possible to make any closer diagnosis than that there was some disease of the fallopian tube.

2. After rupture, but before the fetal heart can be heard, the case may come under notice at various stages: (a) after one or more slight hemorrhages have occurred, causing symptoms sufficient to attract attention, but not making the patient seriously ill; (b) after profuse internal bleeding has occurred, reducing the patient to a state of collapse; (c) after the patient has recovered from the collapse caused by a severe internal hemorrhage.

(a) This is commonly the earliest stage at which the condition is diagnosed. There are five indications from which the diagnosis may be made with a close approach to certainty. These are (1) a history of the symptoms of early pregnancy—the patient thinks herself pregnant; (2) these symptoms having lasted a month or two, the patient begins to suffer from attacks of severe, paroxysmal abdominal pain; (3) about the same time she begins to have irregular hemorrhages from the uterus, and with one of these hemorrhages there may be the passage of a deciduous membrane (a most important sign); (4) there is a swelling behind and on one side of the uterus; (5) there is slight enlargement of the uterus. The severe pains probably depend upon distention of the tube, and the sudden distention of the tube is probably caused by slight hemorrhage into it. In cases operated on after the diagnosis had been made, the tumor has been found to consist of the dilated tube surrounded by blood clot.

Treatment.—We have to consider the alternatives of expectancy and abdominal section. Galvanism has been recommended, but practically amounts to expectancy. Puncture by the vagina, and subsequent injection into the sac, or the use of galvanism and cutting into the sac, have been employed. They bring the risk of abdominal section, without the certainty of cure. If the assemblage of symptoms be complete, the best treatment will be abdominal section without delay. If the diagnosis be not clear, but only probable, the relations and size of the tumor should be defined as exactly as possible, and the case carefully watched to determine if the tumor be increasing in size. If it increase in size, abdominal section should be performed as soon as the fact of increase is certain.

(b) In collapse following profuse hemorrhage, if the patient be seen before she is

so prostrate as to have no chance of recovery, the abdomen should be opened at once, the effused blood let out, the diseased tube removed, and the abdomen washed out and drained.

(c) After the patient has recovered from the collapse caused by a severe hemorrhage (which is the stage at which most of the published successful operations for extra-uterine gestation have been performed), it is to be remembered that the hemorrhage may recur, and that peritonitis may follow, although it seldom does. From these risks the patient is saved by a successful operation. On the other hand, a large hemorrhage generally, though not always, is accompanied by stoppage of the pregnancy; and if this happen, the patient will recover if she survive the shock of the hemorrhage. Recovery depends much upon the condition of the patient at the time of operating.

The decision as to the course best for the patient is here more difficult than in the before-mentioned circumstances. The less the hemorrhage, the better the patient's condition, the less likely it is that the pregnancy has come to an end, and the greater is the prospect of recovery from the operation. The greater the hemorrhage, the more exhausted the patient, the less is the prospect of recovery from operation and the greater the chance that the pregnancy will have come to end. If symptoms of internal hemorrhage be followed by those of peritonitis, the abdomen should be opened without delay, the effusion let out, and the diseased part removed.

3. After symptoms of rupture have passed off, the fetal heart being still audible.—In this stage of the pregnancy it is not common for very urgent symptoms to arise. The patient may suffer from discomfort caused by the enlargement of the abdomen, or by the fetal movements, or from symptoms of pressure on bladder, bowel, vein, etc., but seldom from any more serious troubles. The diagnosis of pregnancy is easy, for the fetal heart can be heard. The only difficulty is to ascertain that the pregnancy is not uterine. This is best done by careful bimanual examination under an anæsthetic, by which method it is possible to distinguish the uterus from the fetal tumor. It can be felt through the abdominal wall if in front of the sac; through the rectum

if it be behind. Diagnosis may be difficult, for the uterus may be fixed, elongated, and spread out in front of the tumor so as to be hardly distinguishable from it. At this stage decision is difficult. On the one hand, the danger to the mother is not greatly increased by waiting till full term, and by operating at term the child is given a prospect of life, and the danger of an operation some time after the child is dead is less than that of an operation in the second half of pregnancy. Operative interference may therefore at this period be postponed, unless demanded by urgent symptoms, and treatment limited to the relief of symptoms by palliative measures. On the other hand, the earlier the pregnancy the less is the danger from hemorrhage during operation. Experience must be allowed to weigh in the decision. The earlier the pregnancy, the clearer is the indication for operation; the nearer term, for postponement.

4. At term.—This is marked by the onset of *spurious labor*. This curious phenomenon is characterized by paroxysmal abdominal pains, which to the patient seem like those of labor, and by a discharge of blood and mucus from the vagina, like the "show" which is an early symptom of normal labor. Dilatation of the cervix has been observed to occur in spurious labor, followed by its contraction when the pains have passed off. This, with other considerations, makes it probable that the spurious labor pains are real uterine contractions. It may last from a few hours to two or three weeks. When it has passed off there is a lochial discharge and a secretion of milk from the breasts. The mammary activity may last from a few days or even years.

The ideal *treatment* of extra-uterine pregnancy is the delivery of a living mature child by abdominal section at term. But, up to the present time, four-fifths of the cases so treated have ended in the death of the mother, and the majority of the children have died. Further, a large proportion of extra-uterine children born alive have been deformed. So, unless urgent symptoms are present, we shall give our patient the best chance of recovery by letting spurious labor pass off without more than palliative treatment.

5. After full term.—At term the child dies, and then, as a rule, the liquor amnii is re-absorbed. The circulation through the placenta ceases, blood is extravasated

into it, and the vascular connections between it and the maternal organism become less and less. The length of time which it takes for the placental circulation on the mother's side to cease varies widely in different cases.

The *diagnosis* of an extra-uterine gestation after the child is dead will usually be assisted by the history. But if this be deficient or misleading, the diagnosis may be extremely difficult; indeed, impossible, without an exploratory incision, to distinguish an extra-uterine fetus from a solid, or partly solid, ovarian or uterine tumor. If there be urgent symptoms, operation is indicated, whatever the nature of the tumor. If the patient be not suffering in health, some guide for treatment will be gained by carefully measuring to see whether the tumor grow. The child may remain for months or years in one of the conditions mentioned above (unchanged, mummified, calcified, or converted into adipocere) without causing any disturbance of the mother's health. The placenta becomes gradually absorbed. If this be the course of the case, no treatment is required. If suppuration take place, the commencement of this change will be indicated by hectic fever. The better course is to open the abdomen and remove the child as soon as febrile symptoms begin. It is well to wait for symptoms, because (1) an operation may not be needed at all; (2) the longer we wait, the less will be the vascularity of the placental site, and the more likely will it be that both fetus and placenta can be removed.

6. After suppuration and disintegration of the child have taken place.—The most favorable place at which the suppurated cyst may burst is the abdominal wall, and next to that the vagina, because here the opening can most easily be got at. The nature of the abscess, if there be no previous history, will be clear, from the discharge of fetal bones. The treatment is to enlarge the opening as much as is safe, and to remove the fetal bones.

Pregnancy may take place in an imperfectly developed cornu of a bicorned uterus, the connection between the gestation cavity and the cervix uteri being reduced to a mere band of fibro-muscular tissue. Such cases are difficult to distinguish from tubal gestation even on the post-mortem table. The nature of the

case is shown by the insertion of the round ligament, which in tubal gestation is of course internal to the sac; whereas, if the sac be a uterine horn, the round ligament will be attached to its outer aspect. Clinically, as to symptoms, course, and treatment, these cases differ in no essential respect from tubal pregnancy.

G. E. HERMAN.

EYE, DISEASES OF THE.—

The Eyelids.—Anatomically the eyelid is a complex structure, and its diseased conditions are correspondingly varied in character; its skin and cutaneous glands, conjunctival mucous membrane, muscles, Meibomian glands, tarsal "cartilage," and eyelashes, with their follicles and sebaceous glands, are all liable to be affected. Again, the position of the lid is such that any departure from the healthy condition readily causes discomfort.

Blepharitis.—The edges of the lids are especially prone to disease, and principally to a chronic form of inflammation known as marginal blepharitis. In the more severe forms of this affection the palpebral border is dusky-red, swollen, and covered with hard, dark yellow crusts. On removing these latter a moist surface is exposed, often with ulceration or small yellow pustules round the insertion of eyelashes; sometimes there is eczema of the neighboring skin. If neglected, the ulcers may damage or even destroy the cilia follicles, leading to badly developed, misplaced lashes (*trichiasis*), or to more or less complete absence of them. Sometimes we get ectropion from hypertrophy of the conjunctiva, and epiphora from eversion of, or other interference with, the puncture. In the milder forms there is hypersecretion from the sebaceous glands, leading to the formation of small, yellowish-white crusts, on removing which we find the underlying surface somewhat reddened but not ulcerated. Sometimes we have mere redness of the edges of the lids, especially in persons with delicate skin and light complexion, often associated with some error of refraction and consequent straining of the eyes. This condition is also liable to be caused by external irritation, as exposure to dust or cold. The more severe cases usually occur in strumous children, and frequently date from an attack of measles.

Treatment.—Attend to the general condition of the patient; syrup of the

iodide of iron or other chalybeate being frequently indicated. External irritants and overuse of the eyes are to be avoided, and glasses ordered if necessary. Locally attend to removing the crusts and preventing their re-formation. Warm alkaline lotions (*e. g.* 10 grs. of biborate of soda to the ounce of water) to be used several times daily, the softened crusts then picked off, and dilute nitrate of mercury ointment (1 part to 7 of vaseline) applied to the roots of the lashes. In very severe cases all the affected lashes should be pulled out and the excoriated surface of the lid touched with a strong solution of nitrate of silver (20 grs. to the ounce). When the lashes have been destroyed and the lids everted we cannot restore a healthy condition, but cleanliness, astringent lotions, and slitting the everted canaliculi will cause much improvement.

The crab-louse occasionally takes up its abode on the edge of the lids, and its eggs are then found disposed along the sides of the lashes like little dark beads. At a superficial glance the condition might be mistaken for blepharitis, or dirt on the lashes. The use of a mild mercurial ointment, such as that mentioned above, will soon kill the pediculi.

Symptomatic Indications.—In recent simple cases *pulsatilla* is usually sufficient. When attended with febrile symptoms, eyelids swollen, hard and red, with heat, burning, and dryness *aconite* will do good service. Swelling and redness of the lids, with burning and itching, constant agglutination, bleeding on opening require *belladonna*, which is also useful in eversion of the lids. *Euphrasia* is useful when the margins are ulcerated, with itching in the daytime and agglutination at night, with constant winking. *Calcium sulphide*, when the Meibomian glands are affected or the lids are ulcerated.

Hordeolum, or **stye**, is a circumscribed hard swelling at the outer edge of the margin of the lid, due to a suppurative inflammation of one of the sebaceous glands at the roots of the lashes. There is considerable pain at first, and marked swelling from infiltration of the adjacent loose tissue of the lid. The most severe cases are of the nature of boils; in these the pain is very acute, and there is often considerable chemosis of the conjunctiva.

Treatment.—In an early stage, touching the part with nitrate of silver, pulling out the corresponding eyelash, and using

lead lotion, often cut short the inflammation. Later on, warm applications, are useful in soothing the pain and in hastening the suppurative process. When pus has formed it should be evacuated. General treatment is often indicated by the condition of the patient, mild purgatives, iron, and nitro-hydrochloric acid being frequently serviceable. Some young adults are particularly subject to styes occurring in successive crops, and the local treatment of most service in such cases is the use of an eye douche, with lead lotion. Styes are sometimes associated with an error of refraction, which should be corrected by the necessary glasses. At other times they are dependent on some defect in the general health, or a local irritation, as from blepharitis.

Symptomatic Indication.—*Pulsatilla* is generally all that is needed for the cure of a stye, although *staphisagria* may be required when they frequently recur.

Distichiasis and **trichiasis** signify different forms of misplacement of the eyelashes produced by disease. In the former condition they are disposed in a more or less complete double row, while in the latter they are obliquely placed and often stunted; in both affections some of the displaced lashes rub against the cornea and thus set up irritation, sometimes leading to pannus and even ulceration. The usual causes of trichiasis are blepharitis and trachoma.

Treatment.—Temporary relief can always be afforded by epilation of the misplaced lashes. The more radical operation consists either in destroying the cilia at fault or in giving them a new position. If there be only one or two lashes actually rubbing on the cornea, we may destroy their follicles by electrolysis. In more severe cases we may remove all the offending lashes and their bulbs by judicious excision of part of the lid margin.

Ankylo-blepharon, or union of the edges of the upper and lower lids, may be congenital, but generally arises from injuries (wounds or burns) or from ulceration. It is rarely complete. Division of the adhesions with scissors, and attention for a few days so as to prevent reunion, will generally effect a cure.

Entropion, or inversion of the lid margin, may affect either the upper or lower eyelid, but its nature usually differs. It always causes much discomfort from the rubbing of the lashes against

the cornea. Entropion of the lower lid generally occurs in old people, and is then due to a spastic contraction of the palpebral fibers of the orbicularis muscle in association with loose senile tissues. It may be relieved by excision of a strip of skin and orbicularis along the whole length of the lid, a little below its margin; sutures may or may not be employed.

We occasionally get a spasmodic entropion of the lower lid from the prolonged use of bandages, as after cataract extraction. Generally, repeatedly brushing a little collodion outside the lid, a little below the lashes, is sufficient to relieve it, and in any case it soon disappears on discontinuing the use of the bandage. Entropion of the upper lid is usually organic, due to a cicatricial contraction of the conjunctiva and inversion of the tarsus from burns or old trachoma. Relief can be obtained by radical removal of all the lashes.

Ectropion, or eversion of the lid margin, may be caused by chronic marginal blepharitis, or by relaxed tissues in old age, or, again, by cicatricial contraction (as from burns or wounds, or from abscesses in caries near the orbital margin); or it may be due to a rapid hypertrophy of conjunctiva, as sometimes occurs in purulent ophthalmia. The lower lid is most frequently affected. This condition often produces much deformity, the conjunctiva is usually inflamed, and the eversion of the puncta causes the tears to flow over the cheek.

Treatment.—In the non-cicatricial cases we can remove a horizontal strip of the everted conjunctiva and trust to the subsequent contraction drawing the lid into position; or shorten the lid by removing a V-shaped piece of its entire thickness and bringing the edges together with sutures or a hare-lip pin. Cicatricial ectropion may affect either lid, and is often only partial. The remedial operation necessary must therefore be determined by the particular case, but the method most frequently useful in the entropion of the lower lid is that known as the V-Y operation.

Blepharospasm is a spasmodic contraction of the orbicularis muscle, usually a reflex result of irritation of the fifth nerve. It may occur from a foreign body in the eye, a phlyctenule, etc., or from caries of the teeth. In other cases there is pain or pressure over the supra-orbital or other branch of the fifth,

while occasionally it is met with in weak hysterical subjects without any evident local cause.

Treatment.—Must be determined by the cause. In cases dependent on ocular conditions any foreign body present must be removed, and in phlyctenules great relief is afforded by the use of cocaine and atropine. Counter-irritation by blister or seton, and the cold face-douche are often of great service. In severe cases that do not yield to other treatment canthoplasty is useful, the external canthus being divided with scissors, and the adjacent conjunctiva united by suture with the apex of the incision.

Symptomatic Indications.—For quivering of lids, with dazzling of sight, *pulsatilla* is an efficient remedy. *Belladonna* is more useful when contraction is due to cerebral irritation. *Chamomilla* is useful in women and children, with irritability of temper, nervous origin.

Ptosis, or drooping of the upper eyelid, may be mechanical, congenital, or paralytic. Ptosis may be said to be mechanical when it occurs in association with a shrunken globe or empty socket; or, again, in trachoma, where it is due to relaxation of the upper conjunctival fold and increased difficulty of elevation of the lid from its greater weight. The congenital form is often unilateral and varies in degree. It is said to be due to imperfect development of the levator muscle. In these latter cases the appearance may be improved by the removal of an oval piece of skin from the upper lid, so as to cause the shortening desired; but care must be taken not to leave the cornea permanently exposed by removing too much. When due to paralysis electricity may be useful.

Symptomatic Indications.—*Gelsemium* and *veratrum alb.* are useful in paralysis of levator palpebræ sup., heaviness of lids. *Causticum* in paralysis of orbicularis.

Certain other congenital anomalies are to be met with in the eyelids, as **coloboma**, which appears as a wedge-shaped fissure, and which is usually in the upper lid. The treatment consists in paring the edges and uniting them with sutures; in very rare cases the lids are completely absent. **Epicanthus**, which consists in a fold of skin passing from the side of the nose to the inner end of the eyebrow and concealing the inner canthus. It commonly disappears

as the bridge of the nose is developed ; but should it not do so the deformity may be removed by excising a vertical elliptical fold of skin from the upper part of the nose.

Chalazion, or Meibomian cyst, appears as a hard, round, painless tumor in the substance of the lid, about the size of a split pea, and its position is recognized on everting the lid by a grayish semi-translucent patch in an area of increased conjunctival vascularity. It is due partly to an hypertrophy of the Meibomian gland, partly to retention of its secretion and a chronic inflammation of the surrounding tissues. Occasionally it inflames acutely, and may then point cutaneously. Where possible it is always best to open it by a crucial conjunctival incision and remove all the contents with a scoop. They often occur in crops, and, like styes, are especially frequent in young adults.

Symptomatic Indications.—Inflammation of Meibomian glands, *amm. brom.*

The other tumors which are not infrequently found on the eyelid are milium, molluscum contagiosum, xanthelasma, and nævus. Their character and appropriate treatment are the same as when they occur in other situations. In this region also appear congenital dermoid tumors, warts, fatty tumors, and more rarely sarcoma and epithelioma. The eyelid is a favorite situation for rodent ulcer, while we also frequently find here primary and tertiary syphilitic sores and lupus.

Symptomatic Indications.—*Merc.* or *thuja*.

Lachrymal apparatus.—The lachrymal gland is rarely acutely inflamed, showing localized symptoms of inflammation, the pain often very severe, and pus generally soon forms. It should be evacuated by early incision, as fistula may be the result when the pus is allowed to find its own way out.

Chronic inflammation of the lachrymal gland is more commonly met with, and is recognized by a circumscribed hard swelling in the upper outer part of the orbit, the enlargement being visible in this part of the conjunctival fornix on everting the upper lid. We should try to produce absorption by local application of iodine or mercurial ointments. If pus forms it is to be evacuated as in acute cases. Very rarely a bluish translucent swelling appears in the same position—

a retention cyst in connection with the gland ducts (*dacryops*). A small seton placed and tied loosely in the anterior wall of the cyst, and allowed to ulcerate through, is a good method of treating this affection.

The tumors most liable to occur in the gland itself are cysts and sarcomata. When necessary the gland can be extirpated through an incision at the outer orbital margin above.

Epiphora.—In by far the greater number of cases of lachrymal disorder the drainage of the tears is defective, in consequence of which they run over the cheek, producing the condition known as epiphora, stillicidium lacrimarum, or "watery eye." In such cases it is well always systematically to examine each part of the drainage system in the natural order of the passages from above downward.

First, one of the *puncta* may be at fault, (*a*) from displacement, as in ectropion ; or (*b*) it may be obstructed by the presence of a foreign body, *e. g.*, an eyelash ; or, again, (*c*) the *puncta* may be narrowed, sometimes even quite occluded, as a congenital malformation or as the result of old inflammation.

Next, the *canaliculus* may be obstructed by a chalky concretion or by a fungoid growth (*leptothrix*) ; or its caliber may be narrowed, either from swelling of its mucous membrane, as in chronic blepharitis, or from cicatricial contraction, the result of a former inflammation. The most common position of stricture is just at its entrance into the sac.

The *sac* is subject to a chronic form of blenorrhea and to acute inflammation. The former condition is generally either the result of extension of inflammation from the conjunctiva or from the Schneiderian membrane, or it begins as simple distention of the sac, due to stricture of the nasal duct below. The increased secretion of mucus from its thickened walls soon bulges the sac, and a swelling appears at the inner canthus which can generally be dispersed by pressure (*mucocèle*). The contents can thus usually be forced backward through the canaliculi, and are either clear, or turbid from admixture of pus.

Acute dacryocystitis, or lachrymal abscess, is generally the result of suppuration of a mucocèle. There is brawny swelling and redness of the adjacent part of the face, often extending to the bridge of the

nose and half across the cheek ; but its most prominent part corresponds to the position of the sac, where the shining red skin seems ready to burst. There is much pain, and considerable general disturbance. If left to itself the pus finds its way though the skin over the sac, but often burrows for a considerable distance before doing so, thus leaving a large ragged sore ; the cicatrix left is always a source of deformity, and often a troublesome *fistula* follows in addition.

Stricture of the nasal duct may affect any part of it, but most commonly occurs just below the sac. It may be caused by a uniform circumscribed, or by a valvular swelling of the mucous membrane, by fibrous contraction of the submucous tissue, or by bony outgrowths. The ætiology of the affection is obscure, but some cases can be traced to a syphilitic or strumous periostitis, or necrosis, and others to an extension of inflammation from the nasal mucous membrane.

Treatment.—Foreign bodies in the puncta or canaliculi must be removed, the latter being slit up if necessary. A narrowed punctum may be dilated by a fine conical sound, or enlarged by incision. In epiphora from ectropion the canaliculus should be slit along its entire length, and the same treatment must be followed in stricture of the canaliculus. In all cases of mucocele and stricture of the nasal duct the upper or lower canaliculus is to be divided with a Weber's knife, and probe passed. The probing should be repeated in a few days, and the interval gradually increased to a week or month as the case improves. The probe used should be fairly large if it will pass without force, a convenient size being No. 5 or 6, of the bulbous-ended kind known as Couper's. Washing out the sac and duct with boracic-acid lotion is also useful, and a weak astringent should be ordered for the conjunctiva. In cases of lacrymal abscess, when still possible, the canaliculus should be slit and the knife passed down the duct so as to divide the anterior wall of the sac. Warm lead lotion is a good application afterward. If the case be far advanced and pus already pointing, an incision should be made into the sac with a Beer's knife, and warm applications used ; when the swelling has somewhat subsided the canaliculus is to be slit and the duct probed.

Granular ophthalmia or trachoma.—

Symptoms.—The form of this disease most commonly met with is a *chronic* one, characterized by thickening and vascularity of the conjunctiva, and by the presence of round, semi-translucent, pale prominences on the inner surface of the lids. From their resemblances to small grains of boiled sago these prominences are called "the sago grain granulations." At first they occur principally on the lower retro-tarsal fold of conjunctiva, spreading gradually to the same position above, and finally affecting the entire lid surface. The ocular conjunctiva often participates in the vascularity and small granulations may even occur in it. Vascularity and cloudiness of the upper part of the cornea (*pannus*), follow the vessels here lying immediately beneath the epithelium ; this condition sometimes extends over the entire cornea. Ulcers are also apt to form on the cornea, especially when there are inverted lashes. There is no tendency to spontaneous cure, and a long continuance of the chronic changes generally leads to entropion, trichiasis, and often corneal mischief as just mentioned.

Apart from direct infection by the secretion from another such case, the chief *causes* seem to be prolonged exposure to a damp atmosphere and bad ventilation ; children being most apt to suffer. Certain races, *e. g.*, the Irish and Jews, seem specially liable to it.

Pathology.—The granulations consist principally of lymph cells superficially, with more and more connective tissue toward the base. As the cells are gradually transformed into connective tissue, so we get finally a cicatrix at the seat of the granulation. The submucous tissue and tarsus are likewise at first infiltrated with cells lymphs, so that here, too, we ultimately get connective tissue contractions the "cartilage" also undergoing fatty degeneration. Pannus is mainly due to the irritation produced by the granulations of the upper lid constantly rubbing against the corneal surface on every lid movement, but possibly the general conjunctival infiltration with lymph cells extends hither, and, on becoming organized, forms new vascular tissue.

In the *acute* form the local appearances are those of a severe conjunctivitis, with development of the characteristic granulations, but often without much pur-

ulent discharge. Such an attack may lead to the chronic form of trachoma, but sometimes it is self-curative from the very violence of the inflammation destroying the granulations. Cases of chronic trachoma are liable to severe acute ophthalmia from comparatively slight exciting causes, and the discharge from all such cases is highly infective, often communicating the same form of disease.

Treatment.—In acute trachoma we should first use mild lotions (*e. g.*, boracic acid 10 gr. to the ounce of water), but, if there be much purulent discharge later, we must brush the lids with solution of nitrate of silver. Chronic granulations are best treated by touching the everted lids with the mitigated nitrate of silver stick (1 of nitrate of silver and 2 of nitrate of potash), and then washing them with water. This should be repeated twice a week, or oftener, according to the severity of the case, and a mild astringent lotion used frequently by the patient. Single granulations may be destroyed by the actual cautery. The corneal ulcers, entropion, or trichiasis, demand the treatment proper for these affections; if there be photophobia, dark glasses are useful. The ordinary partial (upper) pannus usually disappears as the condition of the lids improves. Severe total pannus is much relieved by the excision of a strip of conjunctiva and subconjunctival tissue of about two lines in breadth from immediately round the cornea (*periotomy*). Benefit is also sometimes obtained in suitable cases by inoculation with pus from a mild case of ophthalmia neonatorum. Recently an infusion of jequirity seeds has been used, the purulent ophthalmia so produced often giving good results.

Symptomatic Indications.—*Aconite* is valuable in acute form with severe inflammation or in acute aggravations of chronic form. *Aurum* when pannus is present is serviceable; there is much photophobia, hot, burning tears, and swelling of the glands. *Mercurius* is useful in chronic cases, with pannus and superficial ulceration. *Pulsatilla* in papillary trachoma without pannus, with evening aggravation, better in open air. *Sulphur* will frequently do good service when other remedies fail to act. *Thuja* is indicated by large wart-like granulations, pains worse at night. *Euphrasia*

by profuse lachrymation and thick discharge, excoriating the parts.

Diphtheritic ophthalmia is a very serious disease, happily rare in this country.

Symptoms.—At first the conjunctiva in its entire thickness is infiltrated with a firm, fibrinous exudation, rendering the lid hard and stiff, and patches of the mucous surface are smooth, firm, and of a light gray color. The existence of the exudation leads to pressure on the vessels, and the conjunctiva is found pale and almost bloodless on tearing away a piece of the superficial layer. The nutrition of the cornea is necessarily greatly interfered with, and sloughing often occurs. When this stage has lasted about a week, the infiltration breaks down, and a free purulent discharge with red prominent granulations occurs. Finally symblepharon from loss of large patches of conjunctiva and resulting cicatricial changes may follow.

Causes.—It often occurs in epidemic form, chiefly in spring and autumn, and usually attacks young children from two to six years old. It may be communicated by direct transplantation of membrane, but in predisposed individuals a purulent ophthalmia may take on this type. It is more frequently a precursor of, than secondary to, general diphtheria.

Treatment.—Protect the sound eye by a pad of wool as previously described. In the first stage avoid using strong astringents, especially nitrate of silver, and trust to mild lotions (*e. g.*, boracic acid or quinine) and atropine drops. Both ice and hot fomentations have been recommended by different surgeons. Scarifying the conjunctiva and applying a weak yellow oxide of mercury ointment have also proved useful. The patient's strength must be supported by nutritious food.

Besides the more severe and definite forms of conjunctivitis there are frequently *slight cases* due to the patient's occupation or surroundings. Thus dust of all kinds, smoke, or irritating vapors, are apt to cause a chronic form of conjunctivitis, often associated with some error of refraction. In the former cases sulphate of zinc lotion (one-half to two grains to the ounce of water) should be used and the cause removed as much as possible, glasses being ordered where required. Sometimes on everting the lids small, gritty, calcareous particles pro-

jecting from the saccules of some of the Meibomian glands are found; these should be picked out with the point of a broad needle. Old people often have a troublesome conjunctivitis in the lower lids, commonly associated with slight ectropion; much relief is obtained from lightly touching the inflamed surface once daily with sulphate of copper. Instillation of atropine sometimes produces severe irritation of both surfaces of the lids, and in such cases if a mydriatic must be used, daturine or budoisine is generally much less irritant. Escerine also frequently produces a chronic conjunctivitis when used for some time. This unpleasant effect may often be avoided, in the case of all these applications, by dissolving the salt in a strong solution of boracic acid and adding about one per cent. of hydrochlorate of cocaine.

Subconjunctival ecchymoses may occur during straining, as in whooping cough, or spontaneously without apparent cause. They undergo gradual absorption, and are of no local importance.

Xerophthalmos is a condition of the conjunctiva where its surface is dry and lusterless. Sometimes it exists with almost complete obliteration of both upper and lower culs-de-sac, and may then be due to old diphtheritic ophthalmia or lime-burns, or possibly to a succession of attacks of pemphigus. Sometimes the patch is only epithelial, and confined to an area near the outer and inner corneal margins. This form occasionally occurs in schools or other public institutions, and is associated with night-blindness and scurvy.

Treatment.—The epithelial cases are to be treated through the general health; good diet with vegetables, fresh air, etc., being most important. The parenchymatous forms can only be treated with palliatives, a lotion containing milk, glycerine, and bicarbonate of soda relieving the symptoms somewhat.

Symblepharon, or adhesion of the palpebral and ocular conjunctiva, is usually the result of burns with lime or hot metal. When its extent is such as to obscure vision or limit ocular movement an operation may be tried for its relief. When partial and narrow, it will be sufficient to strangulate it by a tight ligature. Those of larger size are to be carefully dissected off the eye-ball, and the resulting gap filled in as well as

possible by flaps of neighboring conjunctiva, or by a piece of transplanted mucous membrane from the lip.

Pterygium is a triangular, vascular patch of thickened conjunctiva, its apex usually encroaching on the cornea from the inner or outer side. The growth is generally commenced by an adhesion of conjunctiva to a marginal corneal ulcer. If thought necessary, its apex may be detached from the cornea with a scalpel, the tumor dissected up to near its base, and then transplanted into a gap prepared for it below the cornea.

Symptomatic Indications.—Zinc or arsenicum.

Lupus sometimes occurs on the palpebral conjunctiva, and is then usually associated with lupus of the skin or mouth. The affected patch of conjunctiva is very vascular, and is covered with small, soft, dark-red nodular outgrowths. Scraping with a sharp spoon is the best treatment.

A **pinguecula** is a small yellowish thickening of conjunctiva near the outer or inner edge of the cornea, common in old people; it contains no fat as the name would imply. It is of no importance, but may be snipped off if desired.

The other **tumors** of the conjunctiva (dermoid, cystic, malignant, fatty) are comparatively rare.

Phlyctenular Affections of the Eye.—These affections are much more frequently met with in young people between the ages of three and twelve years, and usually in association with the strumous constitution. The attacks tend to recur during early life, such repetition being easily induced by any slight irritation of the eye.

Varieties and symptoms.—Either the ocular conjunctiva or cornea may be the seat of the phlyctenule. When situated on the conjunctiva quite away from the cornea, it appears at first as a papule or pustule about two mm. in diameter, surrounded by a localized patch of injection; this soon breaks down, and we have a flat, whitish ulcer. There may be one or several such pustules, but they seldom cause much photophobia, pain, or lachrymation, and are generally soon amenable to treatment. Sometimes, however, especially when near the corneal margin, the ulcer formed may run on to the cornea, and travel toward, or even across, its center. In such cases the ulcer advances slowly in the form of a small infiltrated crescent with its con-

vexity forward, and with a vascular leash running to its concavity over its recent track from the original starting point. There is generally much blepharospasm during the attack. Very rarely a marginal pustule, instead of spreading superficially, leads to a perforating ulcer at the corneal edge. Phlyctenules at, or just within, the margin are usually small in size and multiple. Sometimes the entire corneal border all round is slightly swollen and vascular with minute phlyctenular elevations like fine sand-grains; the conjunctiva generally is usually injected in this form. More commonly, at one or more points of the corneal margin, we find a vascular elevation, with grayish summit, about the size of a turnip seed. In all such cases there is generally considerable photophobia, and there are often short relapses during treatment, but ultimately they as a rule do well. Occasionally, however, such phlyctenules cause troublesome ulceration, but not so commonly as those which are located quite within the corneal edge, and appear first as prominent grayish opacities about the size of a small pin's head. In these latter the blepharospasm, pain, and lachrymation are usually severe.

Treatment.—In the case of conjunctival pustules, and in other forms without photophobia or deep corneal ulceration, the dilute yellow oxide of mercury ointment (8 grains to the ounce of vaseline) is the most suitable local remedy. A small piece of this salve should be laid within the lower lid once or twice daily, the upper lid then gently rubbed over the eyeball for a few minutes (with the finger placed on its skin surface), and the eye bathed with lukewarm water half an hour later, if irritation continues. Finely-powdered calomel, dusted into the eye once daily, may be substituted for the ointment. Where there is photophobia the patient should wear a large shade or goggles over both eyes, and atropine ointment (2 grains to the ounce of vaseline), or a mixture of equal parts of this and the dilute yellow oxide of mercury ointment, according to the severity of the symptoms, should be applied twice daily. In the vascular traveling ulcer the same local treatment is good, combined with a seton in the temple. Division of the leash of vessels at the corneal edge is also recommended. For small, multiple, marginal phlyctenules

with conjunctivitis, cold or lukewarm boracic acid lotion should be used four times daily, and the atropine ointment put into the eye after each bathing. The measures useful in persistent blepharospasm have been already described under that heading. Constitutional treatment must not be neglected. Good plain food (especially warm milk), with syrup of the iodide of iron, and cod-liver-oil, are indicated, and the patient should get plenty of open-air exercise, with the eyes efficiently protected. As a rule such cases do not do well at the seaside as long as there is much photophobia.

Symptomatic Indications.—*Graphites* is useful in both acute and chronic form, when the canthi are cracked and bleed easily when opening the eyes; great dread of light. *Calcium sulphide*, when ulcers form on cornea; photophobia, lachrymation, throbbing pain, better from external warmth. *Mercurius*, for ulcerations with chalk-white appearance of the cornea; lids swollen and spasmodically closed, excoriating lachrymation, syphilitic subjects. *Apis* for eyelids puffed, conjunctiva chemosed, cornea grayish, smoky, or opaque, pains burning and stinging. *Silicea*, for suppurating and perforating ulcers on cornea, neuralgic pains, phlyctenules on border of cornea and sclerotica, frequently recurring. See CORNEITIS.

Tumors of the cornea are very rare as primary growths, and it is generally only affected in its superficial layers. Dermoid tumor, epithelioma, and sarcoma are the most frequent in occurrence.

Injuries.—*Foreign bodies* on or in the cornea are to be removed with a spud or bent needle; after this operation, and in cases of simple *abrasion*, the eye should be bandaged until the epithelium is restored. Cocaine is very serviceable where foreign bodies have to be picked out, the only disadvantage from its use in such cases being that it renders the cornea abnormally flaccid. Ordinary cleanly cut corneal wounds usually heal quickly. Where *prolapse of iris* has occurred, and the case is quite recent, we may try the effect of eserine, or atropine with cocaine, according to its position (the mydriatic where central, eserine where peripheral), so as to induce its retraction within the chamber; *never* use a spatula to push back the prolapsed iris. If the prolapse be of more than a few hours' standing it is

best to seize it with iris forceps, pull it free, if possible, from the edges of the wound, and snip it off internal to the constricted portion. If it has existed too long to be free in this manner, cut it off level with the cornea, or enlarge the original wound and remove a larger piece of iris, including its sphincter edge. In *burns* from lime, hot metals, etc., the prognosis should be guarded, as the cornea may remain fairly clear for some days after the injury, and yet the result prove ultimately unfavorable. In recent cases any remaining fragment of metal or other solid must be removed, and in the case of burns with acids or alkalies the conjunctival sac is to be thoroughly washed out with a mild solution of opposite reaction. Ice compresses should be applied in all cases of severe recent injury, and in corneal burns a drop of atropine and one of castor oil are to be put inside the lid, thrice daily. When keratitis results, hot fomentations, etc., must be used as recommended above.

Diseases of the Iris.—Iritis.—The subjective symptoms of acute iritis are pain, photophobia, lachrymation, and impairment of vision. The amount of pain varies much in different cases and at different times; it is usually worst at night and during an early stage of the attack, and is most apt to be severe in the arthritic and the traumatic varieties. The first symptom of iritis is often an itching sensation down the side of the nose, and the pain is referred not only to the eye, but also frequently to the supra-orbital, temporal, and other branches of the fifth nerve. The photophobia and lachrymation are seldom so severe as in corneal affections, and are worst at an early stage of an acute attack. The impairment of vision is generally due to the opacity of the media (cornea, aqueous, pupillary area of anterior capsule, or rarely vitreous); sometimes also to hyperæmia of the optic disk and retina. The local symptoms are circumcorneal congestion, discoloration of iris and loss of its luster, narrowness of pupil, slowness of pupillary reaction, and posterior synechiæ. The circumcorneal congestion occurs as a lilac-colored zone, about two to four mm. wide; sometimes the anterior and posterior conjunctival vessels are also congested. **Discoloration.**—A blue or gray iris becomes greenish, and a brown becomes dark reddish-brown; occasionally the

change of color is only partial. The discoloration, loss of luster, narrow pupil, and sluggish action to light and mydriatics are all due to congestion, with effusion of lymph and serum into its substance. A large amount of solid exudation into the iris often occurs in syphilitic iritis, sometimes appearing as distinct yellow or rust-colored nodules on its anterior surface. Sometimes we get opacities in the aqueous humor from pus or blood corpuscles; their presence in suspension assist in producing an apparent discoloration of iris. When they form a deposit in the anterior chamber we get hypopyon or hyphæma. A large hypopyon is usually found in cases of iritis secondary to keratitis or purulent choroiditis. Hyphæma is commonly the result of wound of the iris, but sometimes occurs from a blow, or during whooping cough. Occasionally we get a round gray gelatinous mass in the anterior chamber from coagulation of the exudation, looking somewhat like a dislocated lens. Posterior synechiæ are the results of an exudation of lymph on the posterior surface of the iris, gumming it to the anterior lens capsule; they usually occur at the pupillary edge. They become readily visible on using atropine, the pupil dilating between the synechiæ, which now appear as pointed projections from the edge of the iris. If no apparent change in the pupil take place on using atropine, the pupillary edge is adherent all round (excluded pupil), or the entire posterior surface of the iris is adherent (total posterior synechia). When much lymph is exuded it may cover the entire pupil, forming, when organized, a more or less dense whitish membrane (occluded pupil). In non-plastic inflammation no posterior synechiæ are formed. Not infrequently we get a punctate precipitate on Descemet's membrane, a secondary keratitis punctata.

Causes and varieties.—Iritis may arise from local injury or from constitutional disease; it may also be secondary to other inflammation in the same eye, or sympathetic from wound of the opposite eye.

Traumatic iritis is not only caused by injuries of the iris itself, but may follow any penetrating wound of the eyeball, particularly in old people and where the lens has been wounded. Slighter forms of it often follow cataract extraction; sometimes, after this operation, the iritis is

severe, and may be suppurative where there is purulent infiltration of the corneal wound. Occasionally superficial corneal wounds and direct blows on the eye are followed by iritis.

The *constitutional* causes of iritis are syphilis, rheumatism, gout, and possibly struma. *Syphilitic iritis* is acute, and usually symmetrical; it occurs in the secondary stage of the disease, either acquired or congenital. There is often much effusion of lymph, and occasionally vascular nodules of it project from the surface of the iris near the pupillary edge; when large, these may suppurate and cause hypopyon. *Rheumatic iritis* is recurrent, and both eyes usually suffer, but seldom both at once. The interval between the relapses may be many months. There is rarely much lymph effused, but the congestion and pain are often very severe. It sometimes accompanies gonorrheal rheumatism. *Gouty iritis* resembles the rheumatic in its being recurrent, and in its affecting one eye at a time. It is sometimes very chronic and insidious, leading slowly to much contraction of pupil and impairment of vision, without severe pain. *Struma* is said to be the cause of some cases of slight iritis, with keratitis punctata, occurring in young adults. *Secondary iritis* may result from continuity of structure in inflammations of the cornea (particularly when complicated with hypopyon), ciliary region, or choroid. *Sympathetic iritis* and its peculiar symptoms will be considered later.

Results of iritis.—The adhesions are often persistent, but if due to freshly effused lymph they will nearly always, sooner or later, yield to atropine, often, however, leaving permanent dark spots of uveal pigment on the anterior surface of the lens capsule. When complete exclusion of the pupil occurs the body of the iris becomes bulged forward by the aqueous fluid between it and the lens capsule, so that the anterior chamber is shallow, except just over the pupil; in such a condition we are liable to get secondary glaucoma. In old-standing cases of chronic iritis with numerous posterior synechiæ, secondary cataractous changes often occur in the lens. When the pupil is occluded vision is always much interfered with, particularly, of course, if the membrane be dense, and in such cases also secondary glaucoma may follow.

Treatment.—Perfect rest of the eyes

and the use of a shade or dark goggles must be insisted on till the attack has quite passed off. Locally, atropine drops (4 grs. to the ounce), one to be instilled from four to eight times daily, according to the severity of the attack; they are useful in often breaking down synechiæ already formed, and in preventing the formation of new adhesions, and they also diminish congestion and relieve pain. If the latter be very severe, two or three leeches should be applied to the temple, and the eye bathed frequently with hot belladonna lotion. A dry pad of cotton wool is to be worn over the eye and removed only when necessary for local applications. In syphilitic cases mercury in some form should be given to slight salivation, and continued cautiously till acute symptoms disappear. Salicylate of soda is worthy of trial in arthritic cases. The diet must be carefully regulated. In severe recurrent iritis that does not yield to ordinary treatment, an iridectomy is sometimes followed by excellent results. In cases of recent injury where iritis is dreaded, ice compress continuously applied over the closed lids for twenty-four hours is valuable as a prophylactic measure. On the very first onset of the symptoms of iritis two or three leeches to the temple will often cut short the attack.

Symptomatic Indications.—*Aconite* is valuable in the rheumatic form when induced by exposure to cold, *arnica* when the disease is the result of traumatism. *Belladonna* is useful when severe pains come and go suddenly, with flashes of light, or the eye feels as if torn out. *Aurum* is indicated in syphilitic iritis, with pain in orbital bones, and great mental depression. *Mercurius* is one of the most frequently required remedies, with tearing, boring pains around the eyes, scleritis and conjunctivitis, profuse flow of saliva. *Pulsatilla* is frequently useful in rheumatic form, with depression and chilliness. *Arsenicum* is useful for burning pain, worst at night; severe cases.

Iridodonesis, or tremulous iris, is generally due to loss of its posterior support from luxation or absence of the lens, or from fluidity of the vitreous. Sometimes the iris quivers slightly in a healthy eye, especially in myopia.

Injuries of the iris.—(1) *Foreign bodies* which have penetrated the cornea and become fixed in the iris must be removed,

along with the portion of iris implicated, by iridectomy.

(2) **Iridodialysis** (coredialysis), or separation of the iris from its ciliary attachment, sometimes results from a blow on the eye, and is usually accompanied by hyphæma. When recent, the treatment should consist in ice compresses for twenty-four hours, followed by warm fomentations, so as to favor removal of the blood clot.

Tumors of the iris may be solid or cystic. The solid tumors are tubercular, syphilitic, or sarcomatous. Where there is reason to suspect them to be tubercular or sarcomatous the affected piece of iris and the growth should be removed; if this cannot be done effectually, the globe should be excised. In syphilitic cases specific treatment must be adopted. *Cysts* are generally the result of injury, and should be removed, as they are liable to lead to secondary glaucoma.

Congenital anomalies.—Coloboma usually occurs below, or down, and appears as a gap in the iris like that left by an iridectomy. It is due to imperfect closure of the fetal choroidal cleft. Irideræmia (absence of iris) is a rare condition, often associated with microphthalmos or other congenital ocular defect. Persistent pupillary membrane is usually only represented by traces, which appear as thin bands of iris tissue attached to the interior surface of the iris, but not to the lens capsule.

Diseases of the sclerotic and ciliary region.—**Episcleritis** appears as a swollen, congested, discolored patch of considerable size in the ciliary region, the unaffected part of the globe usually remaining of normal color. It is really a circumscribed inflammation of the sclerotic with effusion into the subconjunctival tissue over it, and congestion both of the deeper and of the conjunctival vessels. The color is usually rusty or purplish-red.

As a rule, the subjective symptoms are slight, but sometimes the pain is severe, and there is generally much tenderness on pressure over the affected part. It is most apt to begin in the outer ciliary region, but relapses are usual, fresh spots being attacked until often the entire ciliary area has suffered. It rarely occurs in both eyes at once, but the second eye is often attacked later.

Its course is slow, the swelling reach-

ing its height in two to three weeks, and then undergoing slow absorption; the middle of the formerly inflamed patch generally remains dusky. It is much more common in adults.

Causes.—One form, rather more sharply limited than the usual one, is due to tertiary syphilis. In other cases rheumatism and anæmia seem to be predisposing causes; menstrual disturbances are frequently associated with it in women.

Treatment.—Rest, warm bathing, dilute yellow oxide of mercury ointment with atropine (with *massage*), and blisters to the temple are most serviceable. The medicinal treatment must be regulated by the history and condition of each individual case.

Symptomatic Indications.—*Aconite*, in the acute stage with violent tearing, aching pain in the eyeballs, heat and dryness in eye, especially after exposure to dry cold air. *Mercurius*, when the sclera is thinned and blue, aching in the eye, worse at night; syphilitic origin. *Silicea*, severe pains extending from the eyes to the head, relieved by wrapping up the head. *Thuja* is useful in all forms, especially when with general cachexia, syphilitic or scrofulous.

Sclero-kerato-iritis (relapsing cyclitis, anterior sclero-choroiditis). A disease in which a somewhat similar scleral swelling to that just described occurs, but associated with peripheral corneal opacity and iritis. The swelling is slight, diffuse, and of a deep violet color, occurring in one or more large patches, coming quite up to the corneal border.

The subjective *symptoms* are usually severe. It is extremely tedious, and relapses are frequent, causing more and more corneal haze, and thinning, staining, and bulging of the ciliary region. It is most common in women about middle life, and is often associated with a family history of struma, or, according to some, of arthritic disease.

The *treatment* is much the same as in the last affection, atropine being especially indicated here, and the use of dark glasses. Mercury with cod-liver oil and iron are useful. It is extremely intractable, and, when practicable, change to a warm, dry climate is advisable.

Cyclitis is as rare a primary affection, and would be recognized by deep circumcorneal injection, with tenderness

on pressure in this region, and by opacities in the anterior part of the vitreous without visible iritis. The tension is often much reduced, but later on the eye may become glaucomatous from ultimate implication of the iris and posterior synechiæ. A chronic relapsing form of the affection, associated with irido-choroiditis and keratitis punctata, is occasionally met with in young people, and often with a history of inherited gout. In the less severe cases a good result is generally obtained, the best treatment being rest, dark glasses, and atropine; and internally iron and quinine, with a mild mercurial course.

In **traumatic cyclitis** marked pain is an early symptom, along with the other signs mentioned above. The rest of the uveal tract (iris and choroid) are soon affected, and this form of inflammation is often a forerunner of sympathetic inflammation of the other eye. Sometimes the inflammation becomes purulent in type (panophthalmitis, and in such cases the liability to sympathetic disease seems decidedly less than in the plastic form, though the excision generally practiced in panophthalmitis may possibly account for this difference.

Wounds of the sclerotic.—There is generally simultaneous wound of some part of the uveal tract, and often of the retina, with loss of vitreous. Often we find hemorrhage into the anterior chamber, or vitreous, or both. If the wound be quite behind the ciliary region, *i.e.*, quite a quarter of an inch from the corneal margin, and recent, we should apply an ice compress, and trust to its healing. If it gape much, one or two fine stitches may be inserted, but care should be taken not to embrace the deeper layers of sclera in our suture, as then the choroid will almost certainly be included, and an irritable eye with uveitis may be left. When a foreign body is embedded in the anterior, but post-ciliary, part of the sclerotic, it must be removed, the wound being enlarged for this purpose if necessary. Where the ciliary region is deeply wounded stitches should never be used, and it is really safer in all such cases to excise the eyeball at once. If the lens have escaped injury, however, and the case be quite recent, ice compress may be applied and the eye watched, and excision deferred till there be evident signs of cyclitis or marked sympathetic irritation.

Rupture of the sclerotic is not an uncommon result of a direct blow on the eye, usually occurring a little outside, and concentric with, the corneal margin. The rent is generally large and involves all the tunics; we then may get escape of the lens and part of the vitreous; there is blood in both aqueous and vitreous chambers, the eye is soft, and vision is greatly reduced. The conjunctiva is the tunic most likely to remain unruptured, and then the lens may pass through the scleral rent and remain under the conjunctiva as a round, translucent tumor. In very severe cases of rupture, immediate excision is best. In less severe cases, and especially when the conjunctiva has escaped untorn, we should apply ice compress and wait till the absorption of blood enables us to judge of the probable future usefulness of the eye. If it be decided to retain it, a subconjunctival dislocation of lens should be left until the scleral rent has healed, when it can easily be removed.

Primary tumors of the sclerotic are exceedingly rare; sarcoma and fibroma have been observed. It is often secondarily affected in the case of morbid growths of the choroid or retina.

Sympathetic affections of the eye.—The condition most liable to excite sympathetic disease is plastic inflammation of the uveal tract (iris, ciliary region choroid), usually the result of a wound involving the ciliary region. The eye injured or first inflamed is called the “exciting,” the other the “sympathizing” eye.

Sympathetic irritation.—The common symptoms are lachrymation, photophobia, and occasionally dimness of vision in the sympathizing eye. It flushes on exposure to a bright light, especially if the exciting eye be also exposed or otherwise irritated. Sometimes pain is felt in the forehead or shooting across the root of the nose. The occasional dimness is usually mainly due to a relaxation of the ciliary muscle rendering accommodation impossible, or sometimes possibly to a condition of spasm rendering distant objects indistinct. In such cases the pupil will be found to react well to light, but to be in a constant state of oscillation. Sometimes there seems to be a true temporary blindness, the nature of which is doubtful.

Treatment.—If the exciting eye be lost or manifestly a dangerous one, it must be excised without delay. If, however, it be

uninflamed, its vision good, and the wound not such as is likely to lead to sympathetic inflammation, the patient should be kept at rest, dark goggles worn, and the condition watched for a few days. If the irritation persist, or increase, it is advisable to excise, but even after excision the symptoms may not cease for a considerable time.

Sympathetic inflammation usually sets in a month or two after the injury, but it may appear as early as two weeks, or may be delayed for many years. It always attacks both eyes, but not necessarily with like severity. One of the earliest and most constant signs is the occurrence of keratitis punctata. In severe cases the iritic adhesions are rapidly formed, extensive and firm, and the iris itself is much thickened, with numerous large blood vessels visible on its dulled surface. Eventually we get occluded pupil, increased tension, and secondary cataract. In the worst cases ciliary staphylomata form, and the globe finally shrinks. In the milder cases no synechiæ are formed, or they give way readily to atropine.

Treatment is frequently of little avail after sympathetic ophthalmitis has begun. The exciting eye, if quite blind or practically useless, must be excised at once. If there be any hope of useful vision in it, however, it should be retained, as its removal will now do little or no good to the other, and it may eventually be the better eye of the two. The sympathizing eye, and the exciting eye, if retained, must be covered with a black bandage and treated with atropine, leeching, or blistering to the temple, and perfect rest in a dark room. In moderately severe cases, when the eye has become perfectly quiet (always at least a year after the beginning of the inflammation), an operation may restore some vision. Our great aim, however, must be to *prevent* this form of inflammation by early excision of lost dangerous eyes, whether blind from injury, or from past inflammation in which the iris or ciliary region has participated. We have already mentioned cases of injury where excision is advisable.

Symptomatic Indications.—See OPTHALMIA.

Diseases of the Optic Nerve.—Developmentally and structurally the optic nerve is unlike ordinary cerebro-spinal nerves, and is to be regarded as a direct prolongation of the brain. It is pecu-

liarily liable to suffer in affections of the central nervous system, in certain general diseases, and in some forms of chronic poisoning.

Inflammation of the optic nerve.—*Pathology.*—The intra-ocular end of the nerve ("papilla") is the part most commonly inflamed, and to this condition the term "papillitis" is applied. When the inflammation first attacks the nerve trunk behind the eyeball, it is known as a "post-ocular neuritis." "Optic neuritis," should be retained as a general term for inflammation of any part of the nerve. Optic neuritis may be acute or chronic, may occur at any point in the course of the nerve, may affect the whole thickness or only a part of it, and may or may not lead to permanent atrophy. Where the periphery of the nerve is mainly involved, the condition is known as "perineuritis;" where the inflammation attacks the central part of the nerve as "axial neuritis." Usually both nerves are affected, though not necessarily to the same degree nor consentaneously; unilateral optic neuritis is generally dependent on a local cause, such as orbital cellulitis. In the early stage of the papillitis, the connective tissue is unaffected; and if the inflammation proceed no further, we can finally get a healthy disk and retention of normal vision. Usually, however, ultimately there are interstitial changes.

Symptoms.—There is usually no ocular pain, and there may not even be loss of sight for some time. In exceptional cases, indeed, papillitis may run its course and disappear again without there being any impairment of vision, but usually sight fails gradually. The manner of the failure varies according to the kind of the neuritis. In ordinary papillitis a progressive loss of central vision occurs along with a peripheral diminution of the visual field. In some cases of post-ocular neuritis; in the axial form, for example, the central vision alone is first impaired, the peripheral field remaining perfect; in such cases the loss of color vision is characteristic, the power of distinguishing red and green, in a small central area, being often lost at the very commencement of the affection.

Ophthalmoscopic appearances.—We must exercise much caution in diagnosing positively the slighter departures from the normal vascularity of the papilla, and invariably examine both eyes. In simple

passive congestion of the papilla, it is redder than normal, and the veins are somewhat dilated, but there is no swelling, and though its margin is wanting in definition, it is not actually obscured. Between such a condition and a fully-developed papillitis or "choked disk," there are many gradations; which may simply be stages in the development of a high degree of papillitis, or any one of them may be the final condition, where the inflammation is of less severity. In advanced papillitis the changes are unmistakable; swelling of the papilla, with obstruction of its margin, loss of translucency, increased vascularity, and obliteration of the physiological cupping. Numerous straight vessels radiate from it on every side, coursing over its obscured edge, and small hemorrhages often occur on or near it. The veins are distended, dark and tortuous, and the arteries usually narrowed; both sets of vessels, but especially the arteries, are often hidden on or near the disk. Smooth, opaque, whitish spots occur on the papilla or on the surface of the adjacent retina, concealing completely what they cover, and there are often large areas of cloudiness in the retina. As the papillitis subsides, the redness and swelling diminish, and the disk margin again comes into view. The disk is first opaque and "woolly" looking, but gradually becomes smoother and is ultimately (stage of atrophy) of a white color, with concealment of the lamina cribrosa; around it there is often a pale zone from changes in the retinal pigment; the vessels are all narrowed, and are often bordered by opaque white lines.

Causes.—(a) A large majority of cases of papillitis are due to intracranial disease; *e. g.*, tumors, meningitis, cerebral abscess, internal hydrocephalus, aneurism of internal carotid. Injuries to the head may cause optic neuritis either through meningitis, effusion of blood (within the skull or within the nerve sheath), hernia cerebri, or, possibly, through a laceration of the brain.

(b) Optic neuritis (usually one-sided) occurs in many orbital affections; *e. g.*, tumors, cellulitis, periostitis, etc. In the case of orbital tumor there is generally protrusion of the eyeball.

(c) Papillitis has been observed in association with acute myelitis, and in cases of injury to, and caries of, the cervical spine.

(d) In general diseases, *e. g.*, progressive pernicious anæmia and Bright's disease, but cases of the latter have a characteristic retinitis in addition. Acquired syphilis may cause optic neuritis either through meningitis or from a gummatous growth, which may be within the skull, or at the optic foramen, or on the nerve trunk, the neuritis being generally one-sided when in either of the two last situations. Diabetes mellitus causes an axial neuritis, and probably the same limited inflammation is caused by chronic poisoning by lead, alcohol, tobacco, and bisulphide of carbon.

(e) Sometimes optic neuritis is simply an extension of inflammation from neighboring ocular tissue.

The *Prognosis* must always be guarded as to the final condition of the vision, and depends more on the cause than on the intensity of the papillitis. It is relatively more favorable where the cause is removable or amenable to remedies. A papillitis with good vision, may lead ultimately to complete atrophy and blindness, while a papillitis with the barest perception of light may be followed by almost perfect recovery.

Treatment.—Where not contra-indicated, *mercury* and *iodide of potassium* should be employed, the latter in full doses. Perfect rest must be insisted upon, and the cause treated by appropriate remedies when possible, or removed altogether in the case of exposure to poisons. Locally, dry or wet cupping, or blisters to the temple, may be tried, and ice to the forehead has been recommended in an early stage.

Atrophy of the optic nerve.—*Pathology.*—In all cases of atrophy the nerve is ultimately affected in its entire length. In all true cases the nervous elements are involved, and there is a corresponding loss of function. In the post-neuritic atrophic process the nerve fibers finally either break down and are removed, or undergo gray degeneration; in the former case the diameter of the nerve is much reduced from contraction of the hypertrophied fibrous tissue. In simple atrophy there is seldom much increase of connective tissue, but the nerve fibers lose their medullary sheath by a process of granular fatty degeneration, while the axis cylinders are usually retained, but converted into fine indistinct fibrils; there is consequently little change in the

size of the nerve. This "gray degeneration," may be diffuse, affecting the whole nerve uniformly, or insular and varying much in extent in different sections. In most cases of atrophy both nerves are affected, though one may be considerably in advance of the other.

Causes.—All cases may be divided into inflammatory and non-inflammatory or simple. (1) Those due to inflammation are traceable either to a papillitis, a post-ocular neuritis, or an inflammation of the choroid or retina. (2) Simple atrophy may be primary or secondary. In the primary form visible atrophic changes occur consentaneously with gradual failure of vision, often in association with disease of the central nervous system (locomotor ataxy, etc.). The more immediate cause of this form seems to be severe bodily fatigue, anxiety, exhausting brain work, sexual excess, etc. In the secondary form of atrophy the loss of vision precedes the visible atrophic changes. This occurs in all cases where interrupted conductivity in one part of the nerve leads to subsequent atrophy in the remainder, as where the nerve has been cut across, or torn through, or pressed upon (by tumors, foreign bodies, etc.), or has its blood supply interrupted (as from embolism). Syphilis may induce either a post-inflammatory atrophy or a secondary one (as from pressure of a gumma), and a specific history is also common in cases of simple gray degeneration.

Symptoms.—The failure of vision in post-neuritic cases has been already described. In atrophy from choroiditis and retinitis the failure is usually gradual, central visions often remaining fairly acute while the rest of the field has become amblyopic. In the secondary form of simple atrophy vision often fails suddenly. In primary atrophy the loss of vision is slow and continuous, there being both central failure and contraction of field. Affection of the color sense is almost constant, green being generally first confused, while later perception fails for red, blue, and lastly yellow. The pupils are generally wide in post-papillitic atrophy, small in spinal cases, and often of medium size in other forms.

Ophthalmoscopic appearances.—The color of the atrophied disk is white, gray, or of a bluish or greenish tint. The disk is often excavated quite up to the

margin all around, but never deeply, and the slope is gradual. The lamina cribrosa may or may not be visible. The edge of the disk is usually well defined. The central blood vessels are in some cases much diminished in size, in others only slightly if at all. In the post-papillitic form the disk margin is often irregular-looking from loss of pigment due to choroido-retinal changes; the central vessels are reduced in size, and frequently bordered by opaque white lines; the excavation is absent or slight, and the lamina cribrosa is invisible. In atrophy from choroido-retinal disease the disk has usually a peculiar opaque, yellowish-red, "waxy" look, and the retinal vessels are greatly diminished in size, and sometimes in number. In the partial atrophy from axial neuritis the pallor is confined to the temporal half of the disk.

Prognosis is always unfavorable, but relatively less so where the cause is removable or may pass away spontaneously. In some of the post-papillitic cases considerable improvement takes place if the sclerosing process does not lead to much pressure on such nerve fibers as have escaped destruction by the inflammation. In marked contraction of the visual field, and in cases of long-standing amblyopia, little or no improvement is to be expected. In cases of primary atrophy, almost complete blindness generally occurs in from one to three years.

Treatment.—Where the atrophy is dependent on some general condition or toxic influence, the treatment must be regulated accordingly. Nervine tonics, such as strychnia, are occasionally useful. Where the atrophic process has not gone too far, the continuous current is sometimes beneficial. One pole should be applied over the closed eyelids and the other over the supra-orbital nerve, the current being broken frequently and the poles transposed. The smallest number of cells which will give the physiological light-flash, on making and breaking the circuit, should be employed; the whole sitting should last about five minutes, and be repeated daily for at least a month. If no improvement take place during this time, either in central acuity or in visual field, galvanism may be abandoned as useless. If any marked benefit result, the current should continue to be employed at longer and longer intervals, as the condition may

indicate. The patient is quite capable of carrying out the treatment for himself after having once been properly instructed.

Injuries.—The optic nerve may be injured by a blow, stab, gunshot wound or fracture of the sphenoid bone. A severe blow on the side of the eyeball may cause rupture of the nerve at its entrance into the globe. A stab or thrust into the orbit may cut or tear the nerve, or cause an extravasation of blood within its sheath, or may sever the central vessels outside its trunk. A foreign body, penetrating deeply, may produce fracture of the orbital walls, or of the clinoid process of the sphenoid bone, thus leading to injury of the nerve. Gunshot wounds may implicate either the orbital or intracranial part of the nerve, and pellets or metallic fragments may penetrate the globe and become embedded in the papilla. Fracture of the base of the skull sometimes causes injury to the nerve at the optic foramen, or behind it if the clinoid process be displaced. Any severe injury to the nerve usually occasions sudden complete blindness of the corresponding eye. If the solution of continuity be incomplete, or if the nerve be simply bruised, there may be partial or complete restoration of vision, but secondary changes often occur leading to ultimate atrophy.

The ophthalmoscopic appearances differ according to the nature of the injury. If the central artery be divided the changes are like those met with in embolism of this vessel. In other cases the disk remains normal in aspect until the atrophic process reaches it, when it gradually assumes the appearance of an ordinary secondary atrophy with normal vessels.

The *treatment* of the recent injury must be based on general surgical principles. Later on, if the continuity of the nerve has been preserved, galvanism may be of some service.

Tumors.—The intra-ocular end of the nerve may be affected secondarily in sarcoma of the choroid or in retinal glioma. The most common form of tumor proper to the nerve trunk is the myxo-sarcoma. It leads to proptosis, papillitis, or simple atrophy, and early blindness; the ocular movements are usually good, and there is little or no pain. The intracranial part of the nerves and the chiasma are especially liable to gummata, and the chiasma may also be the seat of a deposit of cheesy tubercle.

Symptomatic Indications.—*Ammoniacum* is frequently useful when blindness follows upon severe blows upon the head, or the sight is impaired, with smoke before the eyes, shaping in circles, the margins of the circles are gray, becoming black upon motion of the eyes, better in clear, worse in cloudy weather. *Belladonna*, when optic disk is swollen, and outlines are illy defined, the retinal vessels large and tortuous, and a blue and bluish-gray film seems to cover the fundus. Also in hemorrhage of retina, congestion to head, pulsating of carotids. *Cinchona* for sudden blindness with violent pain in occiput, extending into the eyes. *Gelsemium*, when with thirst for light, congestion in head, after diphtheria, or from albuminuria of pregnancy. *Mercurius* is valuable in albuminuric form, especially during pregnancy. *Nuxvomica* when the disease is the result of overindulgence in stimulants and tobacco. *Phosphorus*, when the result of sexual excess. *Pulsatilla*, for "choked disk" much swelling of optic papillæ and enlargement of vessels; vision nearly lost, with headache, relief in open air; menstrual difficulties. *Aconite*, for total blindness produced suddenly by taking cold. *Apis*, when from albuminuria, after scarlet fever. *Arsenicum*, after abuse of liquor and tobacco; urine scanty and albuminous. *Aurum mur.* after scarlet fever and during childbed (albuminuria); sudden loss of vision, with cold perspiration; small pulse.

Diseases of the Retina.—With the exception of its blood vessels and its pigment epithelium, the retina is almost perfectly transparent, and consequently practically invisible ophthalmoscopically. Its diseased conditions may therefore be recognized by a loss of its transparency, or by changes in its circulation or in its pigment layer. Its transparency may be lost over a small or large area from hemorrhages, deposits of pigment œdema, exudations or fatty changes.

Hemorrhages may occur at any part of the fundus, and may be single or multiple, small or large. When recent they present a bright red appearance, but become darker with time, and undergo slow absorption. If large, they may either burst into the vitreous or cause detachment of the retina. When in the nerve fiber layer they present a striated or "flame-shaped" appearance, and when in the

deeper layers they are round or irregular. They interfere with vision according to their size and position, those at the yellow spot causing necessarily much impairment.

Causes.—They may accompany inflammation of the retina or optic nerve, but are more frequently dependent on general conditions, or on retinal disease consequent on general conditions. They are generally due to rupture of vessels, as from increased intra-vascular pressure (*e. g.*, in cases of contusion of the eyeball, optic neuritic with much constriction of veins, violent effort, or high arterial tension), or from sudden diminution of the vitreous support (following wound of the globe), or from weakness of a degenerated vascular wall. Diapedesis may possibly occasion visible hemorrhages in cases where there is an altered condition of the blood, *e. g.*, in diabetes, severe anæmia, leucocythæmia, purpura, pyæmia, etc. They are also commonly found in association with the hemorrhagic diathesis.

Treatment.—Must be mainly determined by the general condition; local application of ice may be employed in recent cases.

Retinitis is usually the result of some general disease.

Symptoms.—The loss of vision, both temporary and permanent, varies much in different cases. Ophthalmoscopically there is loss of retinal transparency, venous dilatation, and a tendency to the occurrence of hemorrhages and white patches.

Treatment depends mainly upon the general condition. Complete rest must be ordered, and all strong light cut off by wearing dark neutral-tint glasses. Counter-irritants and leeches to the temple are sometimes advisable.

Varieties.—1. *Hemorrhagic retinitis* occurs in association with disease or disorders of the circulatory system, and usually affects one eye only. The hemorrhages are small and numerous.

(2). *Albuminuric retinitis* is most commonly associated with chronic kidney disease, especially the contracting form, but is also frequently found in the albuminaria of pregnancy. There are numerous light-colored, soft-edged patches in the retina; minute, opaque, very white dots or striæ at the yellow spot, arranged in the form of an asterisk, with its center

at the fovea; and, generally, papillitis and hemorrhages. These changes may subside if the renal affection improves, those at the macula, however, lasting for a long time. In the cases associated with pregnancy perfect vision is restored with a normal fundus.

(3). *Syphilitic retinitis* usually comes late in the secondary stage, about the end of the first year, or later. The ophthalmoscopic changes are generally slight; the larger veins distended and dark, and the disk outline blurred. Very commonly there are numerous dust-like opacities in the vitreous. The visual failure is considerable and the attack lasts for months, but the result is generally favorable. The *treatment* must be energetically anti-syphilitic, mercury being the remedy chiefly to be relied on. In leucocythæmia, and more rarely in diabetes, retinitis may also occur.

Retinitis Pigmentosa.—A disease where a certain group of symptoms and definite course are usually found in association with pigmentary changes in the retina. The disease is symmetrical and chronic, usually beginning in early life and terminating in blindness soon after middle age. Night blindness is the earliest and most characteristic symptom. There is soon loss of visual field, the central area remaining longest. Ophthalmoscope shows a yellowish-red, "waxy" atrophy of the disk, narrowed retinal vessels, and much pigment in the retina, black masses, shaped somewhat like bone-corpuscles, lying superficial to the retinal vessels. Galvanism is the only form of *treatment* of any avail; it sometimes causes improvement both in field and in central acuity.

Symptomatic Indications.—See preceding section.

Thrombosis may occur in the central artery or vein, and **embolism** in the central artery or in one of its branches. It is rarely bilateral, and is more common on the left side; the usual cause is cardiac disease. In a case of complete plugging, the leading symptom is sudden blindness of one eye. Ophthalmoscope: The disk is pale, with slightly blurred edges. There is a diffuse haze of retina, best marked in the region of the macula; corresponding to the fovea centralis is a bright red spot. The arteries near the disk are often reduced to mere white threads. The only *treatment* that has

proved sometimes beneficial is massage of the eyeball, probably best performed by alternate, prolonged, moderately firm, pressure over the globe and sudden removal of this pressure.

In **retinal detachment** the retina proper is separated from its pigment epithelium, and a serous fluid usually occupies the interval. The fluid may be effused primarily as a hemorrhage, or as a serous exudation in connection with inflammation or tumor of the choroid. The common reason of detachment, however, is some alteration in the vitreous: either a mere diminution of its support to the retina, or contraction of connective tissue formations within it, dragging the retina away from its normal position. Retinal detachment often occurs in cases of progressive myopia. On illuminating the eye, with the mirror held at twelve to eighteen inches' distance from it, some part of the fundus gives a bluish-gray or whitish reflex instead of the normal red seen elsewhere. This discolored detached portion is usually folded and tremulous, and on its surface the retinal vessels run as distinct, slender, dark, tortuous lines. In a recent shallow detachment there is no such difference in color, but its vessels have the characters just mentioned. Always note the extent, mobility, depth, and degree of folding of the detachment, so as to decide as to the probable nature of the displacing agent.

Symptoms.—There is frequently a history of sudden impairment of vision. Generally the detachment gradually extends until there is complete, or almost complete, blindness.

Treatment.—Rest in the recumbent position in a dimly lighted room, with a pressure bandage over the eye, is advisable in recent cases. Puncture of the sclerotic at the site of the displacement, so as to permit the subretinal fluid to escape, is recommended, and this certainly sometimes improves vision considerably for a time.

Glioma of the retina is a disease of early life. It commences insidiously, without inflammation, grows rapidly, and if left to itself soon leads to the death of the child, spreading both centrally and peripherally.

Diagnosis.—The attention of the parents is generally first aroused by seeing a whitish reflex from behind the pupil. By this time there are often signs of secondary glaucoma, and the eye is some-

times tender. By focal illumination a yellowish-white, rounded or lobulated, solid-looking mass may be seen in the vitreous, with blood vessels and often small hemorrhages on its surface. The vessels are distinguished from those found on a detached retina by their irregular distribution, different mode of branching, greater breadth, and somewhat brighter color.

Treatment.—Remove early the affected globe, with as much nerve as possible. If the other orbital contents are affected, while the nerve at the point of section appears healthy, it is advisable to thoroughly clean out the orbit and then destroy the surface with chloride of zinc paste. When the tumor has attained a large size it is prudent to leave it alone, simply giving opiates, if necessary, to relieve pain and induce sleep.

Congenital abnormality.—Opaque nerve fibers usually occur as a brilliantly white patch, narrower at the end next the papilla, with which it is nearly always continuous. Its broader peripheral end has a teased out, brush-like appearance from separation of the fibers. The affected fibers are generally above or below the disk, concealing the large blood vessels more or less. We get a blind spot corresponding to the extent of the opaque area.

Posterior staphyloma.—A certain amount of it is often merely a stationary congenital peculiarity, usually found with myopia, and exceptionally with emmetropia and hypermetropia. It generally occurs as a whitish crescent at the outer edge of the disk, with sharp, even boundaries and a dark border. Another form is progressive, and associated with high degrees of myopia; here the boundaries are less marked and frequently indented, the pigment border is interrupted, and there are often other distinct patches of choroidal disease in its vicinity.

Tubercle of the choroid is generally found in the neighborhood of the macula and papilla, and usually in both eyes. Ophthalmoscope: Yellowish-white, round, somewhat raised spots, varying much in size.

Cause.—Usually miliary tuberculosis, in young subjects.

Rupture of the choroid, from a direct blow on the eyeball, generally occurs near the posterior pole of the globe in the form of a crescent, with its concav-

ity toward the disk. Ophthalmoscope: The fissure is white or yellowish-white; when fresh, hemorrhages are often found at or near it, but later a black pigmented border.

Coloboma is a congenital defect at the lower part of the choroid, the result of imperfect closure of the fetal cleft. It is generally of large size, often extending from the disk to the periphery. Ophthalmoscope: Shows an uneven surface of exposed sclerotic with tortuous vessels on its surface, and often surrounded by black pigment. Coloboma of the iris frequently accompanies it.

Tumors.—*Melanotic sarcoma* is much the most common form; it generally occurs at or past middle life, and especially in eyes damaged by injury or disease. Usually the patient is first seen in a comparatively late stage, with the retina largely detached, the eye glaucomatous, and the lens often cataractous. A positive diagnosis is then difficult, and chiefly from the history. Whenever its presence is suspected it should be excised at once. If the nerve at the point of section be affected, and still more if the tumor have perforated the outer coats of the eyeball, all the contents of the orbit must be removed, and chloride of zinc paste applied.

Diseases of the Vitreous.—**Opacities** in the vitreous are generally due to inflammatory affections of this structure, occurring secondarily to disease of the ciliary body, choroid, retina, or optic nerve. They are common in cases of high myopia. They may also be the result of hemorrhages (from rupture of retinal or choroidal vessels), or of degeneration, especially senile. Occasionally cholesterol crystals in a fluid vitreous appear as a sparkling golden shower on movements of the eye (*synchysis scintillans*). All vitreous opacities are best examined with a plane or slightly concave mirror held at twelve to eighteen inches from the patient's eye. On his turning his eye smartly upward, downward, or laterally, the opacities may be detected against the red background as dark webs or dots which are still in motion after the eye has come to rest. By their rapidity and extent of movement the consistence of the vitreous can be judged. Sometimes the opacities are very minute, like small dust particles diffused through-

out the vitreous, *e. g.*, in specific choroiditis; these are well seen by using a strong convex lens (+18D) behind the mirror, held close to the patient's eye so as to focus them accurately.

Symptoms.—He generally complains of seeing black specks floating about, and sometimes, especially where the opacities are large and central or diffuse, vision is much reduced.

Treatment.—Heurteloup's leech to the temple, along with the remedies appropriate to the exciting cause. The dust-like opacities associated with specific disease usually disappear under a mild mercurial course.

Suppurative hyalitis occurs from injury or from a purulent choroiditis. We get a yellowish reflex from the purulent deposit, the tension is reduced, and there is generally iritis. The prognosis is unfavorable, the eye being usually lost.

Foreign bodies in the vitreous.—If the eye have suffered irreparable damage, and vision be much affected, early excision is best. Where the lens and ciliary region have escaped, and there is no evidence of iritis or choroiditis, try to remove the foreign body. If it be of steel or iron, the electro-magnet is exceedingly useful for this purpose. If it be of other metal, or of glass, etc., it will be found extremely difficult to effect its removal, unless placed well forward in the equatorial region. If evident inflammation of any part of the uveal tract occur the eye should be excised.

Cysticercus is sometimes found in the vitreous, but is very rare.

Persistent hyaloid artery occasionally is met, appearing as an opaque cord running forward from a branch of the central artery on the disk.

Glaucoma.—We have already mentioned the occurrence of *secondary glaucoma* in several ocular affections; we have now to consider the primary form of the disease.

Symptoms and mechanism.—Primary glaucoma consists mainly in an increased tension of the eyeball due to excess of fluid within the vitreous chamber, and is most apt to occur when the sclerotic is unyielding and thick, as in old hypermetropic eyes. In examining tension the patient stands facing us with head erect, and looks down toward his feet. Place one finger of each hand on the upper lid of the eye to be examined, as near the up-

per orbit margin as possible, and press the globe lightly downward. Each finger is used alternately simply to steady the globe, and to estimate the resistance offered to light pressure when steadied by the other finger. The tension of the two eyes should always be compared. The student should thoroughly acquaint himself with the average tension of the normal eye, so that he may have a mental standard with which to compare alterations in disease.

This excess of fluid is partly due to increased secretion and intra-ocular vascular congestion, partly to diminished escape. Continued high tension in the vitreous chamber will mechanically affect every part of its inclosing walls. The soft ciliary body soon yields to it, and rapid failure of accommodation (shown by increase of presbyopia) follows, often a valuable early symptom of the disease. The ciliary nerves are also affected by the pressure, and this result assists in diminishing the accommodation, besides leading to dilatation and inactivity of the pupil, and to corneal anæsthesia. A sudden access of tension interferes with the circulation in the choroidal vessels, and consequently congestion of the perforating and other branches of the anterior ciliary veins outside the globe occurs. The lens is pushed forward by the pressure behind, and the anterior chamber rendered shallow in consequence. The peripheral part of the iris is also pressed forward, and often becomes adherent to the inner surface of the cornea. The optic nerve and lamina cribrosa, being of less resisting power than the sclerotic, ultimately yield, leading to cupping and atrophy of the disk. The intra-ocular tension being as great as, or even greater than, that in the central retinal artery, except during systole, arterial pulsation is evoked by gentle finger pressure on the globe, or occurs spontaneously. From the impeded blood supply, and the pressure on nerve fibers, there is loss of function, the nasal field being first affected. Other symptoms of glaucoma are steaminess of the cornea and pain, and the patient often sees colored halos round a flame. The pain varies greatly in different cases, being sometimes absent, and sometimes very severe, referred to the eye, occiput, and back particularly, and often then associated with sickness and vomiting.

Course.—Glaucoma is distinctly a progressive disease, leading to blindness, but the rate of its progress and the severity of its symptoms are liable to much variation in different cases, and often in the same case at different times. In consequence of this variability, different forms of the affection are described as acute, subacute, and chronic. In the *acute* form the symptoms appear suddenly and are very severe, the congestion and pain being especially marked, and the tension very high. Vision fails rapidly, and is generally abolished in a week or so if the acute symptoms continue, and sometimes even in a few hours (*G. fulminans*). In *chronic* or *simple* glaucoma there is no congestion and seldom pain; the tension is never very high, and all the other symptoms are proportionately modified and the progress gradual, lasting for months or years before causing total blindness. The *subacute* form is intermediate in severity, and is the most common in occurrence, frequently, indeed, appearing intermittently in an otherwise chronic case. There are considerable congestion and pain, and the vision fails rapidly; such an attack, if continuous, leads to complete blindness in a few weeks. Glaucoma usually attacks both eyes, though not necessarily in the same form, and often with a long interval. The second eye is especially liable to an attack immediately after an operation (*e. g.*, iridectomy or excision) on the one first affected.

General causes.—It seldom occurs before forty-five years of age, and is most common in women and in hypermetropic eyes. Grief, anxiety, overwork, or the local use of atropine, are apt to bring on an acute attack in those otherwise predisposed. Its subjects are often gouty.

Treatment.—*Iridectomy* gives the most satisfactory results, and often affords permanent relief. The incision should be made well behind the apparent corneal margin, and the excised piece of iris removed well up to its ciliary attachment. This operation is particularly indicated in all acute and subacute cases, and should be performed at the earliest possible opportunity. When a painful glaucomatous eye is permanently blind, iridectomy may be done for relief of pain, but enucleation is usually preferable in such cases. In true chronic glaucoma treatment is often of no avail, but even here iridectomy is always worth trying,

as it is more likely than anything else to give relief. Some surgeons prefer *sclerotomy* in this form of the disease, the operation consisting practically in a large incision through the anterior part of the sclerotic, without iridectomy. Eserine is often serviceable by keeping the tension temporarily diminished in the more acute cases, when for some reason iridectomy must be deferred. It may also be used in chronic forms as a preliminary to, or instead of, operation. In glaucoma I have found a solution containing eserine and cocaine serviceable, the latter (by its stimulant action on the sympathetic nerves) presumably preventing the internal vascular congestion usually caused by eserine. Such dilatation of pupil as cocaine would naturally cause, is readily overcome by very weak eserine. R. Cocain. hydrochlor. grs. v; eser. sulphat. gr. j; aq. destill. $\frac{3}{4}$ j. One drop four to six times daily. Eserine should always be employed as a prophylactic agent for the one eye when the other requires operation for increased tension; in such a case it is sufficient to use it just before, and for two or three days subsequent to, the operation. In all cases of glaucoma rest must be insisted upon, errors in diet avoided, and causes of mental excitement, as far as possible, removed. Atropine and similar mydriatics must never be used where a predisposition to glaucoma exists, still less when the disease is actually present.

Symptomatic Indications.—*Belladonna* is the principal remedy in the early stage, when there is much local disturbance; severe pain about the eyes, feeling as if the eyes might protrude. *Spigelia* when there are sharp, stabbing pains through the eye and head, worse on motion. *Aurum*, for excessive tension, with pressure outward, heavy dull aching of globes; upper half of objects invisible; showers of bright, star-like bodies appear before the eyes. *Phosphorus*, when there is a halo around the light, or various lights and colors flash before the eyes.

Errors of refraction and accommodation.—The eye sees by virtue of the rays of light which have passed through its pupil and reached its retina. For the formation of defined images, it is necessary that the rays coming from an object be accurately focused on the outer segments of the rod and cone layer; the normal or *emmetropic* eye, with relaxed

accommodation, is such that parallel rays are so focused. In *myopia* the retina is placed too far back, so that parallel rays come to a focus in front of it, and the resulting retinal image is consequently ill-defined. In *hypermetropia*, on the contrary, the antero-posterior measurement of the eye is too short, so that the rays have not yet come to their focus when they reach the sentient retina, and a blurred image is again the result.

The rays coming from every point of an object are divergent, but when such object is situated at several feet distance from the eye, those passing through the pupil may, for all practical purposes, be considered parallel. It is usual to place our test object at twenty feet in testing the refraction of the eye at rest. To be accurately seen by the average eye, an object must be of such a size that it subtends an angle of five minutes, the apex of the angle being situated near the posterior pole of the lens, where the rays coming from all eccentric points of the object cross the principal axis. The test types usually employed are made on this principle, and we express the visual acuity (V) by a fraction, the numerator corresponding to the distance between the patient's eye and the test, the denominator being the distance at which the type ought to be distinguished by the normal eye. Thus with normal vision, $V = \frac{20}{20}$; but if the smallest type read at twenty feet is that which ought to be distinguished at forty or 200 feet, $V = \frac{20}{40}$ or $\frac{20}{200}$; i. e. $= \frac{1}{2}$ or $\frac{1}{10}$ of normal vision. Test each eye separately.

An ordinary convex or + lens renders divergent rays less divergent, parallel, or convergent, according to the amount of the divergence of the original rays and the strength of the lens. Rays already parallel it brings to a focus at a distance varying inversely with the curvature of the lens. By increasing the curvature of a lens, therefore, we augment its effect on divergent rays, and render its focusing distance for parallel rays shorter. An ordinary concave, or - lens, increases the divergence of already divergent rays, and makes parallel rays diverge as if coming from a point in front of the lens; the interval between this point (or *virtual* focus) and the lens is the focal distance of the lens in question. A lens whose focal distance is one meter is called one diopetre (1 D), and is the unit of the

metric system now generally adopted; a lens of two dioptries (2 D) is, therefore, twice the strength, or one-half the focal distance.

Emmetropia (*E*) and **presbyopia** (*Pr*).—Were it not for the power of accommodation, the normal eye would be incapable of seeing *near* objects distinctly, as the rays would be too divergent. By the action of the ciliary muscle, however, the curvature of the crystalline lens can be increased, so that rays of very considerable divergence can be brought to a focus on the retina. This temporary increase in curvature (or accommodation) is dependent on the elasticity of the lens substance, and diminishes with age. Whenever it has failed so much that objects must be placed at nine inches or more from the eye so as to be clearly seen, the condition of presbyopia is said to exist, and the increased curvature required must be artificially supplied by suitable convex glasses. Presbyopic glasses of 1D are necessary in the emmetropic eye at about 45 years of age, and they require to be increased by about 1D for each five years of life up to the age of 60, and afterward by 0.5D for each subsequent five years.

Hypermetropia.—Although all objects must appear indistinct to the hypermetrope with relaxed accommodation, he is able to see distinctly by an effort of his ciliary muscle, provided he be still young and the hypermetropia not very large in amount. Some such effort is necessary even for distant objects, but a greater is required for all near vision. In as far as convergence and accommodation are naturally consentaneous acts, such a hypermetrope is apt to develop a convergent concomitant squint, and a continuance of the accommodative effort leads to fatigue, supra-orbital headache, and occasional blurring of images from failure to maintain the accommodation necessary. The glass suitable for such an eye is a convex one, of such a strength that parallel rays will, by its aid, be focused on the retina without the use of accommodation. To overcome all action of the ciliary muscle in young people it is necessary to use atropine, but the full correction found under its use should not be ordered, a glass of 1D less than this being most suitable. The hypermetrope should wear his glasses constantly.

Myopia.—For distinct vision the object must be comparatively near the eye, so that the rays coming from it and passing through the pupil have such a divergence that they will be focused on the retina. Distant objects can only be rendered distinct by the aid of the concave lens, and the weakest that will give this result must be the one ordered. Should there be insufficiency of the internal recti, prisms with their bases inward are often very serviceable for near work.

Astigmatism.—In *regular* astigmatism one meridian of the eye is of less refractive power than any other, and at right angles to this is the meridian of greatest refraction. If one meridian be emmetropic while the opposite is myopic or hypermetropic, we have respectively simple myopic or simple hypermetropic astigmatism. If both such meridians be unequally myopic the condition is called compound myopic astigmatism; if both be unequally hypermetropic we have compound hypermetropic astigmatism. Again, if one meridian be hypermetropic, while that at right angles to it is myopic, the case is one of mixed astigmatism. The consequence of astigmatism is that no object is seen with perfect distinctness, but any straight line will be comparatively well defined *if at a suitable distance from the eye*. The correcting glass required is a cylindrical one (+ or -), with a spherical in addition where the astigmatism is compound or mixed.

Affections of Ocular Muscles.—**Convergent strabismus** of a concomitant nature has been mentioned when considering hypermetropia. It usually first appears in early childhood, and may only be periodic, or worse during strong accommodative efforts, but sometimes it is constant in presence and in degree. If both eyes see equally well, it is often alternating, affecting sometimes one, sometimes the other, eye. In the constant form, diplopia is generally avoided by a mental suppression of the image from the squinting eye, which latter consequently becomes defective. Occasionally the squint disappears spontaneously after some years.

Treatment.—The glasses required for the hypermetropia are usually sufficient to prevent a concomitant squint if given sufficiently early. When the squint persists, however, after using glasses for some time, one internal rectus should be

divided, and if this be insufficient the other eye may also be operated on some weeks later.

Divergent strabismus not infrequently occurs in myopia from insufficiency of the internal recti; here, again, diplopia seldom exists when the squint is constant.

Treatment consists in giving the requisite glasses and dividing one or both external recti. Divergent strabismus also often affects an eye whose vision is defective, as from corneal opacities.

Ocular paralysis.—Paralysis of the nerves supplying the *extra-ocular* muscles leads to strabismus, and to diplopia, which latter is always more troublesome when the strabismus is slight, *i. e.*, when the double images appear close together. The false image is always displaced in the direction in which the affected muscle would act were it not paralyzed. The strabismus is due to the unopposed action of the sound muscles. Such a paralysis is usually uni-ocular. The whole of the third nerve is seldom equally affected, one or more branches generally suffering more than the others. Very rarely all the extra-ocular muscles are paralyzed (*ophthalmoplegia externa*) in both eyes.

Paralysis of the intra-ocular muscles.—The iris (sphincter and dilator) and the ciliary muscle may be affected separately or together. In third nerve paralysis the sphincter iridis and ciliary muscle are usually both affected. Paralysis of all three intra-ocular muscles (*ophthalmoplegia interna*) is occasionally found.

Causes.—Syphilis is a frequent source of these affections, either by a periostitis (at the base of the skull or at the sphenoidal fissure) or by gummata somewhere in the course of the nerves or at cerebral centers. Other causes are meningitis, orbital or intracranial tumors and fracture of the skull. Some cases are said to be rheumatic in origin. Paralysis of the ciliary muscles (cycloplegia) is not uncommon after diphtheria. In an early stage of tabes dorsalis, temporary localized extra-ocular paralysis are sometimes observed, and in a later stage of this affection a form of iridoplegia in which the pupils do not react to light, but still contract on convergence of the eyes.

Treatment.—Where syphilis is a possible cause a course of mercury and iodide of potassium is indicated. Galvanism

may also be employed. Instillation of a weak solution of eserine ($\frac{1}{2}$ or 1 gr. to the ounce) is useful in post-diphtheritic cycloplegia. In some incurable cases the diplopia may be prevented by the use of prismatic glasses, and the pupil may be restored to its normal size and the ciliary muscle stimulated by a solution of eserine of an appropriate strength according to the effect desired.

Symptomatic Indications.—*Belladonna* may do good when the strabismus occurs in children as a result of convulsions; *spigelia*, when caused by irritation of the digestive tract; *bryonia* when of rheumatic origin.

Nystagmus, or involuntary oscillation of the eyeball, may be vertical, horizontal, or rotatory. It is generally due to congenital or early infantile defect of vision, and usually affects both eyes. It is also occasionally found in coal miners, probably from the combined influence of insufficient light and of a constantly strained unnatural position of the eyes when at work. This latter form may be cured by change of employment, but ordinary nystagmus does not yield to treatment.

Diseases of the Orbit.—**Periostitis** usually affects the orbital margin, and is most common in strumous children; sometimes it is due to injury or syphilis.

Symptoms.—Dull pain, circumscribed swelling with redness, and much tenderness to finger pressure. At first the swelling is hard, but it usually softens later on the formation of pus, and on puncture bare bone may be detected by the probe. If the disease be deep in the orbit, the general symptoms are more severe, and the eyeball is pushed forward or displaced laterally.

Course.—As a rule such cases do well, but sometimes deeply seated periostitis or caries may cause optic atrophy, or even endanger life by the inflammation spreading to the meninges or causing venous thrombosis.

Treatment.—Poulticing or hot fomentations. Early evacuation of pus. Constitutional treatment as indicated.

Orbital cellulitis.—*Symptoms.*—Proptosis and impaired movements of globe, conjunctival chemosis, redness and swelling of lids; severe localized pain and general fever. On pus forming, we find a circumscribed, fluctuating, conjunctival bulging. Sometimes we get optic neuritis, or even purulent choroiditis, and

still more rarely we may have pyæmia or purulent meningitis.

Causes.—Wounds, spreading of inflammation from a neighboring cutaneous erysipelas or from caries. Sometimes it is metastatic, as in splenic fever, glanders, or pyæmia.

Treatment.—As of last affection.

Tumors in this situation usually cause proptosis and impairment of ocular movements, and often lead to papillitis or optic atrophy. Both orbits are rarely affected. The *primary* tumors are cystic (dermoid, cysticercus), sarcomatous, bony (ivory exostosis), and vascular. In the vascular variety a bruit is usually heard over the orbit and adjacent part of the skull, and often pulsation is visible. The *secondary* tumors arise in the globe itself or in the neighboring parts. Many of the vascular tumors here are intracranial in origin, the most common being arterio-venous aneurism from rupture of the internal carotid into the cavernous sinus, generally caused by fracture of the base of the skull.

Treatment.—Cysts may be evacuated by free incision (after needle puncture so as to eliminate the remote possibility of its being an encephalocele). Exostoses, when not attached to the thin upper wall, and when their base is narrow, may be removed. Malignant tumors should be removed early along with the eyeball and all the orbital contents, and chloride of zinc paste then applied. In many vascular tumors ligature of the common carotid is advisable; digital compression may be tried as a preliminary.

R. MARCUS GUNN.

FACIAL BONES, FRACTURE OF.
See FRACTURES.

FACIAL NERVE, Paralysis of the (Bell's Paralysis).—Paralysis of the facial or seventh nerve may be produced (1) by lesions at any point in the motor tract—*i. e.*, in the cortex (where the movements of the face are represented in the corona radiata, internal capsule, or crus), at the point of decussation of the facial motor fibers in the pons, or by a lesion in the nucleus of the facial nerve of the opposite side; (2) by disease of the facial nucleus or of the nerve on its way to the facial muscles.

For facial paralysis arising from the first-mentioned lesions, see HEMI-
PLEGIA.

The facial nerve is liable to be affected in three different places—in *the face*, from cold, the result of sitting in a draught or riding in a carriage with the window down, or it may due to an injury, or the pressure of a tumor; *in the temporal bone*, secondary to disease of the middle ear or due to rheumatic or syphilitic neuritis; and *inside the skull*, where it may be compressed or destroyed by a tumor, or involved in the lesions resulting from an acute or chronic meningitis.

The *nucleus of the facial nerve* is liable to be destroyed by tumors in the substance of the pons, and by hemorrhage or softening.

Symptoms.—The period of onset of facial paralysis may vary from a few hours to a day or two, or the patient may wake in the morning and find that his face is paralyzed. The condition of the face is the same whether the nerve or its nucleus be affected. All the muscles supplied by the nerve are paralyzed, and consequently, when the affected side is at rest, the corner of the mouth is lower and the forehead smoother. When movement is attempted it is seen that the brow cannot be wrinkled or elevated, the eyelids cannot be closed, and, in showing the teeth, the middle line of the upper lip is drawn over to the normal side; whistling and blowing up the cheeks are impossible. At the same time the buccinator is paralyzed and the food collects between the cheek and the jaws, and the nostril cannot be opened, as in sniffing. There is no response from the muscles of the affected side to involuntary stimuli, and the patient smiles and laughs on one side only of his face.

Taste on the same side is lost if the lesion involve the part of the facial nerve between the origin of the large petrosal and the chorda tympani nerves.

The electric reactions are very important, and assist the prognosis of the case. The facial *nerve* loses its reactions to both faradic and galvanic currents very rapidly; they may have completely disappeared at the end of one or two weeks. The faradic reaction of the *muscles* corresponds to that of the nerve. The galvanic reaction of the *muscles* is diminished in the first week; there is then a gradually increasing excitability, which attains its maximum in from three to four weeks, and after that declines. At the same time the contractions of the muscles are slower and more deliberate, and the serial

changes of the reaction of degeneration are observed (*see* ELECTRICITY). The chief point to be noticed is that the muscles react sooner to the positive than to the negative pole.

These changes are due to degeneration of the nerve and muscle, the latter being cut off from its nerve nucleus. As a rule, the reactions of the nerve to both currents and the faradic reaction of the muscles gradually return; in favorable cases in a few weeks. In cases in which recovery is late not until from four to six months, while in cases presenting no improvement in motor power the reactions remain permanently absent, and after a time the galvanic reaction is also lost.

Recovery of power over the paralyzed muscles usually takes place a little before the electric reactions are obtained.

In cases in which the electric reactions return in a few weeks, the first parts to regain power are the muscles of the forehead and the orbicularis palpebrarum, and it may be several weeks later before the muscles about the mouth improve.

In some cases the facial nerve is so little damaged that there is no change in the electric reactions, or only a diminished reaction to the faradic current. Here, although all the muscles of the face may be completely paralyzed, recovery of power is rapid and complete. In old cases, with no improvement, contraction takes place in the fibrous tissue of the muscles, drawing the mouth toward the paralyzed side, and it is only on voluntary movement that it can be told which is the side affected.

The *diagnosis* has to be made from that caused by the disease of the cortex or internal capsule of the opposite side. In the latter the upper part of the face—*i. e.*, the forehead and eye—is not usually so much affected, though it does not always escape; there is no alteration in the electric reactions, and some paralysis of the limbs of the same side is usually present. Another point is that, although the patient cannot voluntarily retract the paralyzed angle of the mouth, it is at once thrown into action by emotional stimuli, such as smiling; this is never the case in paralysis of the facial nucleus or nerve.

When the lesion is in the substance of the pons, the sixth nerve of the same side is usually involved, and there is paralysis of the arm and leg of the opposite side,

producing what is called “crossed paralysis.” Tumors or meningitis outside the medulla usually cause paralysis of other cranial nerves, especially the auditory. Failing these symptoms, and especially if there be a history of injury or ear disease, the lesion is most probably in the temporal bone.

The *prognosis* in the most common form—*i. e.*, the rheumatic—is favorable according to the way in which the muscles react to the electric currents, but recovery may be delayed for from six to twelve months. The prognosis is good in early syphilitic cases. When the paralysis is due to caries of the petrous bone the prognosis is more unfavorable, and, unless the lesion be syphilitic, facial paralysis, due to tumors in or outside the medulla, is part of a necessarily fatal disease.

Treatment.—In “rheumatic” cases, hot fomentations should be applied to the face, with glycerin and belladonna liniment. After the inflammatory condition has subsided, blisters should be applied behind the ear and the constant current employed, but the use of the latter is to be avoided in the early stages. The positive pole should be placed behind the ear of the affected side, and the negative passed gently over the muscles, only the weakest current which will produce a contraction being employed. Even should the muscles react to the faradic current, it is best to employ the constant current, as the use of a faradic current of the strength necessary to produce contraction of the muscles is often exceedingly painful. The constant current should be persevered with so long as there is any reaction in the muscles, but when this is lost it is useless to continue electrical treatment; so long as the muscles react to the constant current, there is a possibility of recovery. Faradization of the opposite healthy muscles in late contracture of the paralyzed muscles has been advised, but it is not to be recommended. The muscles should also be gently rubbed, and this should especially be done in cases of late contraction of the paralyzed muscles. Disease of the ear should always be looked for, and treated if present.

In cases due to syphilis, iodide of potassium in increasing doses should be given, and electrical treatment employed. Where the disease is due to non-syphilitic tumors little can be done, as such cases

are, as a rule, beyond the reach of surgical operation.

Double facial paralysis rarely occurs; it is produced most often by syphilis, diphtheria, and meningitis, or by tumors about the pons, and in some cases from cold.

C. E. BEEVOR.

Symptomatic Indications.—In recent cases *aconite* is often curative, particularly when the condition is the result of cold, *rhus tox.* being the principal reliance when the disease is of rheumatic origin, the result of exposure to wet, strains or overexertion, or when attended with stiffness, tingling, and numbness. *Nuxvomica* may be useful when the disease is the result of alcoholic excess. *Phosphorus* is valuable when from degenerative changes in the nerve centers. *Cauticum* has proved beneficial in cases of long standing, with tearing rheumatic pains.

FACIAL SPASM.—A curious clonic contraction of the muscles supplied by the facial nerve, involving either one-half of the face, or only the muscles around the eye ("blepharospasm)."

The spasm is commonly reflex to irritation or disease of the fifth nerve of the same side, and may be produced by carious teeth or cold to the face, or may be caused occasionally by the presence of intestinal worms. A tender spot can often be found in the course of a branch of the fifth nerve—*e.g.*, the supra-orbital—pressure upon which stops the spasm. The contractions occur at about the rate at which a person in health blinks, but at times they altogether cease, and are often induced by going out into the cold air. In some cases, occurring in children and in girls about puberty, their cause cannot be discovered, and the movement is allied to what is called histrionic spasm, a condition in which local involuntary twitchings of the face, acquired in childhood, persist during adult life, and are increased by emotional causes.

Prognosis favorable, when any source of local irritation capable of removal can be found, otherwise very difficult to relieve.

Treatment consists in removing any source of irritation, such as carious teeth; and if a painful spot over the fifth nerve exist, a blister there will often stop the movement. In some cases the operation

of stretching the facial nerve has proved beneficial. Tonics, such as iron and quinine in full doses, and morphine applied locally and by hypodermic injection, are useful. Galvanism without interruption of the current, the positive pole being applied behind the ear and the negative on the face, the strength of the current being gradually increased, sometimes arrests the spasm.

C. E. BEEVOR.

Symptomatic Indications.—*Hyoscyamus* is useful in spasms of the face in young persons, in recent cases; *argentum nit.* is better in old cases. *Cimicifuga* will sometimes relieve when due to menstrual irregularity. *Belladonna*, when due to irritation of nervous centers.

FACIES HIPPOCRATICA.—The aspect of the face seen after prolonged wasting disease, or as the result of starvation, or before impending death. The original description by Hippocrates is as follows: "A sharp nose, hollow eyes, collapsed temples; the ears cold and contracted, and their lobes turned out; the skin about the forehead being rough, distended, and parched; the color of the whole face being green, black, livid, lead colored."

FAINTING.—See SYNCOPÉ.

FALLOPIAN TUBES.—**Inflammation.**—May be primary, due to morbid sexual excitement, to alcoholic excess, to chill, especially during menstruation; or to injury, as from the use of irritating intra-uterine injections. It may be infective, as from gonorrhea, or from the extension of puerperal endometritis; secondary to disease of the uterus, such as endometritis, cancer, fibroids, retroversion, or retroflexion; or result from general blood changes, as typhus, scarlatina, cholera, or phosphorus poisoning; or it may be due to venous congestion, as from heart, lung, or liver disease. It is sometimes attributed to perimetritis and hematocele; but where these diseases occur with tubal disease, the latter is generally, if not always, the primary change. It may be due to new growths in the tube itself, tubercle being the most common.

The affection may not go beyond slight catarrh, manifested by swelling and injection of the mucous membrane and slight enlargement of the tube by in-

creased secretion, appearances which are commonly seen at autopsies. Inflammation of the tube, being a frequent cause of peri-oöphoritis and perimetritis, is often found in association with adhesions, especially around its abdominal end. Catarrh of the tube is probably common during life, ending most frequently in recovery. When chronic, it leads to destruction of the ciliated epithelium of the tube, and so to sterility or extra-uterine gestation.

When the abdominal end of the tube has become occluded, its secretion is retained; the fluid may be merely serous or mucous—**Hydro-salpinx**, or hydrops tubæ. Tubes so distended may reach such a size as to cause them to be mistaken for ovarian cysts; they have been rarely found containing more than a gallon of fluid. The usual appearance is that of sausage or club-shaped swellings, constricted at two or three points, 2 to 4 inches in length and 1 to 2 inches in diameter. When small, the distention affects only about the outer two-thirds of the tube. The disease is often bilateral. The enlarged tubes usually sink backward into the recto-uterine pouch. After fluid has accumulated in the tube in consequence of closure of its openings, it is possible for the uterine opening to again become permeable, and a sudden discharge of watery fluid, which has come from the tube, may be noticed by the patient. It is rare, but no doubt such cases do occur. The fluid may be discharged into the peritoneal cavity either by rupture or by re-establishment of its abdominal opening, and, if simply serous, be absorbed and the patient get well.

The tube may contain pus. **Pyo-salpinx**. The pus may be recent and thin, or old, thick, and inspissated. It is often accompanied by much thickening of the wall of the tube, and by adhesion of the tube to neighboring parts. The mucous membrane of the tube may be ulcerated, and the ulceration may perforate the tube, letting out the pus into the peritoneal cavity; or the wall of the tube may be in places thinned, and burst at a thinned spot. The pus may escape through the abdominal end of the tube into the peritoneum. In whatever way the pus gets into the abdominal cavity, the result is acute, and, if not treated, rapidly fatal, peritonitis. The pus may also be discharged by perforation into other parts,

as the rectum, the vagina, or externally. It may also, like serous accumulations, escape through the natural opening into the uterus.

The tube may contain blood. **Hemato-salpinx**. Bleeding from the mucous membrane of the tube is not uncommon; indeed, there is reason to think that it is an important part of normal menstruation, and that slight hemorrhages, not of sufficient extent to cause marked symptoms, occur in many pathological conditions. It is only when the tube is closed and the blood retained that it becomes a source of trouble. It may occur as a result of menstrual retention (*see* AMENORRHEA). It is believed that even when there is only slight temporary hindrance to the escape of menstrual or other blood from the uterus, some of it may regurgitate into the fallopian tubes. As a result of extra-uterine gestation, it is one of the most important conditions of the tube.

Signs and symptoms.—During life, dilatation of the fallopian tube can be made out by bimanual examination, but it cannot be decided whether the tube contains watery fluid, pus, or blood. Stretching of the tube causes pain, and in each of these conditions there is, as a rule, persistent pelvic pain, worse at the menstrual period, and aggravated by sexual intercourse. Menstruation is usually too copious, and the flow may be too frequent, but this is not constant enough to be relied upon.

On physical examination, a tender lump is felt on one or both sides of, and behind, the uterus; and, on careful bimanual examination, the swelling is found to taper off into a cord which runs to the upper angle of the uterus. This sign applies equally to small ovarian cysts; but they are, as a rule, neither painful nor tender. But when a small ovarian cyst has suppurated, the symptoms and signs are practically indistinguishable from those caused by a dilated fallopian tube, except that they are less influenced by treatment. If, as often happens, the pelvic organs are matted together by adhesions, it may be impossible to ascertain with certainty the relations of the swelling. In some cases, after masses of tissue, inclosing suppurating cavities, have been removed from the body by operation, the parts are so matted together by adhesions, and so torn in the process of removal, that it

is impossible, even on dissection, to say whether the cavities are dilated tubes or not; and, in such, the only diagnosis that can be made is that there is disease of the uterine appendages.

Treatment.—The majority of cases of inflammation of the tubes will get well with rest in bed, light diet without alcohol, laxatives, counter-irritation to the skin of the abdomen, and avoidance of intra-uterine treatment. Their course is chronic, often lasting many weeks, and they are prone to relapse. If this treatment, though persevered in, fail to do good, and the patient's suffering be such as to prevent her from performing her domestic and social duties, the diseased parts may be removed by abdominal section. If, in a patient suffering from chronic disease of the uterine appendages, acute peritonitis come on, abdominal section should be performed at once, and the diseased parts, almost certainly the cause of the peritonitis, removed. In deciding as to operation in chronic disease of the uterine appendages, the chief indication is the presence of a definite swelling which can be grasped bimanually. Where there is not a distinct tumor, and the disease is inferred from incurvation, fixity of the parts, and persistent pain, it is very likely that the pain is neuralgic, and the disease little more than thickening of the parts, from organized inflammatory effusion; in such cases removal of the appendages, even if possible, is not likely to be followed by very great improvement.

The abdomen is opened in the middle line about half-way between the pubes and umbilicus by an incision from 2 to 3 inches in length. The peritoneal sac having been laid open and the uterine appendages identified by tracing them outward from the fundus uteri, the adhesions are broken down and parts drawn up through the wound; then, the tube and ovary being held outside, the broad ligament is transfixed as near the uterus as possible and tied, and the part beyond the ligature cut off. If the stump do not bleed, the ligature is cut short and the stump dropped in. If there be much oozing from the torn adhesions, or if pus or other fluid have escaped into the abdomen, the pelvic cavity should be well washed out with plenty of warm water at a temperature

such as the hand can comfortably bear. If washing with hot water fail to check hemorrhage, the pelvis should be packed with hot sponges so as to press firmly on the bleeding point, and pressure kept up for some few minutes. If some point bleeds freely in spite of hot water and pressure, it may be touched with perchloride of iron. If the oozing be only slight, a Keith's drainage-tube should be put in and the wound closed round it, and it may confidently be expected that the hemorrhage will cease. Any kind of clean dressing may be applied. Treatment in other respect just as in other cases of abdominal section.

Tubercle of the fallopian tube and cancer of the fallopian tube are rarely met with. Both conditions usually occur with similar disease elsewhere. Neither has ever been diagnosed as a disease existing by itself.

Dilatation of the fallopian tube at its uterine end is sometimes seen. Little or nothing is known of its ætiology. Its importance is, that fluids injected into the uterus may flow into the peritoneum through a dilated tube, and that the uterine sound may travel up a dilated tube, and so give an erroneous idea of the length of the uterus.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is valuable in the early stage of inflammation, with marked febrile symptoms; hot, dry skin; thirst; anxiety and restlessness. *Belladonna* is also valuable in early stages of congestion when the febrile symptoms are not so marked as for aconite; there are throbbing pains, or the pains come and go quickly. *Bryonia* follows well after aconite or belladonna. In case of serous effusion, it promotes absorption. *Cinchona* in case of suppuration, with debility, does good service. When suppuration appears inevitable, the symptoms pointing to its formation, *calcium sulphide*; which controls the suppurative process. For the peritonitis which sometimes occurs see PERITONITIS.

FAVUS (Tinea Favosa; Honeycomb Ringworm).—A chronic disease of the skin, due to the presence of a vegetable parasite, characterized by the formation of cupped, sulphur-yellow plates in the epidermis, affecting usually hairy parts, especially the scalp, but sometimes

spreading to the hairless parts of the body. The disease in America is rare, and is met with only among the lower classes. It is contagious, although less so than ringworm, and frequently affects several members of the same family at the same time. It may be contracted from dogs and cats, which, in their turn, probably derive it from rabbits and mice.

Favus generally begins in childhood, duration indefinite. It may last till advanced age, as long as hairs remain to provide a favorable nidus for the growth of its fungus. It begins in the scalp as a pinkish circular spot, which soon becomes covered with fine scurf, and sometimes exhibits faint vesication round the periphery. After about ten or fourteen days a minute yellow point may be seen round a hair, but in the thickness of the epidermis, and covered by some of its layers. As this increases in size to constitute the characteristic "plate" (*scutellum*) its edge becomes considerably raised, but its attachment to the hair, where the epidermis is fixed down, persists, causing the typical central depression. This cupped plate usually shows some concentric marking, and increases until it attains the size, usually, of a split pea. Its central portion may become pale and whitish, but its periphery retains the vivid yellow; finally, it often ruptures the cuticle, which forms a loose, fringelike appendage round its margin. As these plates grow in depth their convex undersurfaces form deep depressions in the rete, from which they can be easily "shelled" out with any blunt instrument, leaving a pit, the surface of which is usually smooth and moist, but sometimes bleeding and ulcerated. If of recent formation, these pits soon fill up again, but if old, they are permanent, as atrophy of the true skin, and atrophic scarring, result from the long-continued pressure. The circular plates, when numerous, exert mutual pressure upon each other, and thus become hexagonal or polyhedral; and when a very large surface becomes involved they lose all form, and the scalp becomes covered with a mass of yellow crusts, intermingled with scabs, blood crusts, and moist inflammatory products exhaling a peculiarly offensive "mousey" odor, pathognomonic of the disease. The fungus early penetrates the hair near the bulb, passing between the root-sheaths to ramify in the hair shaft, and

causing it to become lusterless and friable, although it does not become broken, stumpy, and twisted as in tinea tonsurans. The hair is easily detached and falls off spontaneously, leaving large, bald areas, many of which are permanent. The coexistence of patchy baldness, atrophic scarring, and groups of yellow plates constitutes a typical picture, and the association with myriads of pediculi—which are probably responsible for the greater part of the inflammatory and impetiginous changes present—is almost invariable. Itching is moderate, although sometimes severe. On the body favus shows itself as ringed patches, very like tinea circinata, but seldom attaining large size. In the center typical scutellum-formation generally occurs, and vesication often takes place at the periphery. Unlike favus on the scalp, it is easily curable, the fungus being confined to surface epidermis, and the follicles of lanugo hairs being shallow. The nails are sometimes also affected. The yellow fungus matter may show itself beneath the free margin of the nail, or may form beneath the nail, causing it to become opaque and thickened, with a tendency to splitting both transversely and longitudinally.

For the detection of the fungus of "achorion Schönleini" the crusts or hairs must be soaked in acetic acid or liquor potassæ, and the addition of some ether is useful. The mycelium is somewhat similar to that of ringworm, but is not so fine; it is not so uniform in outline, but is often markedly moniliform or jointed. It breaks up into circular or polyhedral spores, larger than those of ringworm and coarsely nucleated.

Differential diagnosis of ordinary impetigo of the scalp, from severe seborrhea, tinea tonsurans, and psoriasis is by microscopic investigation and careful attention to the preceding description, which will obviate all chance of error.

Treatment must be vigorous and for a prolonged period when the scalp is affected, but removal of crusts from the body followed by any mild antiparasitic application soon cures lesions there. The hair must be cut short with scissors; all scabs must be removed by poultices, or by rags soaked in oil, and the head covered with a flannel cap. Thereafter vigorous washing with hot water and soft soap must be carried out

previous to the operation of epilation, which may be accomplished either by using broad forceps, which seize several hairs at a time, or fine forceps, which remove a single hair. After the daily epilation, inunction of some parasiticide is necessary, resorcin (3 j ad 3 j) and salicylic acid (3 ss ad 3 j) being probably the most potent and successful. When the nails are affected, their avulsion is necessary, and even then cure is slow.

J. J. PRINGLE.

Symptomatic Indications.—*Sulphur* is one of the principal remedies in treatment of this affection; dry or fetid humid eruption, with thick pus, yellow crust, and itching. *Dulcamara* is useful when the disease is worse from cold or damp, rainy weather, with lassitude and weakness. *Viola tricolor* when there is much itching, dry scabs, with discharge of yellow water. *Calcium sulph.*, when there is great sensitiveness to touch or drafts of air, swelling of glands. *Graphites*, humid or scurfy eruption; raw skin, oozing a sticky gelatinous fluid; falling out of the hair.

FEBRICULA.—A term applied to a number of morbid states, of which fever is the prominent feature. It might be described as a morbid genus without essential attributes, consisting mainly of aberrant varieties of other determined species. The febrile disorders to which the term is applicable may be roughly grouped under the following heads:

1. Abortive or incomplete forms of the specific continued fevers—typhus, typhoid, and relapsing fever. Cases of irregular type may occur at any time, but are more often met with during the epidemic prevalence of these diseases.

2. Cases of scarlet fever, modified variola and more rarely measles and erysipelas, in which the eruption is either absent or unnoticed.

3. In rare instances, anomalous forms of intermittent fever.

4. Fevers due to some localized inflammation, in which the local signs are transient, ill-developed, or beyond the reach of observation; as in connection with lymphadenitis, tonsillitis, stomatitis, and acute catarrhal affections of the alimentary and respiratory tracts.

5. Fevers due to disorders of digestion with absorption of pyrogenic substances

through the gastric or intestinal mucous membranes.

6. Cases in which the development of primary or secondary syphilis is attended by considerable febrile reaction, of which the source may not be easily discoverable.

7. Fevers depending on some disturbance or exhaustion of the nervous system, as the consequence of exposure to excessive heat, or of some peripheral nerve irritation.

Febricula is common among children, less so among young adults, and rare after thirty.

Symptoms and course.—The only symptom common to the whole group is pyrexia, and it constitutes the whole disease often in young children, in whom a sudden rise of several degrees in the body temperature may constitute the only appreciable deviation from health. The invasion is generally sudden, but may be gradual. The temperature may reach 104° F. or even higher, especially in children. In adults the onset is sometimes attended by chilliness or distinct rigors. Nausea and headache are also common initial symptoms. In children there is often sickness; more rarely the disorder is ushered in by a convulsion. The febrile blush is often well marked, and must be distinguished from the eruption of scarlatina, with which it may be confounded. During the acme of the fever, which generally lasts from twelve to forty-eight hours, more rarely for three or even four days, the ordinary concomitants or symptoms of fever are present in varying number and degree. The pulse and respirations are always increased in frequency. In children the *alæ nasi* are easily set in action, and rhonchi and crackling râles may occur in the lungs, disappearing when the temperature falls. Herpes labialis is sometimes met with. Restlessness and disturbed sleep are usually present, and there may be slight delirium. Constipation is the rule, with slightly furred or red and irritable tongue. There is usually disinclination for food, and in children thirst is nearly always excessive. The urine is scanty and high-colored, and deposits lithates on cooling.

In some cases the symptoms of gastrointestinal derangement predominate; in others, those of the respiratory tract, while in a third group the disturbances of the sensorium overshadow all other symp-

toms. In these rarer cases of cerebral type, which are almost peculiar to children, headache, repeated vomiting, intolerance of light, and irritability or stupor, with or without delirium, are the chief symptoms.

The temperature generally falls by crisis, and is attended by an immediate remission in the symptoms. Convalescence is always rapid.

Diagnosis.—Rests chiefly on the exclusion of other acute fevers. Typhoid fever, pneumonia, meningitis, and scarlet fever are the diseases from which the diagnosis is most difficult in the early stages. The occurrence of a sharp attack of fever in a previously healthy child is in favor of febricula. It must, however, be borne in mind that what at the outset appears to be simple fever may develop into some severe and even highly infectious disease. And, further, some forms of febricula appear to be infectious, as, for instance, the so-called feverish cold, which facts should enjoin both care and prudence in the treatment of these affections.

Prognosis always favorable.

Treatment.—Rest in bed, with simple diet, for a day or two, will suffice in most cases. Cooling drinks and diaphoretics are pleasant and harmless. Constipation should always be relieved by appropriate means. Castor oil and calomel are among the most efficient remedies in the treatment of these affections.

WILLIAM PASTEUR.

Symptomatic Indications.—*Aconite* when the febrile symptoms are marked, or *belladonna* when the symptoms are less active. The latter remedy is almost specific for the disease in children, particularly with cerebral symptoms. *Nuxvomica* is frequently useful when the fever is the result of disturbed digestion, *arsenicum* when due to malarial poisoning.

FEVER (Pyrexia) a disorder of the body-heat characterized by a rise of temperature.

In most diseases presenting the symptom of pyrexia there are other symptoms, which are regarded as either (1) secondary to the exciting cause of the primary disease, or (2) secondary to the symptom of pyrexia.

In the latter group have been placed : quickening of pulse and breathing, nerv-

ous disturbances, such as delirium or coma, digestive disturbances, such as loss of appetite and sickness, disturbance of the salivary, sudorific, renal, and other secretions, wasting and degeneration of the muscles and of some other tissues. But the only essential feature of fever is the disorder of the body-heat.

In *health* the temperature of the body, though not *constant*, is nearly so. Taken in the mouth its daily range for an adult is from about 97.6° F. to 99.6° F. But within this range the temperature is *stable*; *i. e.*, causes, external or internal, which tend to raise or to lower it beyond the normal at the same time call into play physiological agencies which counteract any such effect.

To maintain a stable temperature different from that of the surrounding medium, the body must possess (1) means of producing heat (thermogenesis); (2) means of casting off or discharging heat (thermolysis); and (3) means of automatically adjusting the balance of 1 and 2, whatever their separate variations may be (thermotaxis).

Thermogenesis.—The chief source of heat within the body is the chemical change or oxidative metabolism continually going on in the muscles, and to a much less degree in the glands and alimentary tract during digestion. The muscles may be regarded as “the thermogenic tissues *par excellence*.” The metabolism subserving heat production in the muscles is under nervous control, like that which results in contraction or motion. The thermogenic nerves are closely associated with the motor nerves, but are probably not identical with them. In the case of the involuntary muscles and of the heart the motor nerves are accompanied by others whose function is inhibitory. These cause the contracted muscle to relax, and at the same time set up chemical changes in it which are not oxidative or destructive, but restorative or reconstructive. The motor nerves are, therefore, described as catabolic, the inhibitory nerves as anabolic.

Thermolysis.—The chief avenues by which heat is discharged from the body are the skin and the lungs, about 80 per cent. normally escaping by the skin and less than 20 per cent. by the lungs. These avenues are each controlled by a twofold nervous mechanism. The thermolysis of the skin depends chiefly on the flow of

blood through its vessels, whose caliber is increased by the vaso-constrictor (or catabolic) nerves and diminished by the vaso-dilators (or anabolic) nerves, each set having appropriate "centers" in the cord and medulla oblongata. The discharge of heat by the lungs depends on the rapidity and depth of the respirations, and these are likewise known to be controlled by a twofold nervous apparatus in the central nervous system. Thermolysis, therefore, like thermogenesis, may be regarded as subject to nervous control, which is on the one hand excitator or catabolic, on the other inhibitory or anabolic.

Thermotaxis.—As the mechanisms of heat production and heat loss are thus essentially nervous, that which adjusts their balance in health must also be nervous, and like other adjusting and coordinating mechanisms, must be higher than either—higher in complexity of organization, and higher and later in the scale of evolution. As it is more complex and less automatic, it is likely to be more easily disordered, and less definitely localized in the central nervous than the thermogenic and thermolytic mechanisms.

Temperature.—The temperature of the body at any moment is not, *per se*, a measure either of heat production or of heat loss. So long as the heat discharged is equal to that produced, the temperature remains constant, whether its level be high or low. If heat loss lag behind heat production, the temperature will steadily rise until heat loss becomes equal to and overpasses heat production, when the temperature will fall again. Thus a low temperature may coexist with excessive thermogenesis if thermolysis be adequate, and a high temperature may coexist with diminished thermogenesis if thermolysis be inadequate.

Thermal Ataxia.—If the thermotaxic mechanism be disordered or weakened without any serious disturbance of the other two thermal functions, these latter may vary independently, and, as there is nothing to bring them constantly to a balance, the body temperature undergoes large and irregular fluctuations. Of this nature are probably the "paradoxical" or "hysterical" temperatures sometimes recorded, which may for a short time rise to 110° F. or more, and that without grave or permanent lesion. The rise of temperature is not evidence of pyrexia, and its

fall is not defervescence; the condition is one of inco-ordination, and may be fairly described as thermal ataxia.

Pyrexia.—When the thermotaxic mechanism is disordered or weakened, and thermogenesis is at the same time morbidly and continuously increased, we have the condition of fever or pyrexia. Experiment and observation have alike shown that the high temperature which usually characterizes fever is due, not to continuously diminished discharge, but to greatly increased production of heat. Thermolysis is, indeed, proceeding at an abnormally active rate, and though at first it may lag behind, it at length overtakes thermogenesis. Thus the temperature does not rise continuously, but after a while fluctuates, at a high level indeed, but within moderate limits, for days together. At the same time, thermotaxis being enfeebled, the high temperature of pyrexia is essentially *unstable*, and may be raised or lowered by disturbing causes which in health would be quite ineffective. The increased thermogenesis occurs chiefly in the muscles, and is due not only to continuous overaction of the catabolic or excitator nerves, but to paresis or underaction of the anabolic or inhibitory nerves. The result is excessive oxidative or destructive metabolism, and deficient constructive or reparative metabolism of the muscular tissue. This is evidenced clinically by the excessive discharge in the breath of carbonic acid, and in the urine of nitrogenous waste products (excessive as compared with those derived from the food taken), and by the visible wasting and enfeeblement of the muscles.

Hyperpyrexia.—If the nervous disorder be more profound, affecting alike thermotaxis, thermogenesis, and thermolysis, the latter may fail altogether to overtake the excessive heat production, with the result that the temperature steadily rises until the disorganization ends in death. This condition, which without prompt and adequate treatment is always fatal, is called *hyperpyrexia*. Cases, indeed, occur in which the temperature continues to rise after both respiration and circulation have ceased, the thermogenic activity of the muscles, like their contractility, surviving somatic life, while physiological thermolysis is in abeyance.

Ætiology.—The nervous disorder which shows itself as fever may be occasioned by lesions which are (1) thermal,

(2) mechanical, or (3) chemical; to these we may add (4) reflex.

1. *Thermal*.—Prolonged exposure to hot air or water, by which, in the first place, the normal loss of heat from the skin by radiation and evaporation is checked, and, in the second place, the thermotaxic and inhibitory thermal mechanisms are at length exhausted or damaged owing to the continued strain upon them, gives rise to fever. This is usually accompanied by other signs of nervous disturbance, such as delirium or coma, and is known as sun or heat stroke, or heat-apoplexy. The thermal disorganization is very apt to pass into the graver form of hyperpyrexia.

The rational *treatment* is to abstract heat from the body, and this is best done by the immediate and persistent application of ice or cold water.

2. *Mechanical*.—Tumors, hemorrhages, embolisms, structural degenerations and traumatic injuries, whether in the brain or the spinal cord, may, if they involve the proper thermal tracts or centers, give rise to pyrexia. But similar lesions may equally well cause thermal ataxia, and if thermogenesis be checked or thermolysis increased, they may cause a fall and not a rise of temperature. Cases of each kind are on record,

3. *Chemical*.—Substances which act injuriously on the nervous system, and especially on the thermal mechanisms, may reach them through the blood, and are probably the commonest causes of fever. They may be produced (*a*) within the tissues themselves, when they are the result of morbid metabolism, *e.g.*, in rheumatism, or of normal waste which has failed to be eliminated, *e.g.*, in gout; or (*b*) in some natural or morbid cavity of the body the result of the action of living micro-organisms on blood or tissue or secretion (specific infective diseases, pyæmia, septicæmia); or (*c*) without the body, being introduced by injection into the blood (atropine, certain albumoses).

4. *Reflex*.—The best example is probably the “urethral fever,” which in some sensitive persons immediately follows the introduction of a catheter. Of this kind may be also the pyrexia which accompanies sudden and very painful injuries and local inflammations without suppuration, but associated with painful tension.

Clinical Terms.—The temperature is the most convenient index of pyrexia. In

this respect it resembles the state of the tongue, which, with certain reservations, indicates the condition of the digestive tract, and the state of the pulse, which tells us much, but not everything, of the condition of the circulatory system.

In most cases of pyrexia the temperature rises (onset), continues with moderate fluctuations for some days (acme), and then falls (defervescence), either suddenly (crisis) or by a succession of steps (lysis), to or below the normal. If the fall extend much below the normal, we have “collapse,” often a fatal sign. This is the type of a so-called “continued” fever, and is characteristic of many of the specific infective diseases.

In “hectic” fever, characteristic of tuberculosis, there is, for an indefinite period, a daily evening rise and morning fall of temperature, the fluctuations being large (3° to 5° F.) and rather irregular.

In “intermittent” fever, practically synonymous with ague (malarial fever), every day (quotidian), two days (tertian), or three days (quartan) there is an abrupt rise, a brief acme, and a crisis, the whole occupying only a few hours, and the temperature between attacks being normal.

In “remittent” or relapsing fever we have a succession of attacks of continued fever, each lasting for a few days, and separated by intervals free from pyrexia.

Temperatures are also classified according to a rough clinical scale originally proposed by Wunderlich. Thus, temperatures of:

deg.	deg.	
99.5 to 100.4		are sub-febrile.
100.4 “ 101.3		“ slightly febrile.
101.3 “ 103.1 (evening)		“ moderately febrile.
103.1 “ 104.9 (evening)		“ markedly febrile.
Higher temperatures		“ highly febrile.

Recovery.—From a typical febrile attack: “First, the thermolytic mechanism is waked to adequacy, there is a critical sweat or a relaxation of the vessels of the skin, and a gush of heat from the surface brings down the temperature with a run. But the thermogenic centers have not yet recovered, and the temperature will swing backward and forward for some days, and an epicritical excretion of urea takes place. Thermogenesis becomes less and less excessive, and is

vigilantly counterbalanced by thermolysis; but thermotaxis is yet feeble. The patient's temperature is down, but it is yet far from stable. As convalescence proceeds the stability increases, thermotaxis, the first to be disturbed and overthrown, being at last restored."

Treatment.—The treatment of a disease accompanied by fever must be directed chiefly to the removal or modification of the primary cause of the disease. When this cannot be done, and when the fever, either by reason of its duration or of its intensity, becomes itself a source of danger, it is advisable to employ antipyretic methods. These are directed, first, to increase thermolysis; secondly, to diminish thermogenesis. We have no certain knowledge of any whose chief or primary action is on the thermotaxic mechanism.

Heat loss may be increased with advantage, especially where the skin is dry, by increasing its vascularity and stimulating its sweat glands. For this purpose, alcohol in small and frequent doses, spirit of nitrous ether, and solution of the acetate of ammonium, with abundance of water to drink, are the simplest agents. In the earliest stage, aconite (1 minim of the tincture every five minutes till 30 minims have been given) has a useful effect in relaxing the superficial arterioles, and so discharging heat from the skin; but it is of little value when the fever has reached its height. Heat may also be actively abstracted, and in long-continued fevers with the best results, by the use of the cold or gradually cooled bath. In rheumatic fever, and especially in enteric fever, its efficacy in preventing exhaustion, in promoting comfort and refreshing sleep, and in averting danger to the brain and tissues is now beyond dispute. Simple sponging or other local application of cold is soothing but of comparatively small value as an antipyretic method. The patient should be immersed for from four to ten minutes in an ample bath, the water being at a temperature of 65° to 70° F., and the bath repeated as often as the temperature rises to a certain point, which will depend on the severity and course of the disease; thus, in moderately severe cases of enteric fever it may be fixed at 102.5° F., in rheumatic fever with a tendency to hyperpyrexia, at 103.5° F. In the somewhat rare instances when the patient evinces great repugnance to the

cold water, he may be immersed in a tepid bath at 80° F.; the temperature of the water may then be lowered by the addition of pieces of ice. On removal from the bath he should be very lightly covered. "I consider it proven as a matter of statistics that the cold bath treatment of enteric fever shortens the duration of individual cases, and, above all, very considerably reduces the mortality—namely, from 15 to 20 per cent. to 5 to 10 per cent."—NAUNYN.

Quinine in full doses (10 to 20 grains once or twice a day), and salicylic acid, with its allies, salicin and the salicylates (*e. g.*, 20 grains of sodium salicylate in solution, every three or four hours), tend to allay the pyrexia of almost all diseases, but quinine is much more efficacious in intermittent than in continued fevers, and the salicyl compounds in fevers due to rheumatic causes than in any others.

Chinolin, resorcin, kairin, thallin, have all marked antipyretic qualities, but their occasionally excessive action and other grave disadvantages have caused them to fall out of use in fever. The more recent products of synthetic organic chemistry, antipyrin, antifebrin, phenacetin, methacetin, pyrocin, are in many respects superior, and have come largely into use. Of these, antipyrin is the most to be recommended; it has more advantages and, on the whole, fewer drawbacks than any of the others. It may be given in doses of 15 grains, dissolved (say) in cinnamon or camphor water, at intervals of four to six hours when it is desired to maintain the temperature at a point not higher than 100° F., and this effect may be maintained for several days by slightly shortening the intervals between the doses. It is also useful as an adjunct to cold applications in cases of heat-stroke. In a small proportion of cases it causes an erythematous rash, which is harmless, and disappears in three or four days.

Antifebrin is cheaper than antipyrin, and the effective dose is smaller (3 to 5 grains); but is less soluble, and is apt to give rise to cyanosis or to aniline-poisoning. Phenacetin is also nearly insoluble; it is best given in powder or lozenges (5 to 10 grains), and its action on the temperature is gradual and very durable (eight to ten hours). In ordinary doses it does not produce any untoward effects. All three drugs are apt to give rise to profuse perspiration, but this in itself is no disadvan-

tage. Pyrocin depresses the temperature very powerfully, but is a dangerous drug, and should be avoided in ordinary practice. They produce no obvious effect on the primary disease, and their main action is exerted on the thermogenic mechanism, stimulating inhibition and depressing over-activity. The improvement they produce seems to be entirely dependent on the assuaging of pyrexia. They should be avoided in cases where the heart is flagging or actively diseased (myocarditis, ulcerative endocarditis, diphtheria), after great hemorrhage, during the catamenia, in massive pneumonia with pulmonary œdema, and in the late stages of tuberculosis or other long-continued and exhausting malady. As a general rule, they should at first be administered in small doses, the effect on the temperature and on the heart being observed: this will give data for determining the amount and frequency of the dose appropriate to the particular case.

DONALD MACALISTER.

Symptomatic Indications.—*Aconite* is the main reliance in fever, particularly in the early stage of inflammatory fevers; hyperpyrexia; high temperature; tension of nervous and arterial systems. *Veratrum viride* may be useful in both sthenic and asthenic fevers, when a full, hard, incompressible pulse is present. *Gelsemium* is valuable in remittent and typho-malarial fever, with full, quick, large, rather soft pulse. *Arsenicum* in typhoid, chronic intermittents, malignant and hectic fevers is invaluable; much prostration, thirst, burning pains. *Belladonna*, in cerebral hyperæmia, eruptive fevers, or pyrexia with inflammation of the throat, or mucous membrane.

FEVER AND AGUE.—See MALARIA.

FEVER, Bilious—See MALARIA. **Break-bone**—See DENGUE. **Cerebro-Spinal**—*q. v.* **Child-bed**—See PUERPERAL FEVER. **Endemic**—See MALARIA. **Enteric**—*q. v.* **Gastric**—See ENTERIC. **Intermittent**—See MALARIA. **Malignant Purpuric**—See CEREBRO-SPINAL. **Milk**—See MILK. **Paludal**—See MALARIA. **Periodic**—See MALARIA. **Pestilential**—See PLAGUE. **Petechial**—See CEREBRO-SPINAL. **Puerperal**—*q. v.* **Relapsing**—*q. v.* **Remittent**—See MALARIA. **Rheumatic**—See RHEUMATISM. **Scarlet**—*q. v.* **Simple**

Continued—See FEBRICULA. **Spotted**—See CEREBRO-SPINAL. **Typhoid**—See ENTERIC. **Typhus**—*q. v.* **Yellow**—*q. v.*

FEVER, TRAUMATIC.—**Traumatic, or wound fever.**—The febrile disturbance following a wound or other injury, including simple fractures and subcutaneous wounds.

Course.—In the course of a fully-developed case of traumatic fever two stages may be recognized, a primary simple traumatic or wound fever, and a secondary or inflammatory fever. The secondary fever is often absent; but it may occur without antecedent primary fever, it may be separated from the latter by a distinct interval of remission of temperature, or the one may pass insensibly into the other.

The height and duration of the fever bears an important, but not a direct and unvarying relation, to the extent and severity of the wound, for traumatic fever is, at times, almost or entirely absent after the severest injuries (for example, compound fractures and amputations), and may be severe after trifling injuries.

In wounds treated with modern precautions against decomposition and accumulation of secretions, the severity of traumatic fever has much diminished.

Primary wound fever.—The rise of temperature usually begins immediately after the injury, constituting the reaction from the shock; but it may be preceded by a fall of temperature or delayed until the second, or even the third day, counting the day of the operation as the first. The fever lasts from two to six days. The rise takes place rapidly, and reaches its highest point or fastigium usually on the second, but sometimes on the third or fourth day. In those cases in which the fastigium is reached more slowly the rise is interrupted by recurring remissions; otherwise it is continuous. In uncomplicated cases the highest point is rarely above 100° to 101° Fahr., but may reach 103° or 104° Fahr. The fall or defervescence is, in an equal number of cases, sudden or gradual, in other words by crisis or lysis. The fall in the former is continuous; in the latter is broken by evening exacerbations.

The highest temperature is often noticed twelve hours before the establishment of suppuration, when a sudden fall occurs.

Symptoms.—The general symptoms are similar to those of any simple febrile

disturbance, and are generally proportionate to the degree of fever; they consist in derangements of the circulatory, digestive, and depurative organs, and of the sensorium. The pulse is full and frequent: its chart tracing runs parallel with that of the temperature, except, occasionally, in old people, when it falls relatively much below the temperature. The tongue is furred and there is loss of appetite, thirst and constipation, severe cases being marked by dryness of the tongue and, perhaps, retching and vomiting. The patient suffers with headache, malaise, or a sense of illness; broken rest or sleeplessness sometimes culminates in mental excitement and, rarely, delirium. The skin is dry.

The excretion of urea is increased, and is most abundant a day or two after the highest temperature. Rigors are very rarely or never observed, but a feeling of chilliness may be experienced.

Coincidentally with the development of traumatic fever, the wounded or injured part shows evidences of reaction, such as heat, pain, swelling, and sometimes tension.

Secondary or inflammatory fever.—In favorable cases the defervescence of the primary fever is succeeded by an uninterrupted convalescence; but if from any cause the secretions of the wound are retained, or if undue inflammation is excited in it or in adjacent parts, a sudden or more gradual rise of temperature occurs, accompanied by chilliness, and in the more severe cases by a rigor; an exacerbation of the general symptoms of fever follows. The secondary fever may be directly continuous, without a break, with the primary fever; and in such cases in which the traumatic fever is prolonged beyond the eighth day, or in cases in which at any time the temperature rises after it has distinctly fallen, local inflammatory processes will be generally found at the seat of the wound.

Inflammatory fever usually appears on the sixth to the ninth days, but may occur as early as the fourth day or at any subsequent period until the healing of the wound is completed. If slight it may last only one to two days, while in other cases it may be continuous, passing into the condition of hectic or suppurative fever; or it may be the precursor of one of the complications of wounds. Its origin must necessarily be

sought in any of the causes exciting undue inflammation in wounds, of which the chief are: the retention of secretions in deep, devious, or ill-drained wounds, tensions or ulceration about sutures, the irritation of foreign bodies or ligatures, the presence of sloughs of skin, tendons, and fascia, and, in wounds of certain localities, the retention of urine or fecal matter. Lastly, in wounds adjacent to or involving the large serous cavities, localized inflammation may be set up in the lining membranes.

Causes modifying traumatic fever.—These may be divided into local, and general or constitutional. Of the local conditions, the nature, extent, and severity of the injury exercises an influence only secondary to that of the general condition of the wound. After contused, and the nearly allied gun-shot wounds, traumatic fever is prolonged and severe. It would, however, not be anticipated that wounds inflicted by the cautery are rapidly followed by a well-marked fever prolonged until the eschar has separated.

In the aged traumatic fever is slowly developed, and of little intensity. Excessive loss of blood is followed by a rapidly occurring and high degree of reaction, while after severe shock, the fever is ill-defined and remittent. In those already suffering with fever from chronic suppurative diseases, traumatic fever is quickly excited and unusually severe, although exceptions to this are found in cases in which the removal of a source of irritation is followed by a marked general improvement.

The influence of visceral disease is often grievously manifest when operations are performed in those suffering from somewhat advanced phthisis, by an unusual severity of the fever, with a rapid extension of the pulmonary disease. Albuminuria, whether from granular or lardaceous disease of the kidneys, exercises but little influence on the traumatic fever itself, although it carries with it a serious liability to the various complications of wounds. The subjects of rheumatism and syphilis are liable to outbreaks of these diseases after injuries or operations, with a consequent modification in the course of the temperature. Alcoholism also has an unfavorable effect.

Complications.—Traumatic fever may be complicated by, or may pass into, any

of the various diseases complicating wounds, as septicæmia, pyæmia, erysipelas, gangrene, etc., of which the onset may be diagnosed by the course of the temperature and the general symptoms. Its relations with septicæmia especially are undoubtedly intimate, and, in fact, its severer forms have been described as septic traumatic fever, being indistinguishable from the less acute forms of blood poisoning.

Pathology.—It has been experimentally proved that the perfectly fresh and undecomposed secretion flowing from a wound during the first twenty-four or twenty-eight hours is capable of producing intense fever, and that the serum expressed from fresh blood clot is also pyrogenous, the febrile action being, probably, in great measure due to the febrin ferment, which is set free by the decomposition of the white blood corpuscles. It is, therefore, highly probable that primary wound fever is chiefly due to the absorption into the circulation of the undecomposed sanious serum, together with the blood and lymph exuded from freshly made wounds; and as the same materials are effused in simple fractures, subcutaneous wounds, and contusions, the same theory will hold good for them.

The secondary fever is likewise produced by the absorption of the secretions of inflamed wounds, which, although undecomposed, possess, in addition to an intense febrile action, a locally irritating effect.

Treatment.—The preventive measures, as well as the treatment of traumatic fever, are comprised in the general management of wounds, especially as regards drainage, cleanliness, and the avoidance of tension. Sources of irritation and of pain should, if possible, be removed. Measures calculated to relieve the general symptoms of fever should be employed, constipation being remedied by the exhibition of saline aperients, and excessive fever controlled by quinine, and, if necessary, by sponging with tepid water or the bath.

FREDERIC S. EVE.

Symptomatic Indications.—In the early stage *aconite* is the principal remedy, particularly when the fever is of the inflammatory type. If the fever assumes the typhoid or asthenic character *arsenicum* is efficacious; when pyæmia is pres-

ent lachesis does good service. When of a hectic character as the result of exhausting discharges *cinchona* is valuable.

FEVER, HECTIC OR SUPPURATIVE.—**Hectic**, a continuous or abiding fever, is the constitutional disturbance accompanying long-continued suppuration, and other inflammatory diseases.

In surgical practice it is frequently observed in those exhausted by suppuration, from large abscess cavities, or in the subjects of chronic suppurative diseases of joints and bones; it occurs also as the result of injuries, such as compound fractures, or of operations, and, in fact, of any surgical disease entailing suppuration with exhaustion. But *profuse* suppuration, although a most important element, is not essential to its production, for in medical practice it is a conspicuous symptom of phthisis, even in cases which have not progressed to extensive softening and suppuration of the pulmonary tissue. Empyæma, hepatic abscess, and tuberculous disease of the kidneys may be named among other diseases in which it is commonly observed.

Symptoms.—The gradual onset of hectic fever progresses step by step with increasing weakness and emaciation. The fever is characterized by elevation of temperature to 100° or 102° F., in the evening, with a remission in the morning to or even below the normal standard; in rare instances a rise occurs more than once in the twenty-four hours. The pulse is feeble, and quickened to 100, 120, or above. The digestive organs, at first unimpaired, are soon affected; the appetite becomes precarious, the tongue red at the tip and edges, and slight constipation gives place to frequent attacks of profuse and obstinate diarrhea. During the day, the skin, especially that of the hands and feet, is dry, but, with the decline of temperature toward the early morning, the patient breaks out into a profuse perspiration, which is followed by intense languor and exhaustion. Increased quantities of urea and salts are excreted by the kidneys. The intellect remains clear to the last. The emaciation becomes extreme; the mouth and tongue are covered with aphthous patches; and exhaustion with diarrhea terminate the case.

Lardaceous disease is a common concomitant of hectic, for the conditions of their development are closely allied.

Ætiology and pathology.—Hectic fever is generally referred to the absorption of pus which has undergone fermentative changes; but, by some, exhaustion is looked upon as the chief factor in its causation. The former theory is supported by the following facts: that it does not occur until an abscess is opened, and that it is prevented or checked by adequate drainage, and methods of dressing which prevent decomposition. There is probably truth in both theories; exhaustion doubtless exercising a powerful influence on the centers in the medulla immediately regulating the vital functions, and rendering them more sensitive to the pyrogenous action of purulent matters absorbed into the circulation. The cyclical character of the fever in hectic cannot, however, be taken as proof of its purely nervous origin, for other fevers due to specific causes, as malaria, show an even more regular periodicity.

Treatment.—The local treatment must vary with the nature of the disease. The accumulation and decomposition of pus in abscess cavities should be prevented by drainage, posture, and antiseptics. Parts affected with local suppurative diseases, when a cure is otherwise despaired of, should, if possible, be removed without delay. A nutritious diet, frequently administered, and stimulants in moderate amounts are indicated. Special symptoms will require appropriate treatment. To check diarrhea, pulv. kino co., sulphuric acid, and chlorodyne are respectively the most useful remedies. Excessive perspiration is controlled by the administration of strychnia and of atropine. Quinine may be given as a tonic and febrifuge.

FREDERIC S. EVE.

Symptomatic Indications.—When the result of exhausting discharge *cinchona* is the main reliance. In connection with diseases of the lungs *phosphorus* does excellent service, especially when there are emaciation, loss of strength and paleness, clammy night sweats. When attended with great emaciation, with debility and palpitation of the heart, thirst, restlessness, *arsenicum* will relieve.

FIBROMA.—See TUMOR.

FIBULA, DISLOCATION OF.—See DISLOCATIONS.

FIBROID PHTHISIS.—See LUNGS, CIRRHOSIS OF, and PHTHISIS.

FIBROID TUMORS.—See UTERUS, FIBROIDS OF.

FIBROMA MOLLUSCUM.—See MOLLUSCUM FIBROSCUM.

FIBROMA FUNGOIDES.—See GRANULOMA FUNGOIDES.

FIFTH NERVE.—See FACIAL NERVE, DISEASES OF.

FILARIA MEDINENSIS.—See PEDICULOSIS.

FILARIA SANGUINIS HOMINIS.—An embryo of a minute nematode worm which infests human beings in certain tropical climates.

The female is “a long slender hair-like animal quite 3 inches in length, but only $\frac{1}{100}$ inch in breadth, of an opaline appearance, looking, as it lies in the tissues, like a delicate thread of catgut animated and wriggling. The male is considerably smaller than the female.

The parent worm inhabits the lymphatics; into these the embryos are discharged, and, making their way into the thoracic ducts, reach the blood. They can, however, be found in the blood only during certain hours, as a rule between 6 P.M. and 9 A.M., but by reversing the habits of the patient, making him sleep in the day time and keep awake at night, the filariæ make their appearance in the day instead of at night.

Though constantly discharging large numbers of embryos into the lymphatics, their presence may give rise to no symptoms, and it is only when the ova are prematurely discharged that the ill results occur. The embryos, when fully developed, are extremely narrow, elongated, encapsuled bodies, capable of passing the most minute capillary network, but at an earlier stage of their development they are round, and of much greater diameter. When, therefore, they are prematurely discharged, being carried by the lymphatics to the nearest gland, they are there arrested. In this way complete lymphatic obstruction is brought about, and the diseases known as elephantiasis, lymphscrotum, and chyluria (*q. v.*) are the result, according as the lymphatics of the legs, scrotum, or pelvis are obstructed.

JOHN ABERCROMBIE.

FINGERS, DISLOCATION OF.—See DISLOCATION.

FISH-SKIN DISEASES.—See ICHTHYOSIS.

FISTULA IN ANO.—See ANO.

FISTULA; RECTO-URETHRAL.

—Occurs as a result of an abscess in the tissues between the bowel and the urethra, and quite frequently in the prostate gland. The common termination of these abscesses is in perineal fistula. Having one end of the sinus or sinuses in the urethra or rectum, forming a urethral or anal fistula, though the termination is occasionally by an opening through the perineum externally and through both the rectum and urethra internally, constituting a recto-urethro-perineal fistula. Still more rarely they open into the urethra and rectum without any external opening, constituting a recto-urethral fistula, which is often extremely annoying.

The first sign generally of the formation of a fistula is the appearance in the urine of fecal matter, or less frequently by the passage of the urine per anum, and in some cases the passage of air from the urethra. These symptoms follow upon those of an abscess of the perineum. The appearance of these symptoms will suggest the necessity of a thorough examination both by the urethra and rectum. For this purpose a steel sound should be passed into the bladder, the finger then introduced into the rectum, and the prostate and tissues carefully examined. It is possible where the opening of the sinus is situated too high to be reached by the finger, or if it is beyond the stricture to make out the walls of the sinus. The Bodenhamer speculum may next be introduced, and a probe bent to the proper curve passed through the sinus striking the sound in the urethra.

Diagnosis is to be made from recto-vesical fistula. In the former the urine passes by the bowel only when micturating, while in the latter it may pass at any time, the reverse is just the case with the fæces, in recto-urethral the fæces may pass at any time; in recto-vesical only during micturition. The cause of this variety of fistula may be due to an ulceration of the urethra behind a stricture, and the escape of urine into the tissue causing an abscess; ulceration of the rectum from stricture and escape of fecal matters.

Treatment.—When a stricture exists this requires first attention. When this is relieved the fistula will usually heal of itself, especially when recent. If it should still continue, or if there is no stricture or

other removable cause for the fistula, rest in a recumbent position, keeping the bowels quiet with opium, with an enema every few days to clear them, and the removal of the urine with a catheter will often suffice to bring about a cure. Should the fistula continue the sphincter ani should be ruptured and the fistulous tract cauterized with the fused nitrate of silver, or with the galvanic cautery. A case is reported by Sir Henry Thompson where a cure was effected by placing the patient flat on his face during the act of micturition, so as to make the urine pass through the urethra. This should be tried before resort is had to the incision of all the tissues from without down to and into the track of the sinus, parting the walls of the sinus and bringing the sides of the wound together, as performed by Drs. Nott and Emmet.

FISTULA, Recto-vaginal, Recto-vesical, Utero-vesical, Vesico-vaginal.

—Fistulous openings may exist 1st, between the urethra and vagina; 2d, between the bladder and vagina; 3d, between the bladder and uterus, 4th, between the vagina and rectum. In certain cases a common communication may open bladder, vagina, and rectum into one. The various forms of simple fistulæ usually result either from contusions or lacerations in parturition, from the introduction of foreign bodies, or from the effects of calculous concretions in the bladder, or operations for their removal.

The inconvenience caused by any communication between the bladder and adjacent cavities is extreme, since it is usually attended by constant incontinence of urine. A larger opening may, however, exist between the rectum and vagina without exposing the patient to much annoyance, since in many cases the involuntary escapes of fæces occurs only when the motions are unusually fluid. Although by the use of the actual cautery small fistulæ may be much diminished, yet they can very rarely be made wholly to close, and the after-treatment in these cases is as irksome as in those of operation.

The following are the steps of the operation in a case of vesico-vaginal fistula; The patient should be in her best state of health, and the bowels have been well cleared out. Chloroform having been given, the woman is placed either on her

side, with the knees well drawn up, or in the usual lithotomy position. The parts being well exposed by the duck-bill speculum, the nates being held widely apart by an assistant, the operation proceeds to drag the opening as low down as possible, to facilitate the paring of the edges. This may be accomplished either by hooks, blunt or sharp, by the use of a metal suture, or by the introduction of a flexible sound by the ur  thra, which is brought out again through the fistula, and then bent backward. This latter plan furnishes the most efficient hook, and one which cannot easily slip. In paring the edges, it is necessary to thoroughly denude every part; for if the smallest portion of mucous membrane be left, it may prevent union. None of the mucous membrane of the bladder must be removed. The wound should present a beveled oblique line, slanting from a large vaginal opening to a smaller vesical one. The denudation being complete and free, sutures are to be introduced. These should be passed obliquely from at least a third of an inch outside the edge of the incision. They must not include the mucous membrane of the bladder. The tightening and tying of wire sutures is easily accomplished by the fingers. Care must be taken not to pull them too tight, so as to invert the edge of the vaginal mucous membrane. The instruments used in these procedures consist of small knives, forceps, and needles of various construction. Startin's tubular needle for carrying wire is in most cases the best. Provided the precautions insisted on, as to avoidance of the mucous membrane of the bladder, be observed, it does not appear that there is much difference in result from wire or silk ligatures. Still, as it is certain that wire is not more irritating than silk, and as it is at least equally easy to use, it may be considered preferable.

After-treatment consists chiefly in keeping the bladder empty. A catheter, either the small silver one (Sims'), or a common flexible one, should be retained; and it should be a nurse's duty to see that the urine is constantly flowing. The catheter should be changed and cleaned twice daily; and if at any time the flow of urine stop, it should at once be examined. The patient must lie on her side, with the knees drawn up, and every attention must be paid to sustaining her general health. The sutures may be left in almost

indefinitely; and unless it is clear that the operation has failed, they should certainly not be removed till the ninth day. If cicatrization has occurred, they will cause no inconvenience; and their retention a few days longer than is absolutely necessary is a matter of no consequence, while their premature removal is a very grave error. And should be effected with every precaution.

The nearer the fistula is to the urethra, the more easy is the operation in performance, but the greater the chance of failure. One difficulty in closing urethral fistula arises from the fact that the catheter almost necessarily presses upon the line of union.

In cases in which the fistula is very high up—it may be even connects the bladder with the cervix uteri—certain modifications in the plan of operation will be required. It may be desirable to obliterate the upper part of the vagina, and to connect the uterus with the bladder, thus allowing the menstrual fluid to pass per vesicam, but preventing incontinence of urine.

The operation in recto-vaginal fistula does not differ materially. The paring of the edges must be practiced in a similar manner, and care must be taken to avoid the rectal mucous membrane. The bowels must be kept from acting for ten days subsequently, and it may be well to retain a catheter in the bladder. Whether the sphincter ani should be divided will depend upon the degree of tension which is present when the parts are brought together. It is not a slight measure, and should not be needlessly resorted to, the unincumbered suture of twisted wire is better than any form of compress or button, and far better than the shotted one. After the operation the vagina should be washed out daily by injections of tepid water.

JONATHAN HUTCHINSON.

FISTULA, URINARY.—The external openings of these passages are most commonly in the perineum and scrotum, which are traversed by them in various, often circuitous, routes; less frequently they are in the groins, the upper part of the thighs, the adjacent part of the nates, or even above the pubic symphysis. In the last-named situation, the devious channel usually results from incisions made to relieve extravasation; but in the

scrotum or perineum it is generally due to a previously-existing urinary abscess. Under the term "urinary fistula" all these conditions are included; some of them simple, and easily amenable to treatment; others complicated, and requiring much care and time. Some are merely narrow channels through nearly healthy parts; others pass through structures indurated and deformed by repeated deposits of plastic matter, and sometimes connected with cavities secreting pus, and detaining in their interior some quantity of the urinary secretion. The external orifices of the fistulous passage may be few or numerous; being in the latter case the outlets of sinuous channels springing from the original track, and giving exit to a number of small streams when the act of micturition is performed. Besides the foregoing, there are openings into the urethra which have their origin in loss of substance by sloughing from extravasation, phagedenic ulceration, or violent injury to the parts; and these abnormal conditions are distinct in their nature from the two preceding classes. This mode of arranging the numerous and widely-differing lesions comprehended under the general term urinary fistulæ, indicates three forms of morbid condition, and requiring appropriate treatment.

1. Simple fistulæ. The first class embraces those where, in connection with stricture of the urethra, one or more fistulous passages exist, the surrounding parts being not much altered from their natural or healthy condition. These openings are nature's mode of affording relief in cases of narrow stricture; they act as safety-valves to the pressure exerted upon important organs behind the obstruction. Thus we often see patients enjoying fair health, notwithstanding large fistulous passages in the perineum, by which all their urine is passed. But the annoyance, sometimes the pain, besides the tendency to grow worse, which accompany urinary fistula, to say nothing of considerations arising in relation to the sexual function, demand the interference of the surgeon. As a rule, nothing else is required than to dilate freely the urethra. The urine will flow by the natural channel, and the fistulæ will heal of themselves, if we insure a free passage from the bladder. Those who form the exceptional instances to

this rule are for the most part weak in constitution, have little reparative power, or are subjects of some chronic disease in addition to stricture of the urethra. The management of these is mostly that of the next class.

2. Cases in which the fistulæ pass through tissues indurated and deformed by inflammatory exudation.

In these the primary object is to dilate adequately the stricture, and to observe the effect induced. In some it is sufficient to enable the fistulous passages to heal slowly. Dilatation, however, having been maintained for some time, with little or no benefit, it will be desirable to stimulate the walls of the fistulæ themselves, and so bring about adhesion of opposing surfaces; or to lay them open, in order to produce recent and healthy wounds, so that they may heal up soundly from the bottom. We must attend closely to the general health, and maintain the secretions in a natural condition. To stimulate the indolent fistulæ, one of the best agents is the concentrated tincture of cartharides, applied on a camel's-hair brush, or with a fine syringe. Solutions of the sulphate of zinc or copper, and of the nitrate of silver injected by the syringe, sometimes give good results. An excellent mode is to introduce carefully, as far as possible, a small and flexible silver probe, coated with nitrate of silver, a plain probe having been introduced beforehand as a guide to the length and direction of the passage. It often happens that the external orifice of the sinus is smaller than any other part; in such a case, a little caustic potash should be applied for the purpose of enlarging it, and so permitting free removal of the discharge.

The application of compression to the fistulæ has been tried and success has been claimed; in one all ordinary means having failed, a cure was obtained by making the patient apply firmly to the perineum an india-rubber ball, inflated with air, on every occasion before making water, and for some minutes afterward. This plan was followed during fifteen days, when the opening had soundly cicatrized. Four months after the fistula had not returned.

The cure of obstinate urinary fistula has been attempted by introducing a catheter, permitting it to remain in the urethra for days, the urine passing through

the instrument, and thus preserving from irritation the fistulous passages. Little is thus gained; for however large the instrument and closely it may fit the urethra, before thirty-six hours have elapsed it will lie loosely in the canal, and urine will pass by its side.

It is better to withdraw all the patient's urine by introducing a catheter daily three times or more if necessary. When the patient can do this cleverly for himself, and thus insure, at every want to pass urine during a period of several weeks, that it is carefully removed without contact with the urethra, improvement may be hoped for. In a case where a large portion of the floor of the urethra was lost, the opening closed after three or four months' attention to this practice.

Free incisions through the fistulæ, down to their origin in the urethra, or nearly so, have been found successful in inducing a healthy process of granulation from the bottom of the wound, and thus in ultimately closing the unnatural passages; provided, however, that there is no obstruction to the free egress of the urine by the urethra, otherwise no such measures can be of service. In some cases in which external division of the stricture on a grooved staff is indicated, this operation may be performed in such a manner as to include the fistulous opening in the incision, in which case a successful result may generally be counted on. Old chronic perineal fistulæ are sometimes best dealt with by the galvanic cautery. Another obstinate species of fistulous passage, communicating with the prostatic urethra, sometimes follows the operation of lithotomy; this may be often successfully treated by the introduction of an iron wire heated to intensity; the best means of effecting which is the galvanic current, since it maintains as well as produces the required temperature.

Fistula is not necessarily a continuous passage from the urethra to the surface; opening from the urethra at one end, it may have a blind or fecal extremity. A small tumor, originally formed by a collection of matter, and having a communication with the urethra, constitutes the general form. Its origin has been variously accounted for, some believing it a result of stricture, others of inflammation of the mucous follicles of the urethra. Until the tumor is opened

externally, it will not disappear, when it becomes a fistula of the ordinary kind.

H. THOMPSON.

FISTULA, VESICO-INTESTINAL.

—Fistulous openings sometimes form between the bladder and some portion of the intestinal canal. The result is that some of the liquids from this latter source enter, at first in minute quantity, and give rise usually to much irritability of the bladder and other symptoms of subacute cystitis. These are sometimes the earliest signs of the existence of an abnormal communication. If the urine is examined at this early period, fragments of vegetable and of animal fiber may be discovered under the microscope. Usually the symptoms become gradually more severe, and the fecal odor and color are communicated to the urine. At length considerable fragments of fecal matter enter the viscus, become partially dissolved there, and pass through the urethra. It occurs both in the male and in the female, but chiefly in the former; and in these, carcinomatous disease in the abdomen has been the most frequent cause. For adhesion may take place between an ulcerating bowel and the bladder; and the ulceration may extend into the latter, no cancerous disease being present.

Treatment.—The lesion having been determined, instrumental interference is—except under special necessity, such as for the purpose of removing foreign bodies from the bladder, which are a source of great misery—to be shunned. Purgatives are also to be avoided; but the bowels should be maintained, as far as possible, in the natural condition. The food is to be such as will nourish the body without producing a large and coarse residue of fecal matter. In a case in which for several months the whole of the fæces were passed by the urethra, a great amount of suffering was occasioned by swallowing indigestible substances, like grape-stones, by a careful selection of fluid nutriment, the most painful features were much ameliorated. Now and then washing out the bladder with small quantities of tepid water gently thrown in contributed to the patient's comfort. In this case the ulceration was not due to cancer.

For some of these cases of non-malignant disease another form of treatment remains: When it can be determined

that the fistulous passage connects the bladder with the rectum, or with the sigmoid flexure of the colon, the propriety of opening the descending colon (Amussat's operation) ought to be considered. In one case, this operation was performed with success, the passage of fæces being diverted from the bladder by the artificial anus. The point to be determined, if possible, before operating, is whether the communication exists between the small or the large intestine or rectum, and the bladder. If it is in the descending colon or below, urine will probably issue at some time or another per rectum; if the small intestine is the seat of ulceration and opens into the bladder, no urine can be expected to issue by the bowel. In favorable cases, this proceeding should certainly be adopted.

SIR H. THOMPSON.

FLAT-FOOT.—*Causes.*—Prolonged standing or excessive walking in persons of weak and relaxed fiber, synovitis of ankle, injury to ankle, gonorrheal rheumatism of ankle, genu valgum.

Pathology.—The ligaments which brace up the arch of the instep are lengthened, the head of the astragalus sinks through relaxation of the calcaneo-scaphoid ligament, and the scaphoid tuberosity projects excessively; in bad cases the metatarsus is turned more or less outward, and the outer edge of the foot turned upward by the peronei; ankle bends inward, hence the name talipes valgus.

Treatment.—Steel spring or india-rubber pad under arch of foot; the former being let into sole of boot; internal upright bar to support inner ankle; bad cases of talipes valgus require a horizontal bar for the attachment of straps to correct abduction of metatarsus. Even division of peronei occasionally required. Always strengthen general health; avoid standing; exercise systematically flexor muscles. In nine cases out of ten at least, by judicious exercise of the leg muscles, combined with an india-rubber bandage properly applied to the instep and ankle, a successful result has been attained.

C. B. KEETLEY.

FLOATING KIDNEY.—See KIDNEY, MOVABLE.

FLUCTUATION.—When fluid is present in a cavity, if the hands be placed at opposite points on its walls and a sharp tap be given with a finger of one hand, a shock is felt by the other. This sign is termed "fluctuation," but the same term is also used to describe the sensation received when alternate pressure is made over an abscess or through a joint containing fluid. In the case of a cavity it is essential that it should not be very small nor the fluid too thick. When the abdomen is very tense, it may be necessary for an attendant to place the edge of his hand along the linea alba in order to arrest the vibrations of the abdominal walls which are produced when a tap is given to the side, otherwise they may be mistaken for the fluctuation of fluid within the peritoneum.

FOLLICULAR HYPERÆMIA.—This is an accompaniment of many diseases, particularly of those attended by pruritus, for in these it is readily excited by scratching, as in scabies, eczema, and phthiriasis. It gives rise to red papules which are seen to be seated at the hair follicles in part, and partly to be hyperæmic papillæ. This condition is erroneously styled lichen. Soothing remedies are required. There is also a condition of follicular hyperæmia met with in adults, though rarely. The surface is uniformly dotted over with red points, every follicle being affected, but the papules are not very prominent, and have no central plug. They are almost completely removable by pressure. The skin of the arms, thighs, and trunk is generally affected. The disease is itchy, chronic, very obstinate, and occurs in debilitated persons who have been a good deal worried. The disease seems due to vasomotor disturbances of the follicles, and is nearly allied to lichen ruber. FOX.

FOMENTATION.—When the local effects of heat are needed, but the use of a poultice is not desirable, a fomentation will generally best fulfill the indications. It may be moist or dry. If the former be preferred, a flannel or cloth is placed in boiling water, then thoroughly wrung out and applied to the part as hot as it can be borne, and covered with oiled silk or waterproof. As compared with poultices, hot fomentations have the advantages of being more cleanly and lighter.

the disadvantages being that they cannot be used where there is an open wound, and that they speedily lose their heat, and therefore require to be changed frequently—every half-hour or so. Hot moist fomentations are especially useful in cases of peritonitis, and in renal and other forms of colic. Their action may be aided by the addition of a few drops of turpentine (the so-called turpentine stupe), or, if a sedative effect be desired, by sprinkling a dram or more of laudanum over the flannel, or by using a decoction of poppy-heads, instead of boiling water. The decoction is prepared by boiling $\frac{1}{2}$ lb. of poppy-heads in 2 quarts of water for ten minutes, straining, and allowing the clear fluid to stand by the fire. Instead of cloths or flannel, spongio-piline may be used in a similar way, and has the advantage of retaining the heat rather longer. Sometimes dry fomentations are preferable; for this purpose either hot bran or chamomile flowers are applied in bags, or a piece of flannel or cotton-wool simply warmed in front of the fire. This is particularly applicable for the relief of earache or colic.

FOURTH NERVE, DISEASES OF.—This nerve, which emerges from the valve of Vieussens and courses round the outer surface of the crus cerebri to supply the superior oblique muscle in the orbit, is liable to be paralyzed from neuritis due to syphilis, from compression by tumors at the base of the brain, by an aneurism of the internal carotid, and by growths in the orbit. The nucleus in the upper part of the floor of the fourth ventricle is liable to be destroyed by tumors inside the pons, and may undergo atrophy in association with the other ocular nuclei, as in ophthalmoplegia externa.

Symptoms.—Diplopia and a slight amount of paralysis, observed when the patient looks downward. The action of the superior oblique is to direct the eyeball downward, and at the same time rotate it so that the upper end of its vertical axis comes nearer to the middle line; the defect of movement is therefore downward and inward, but it is often too slight to be noticed. Diplopia is present on looking downward, and the false image is below the true one, and its upper end is tilted toward the middle line of the

body. To obviate the diplopia the patient inclines his head forward and toward the sound side.

Treatment.—As syphilis is the most common cause of paralysis of this nerve, iodide of potassium should be given in large doses. When the lesion is due to the presence of a tumor, the same treatment is advisable, as the growth may be of syphilitic origin.

C. E. BEEVOR.

FRACTURES.—Sudden and violent solutions of continuity in a bone.

Varieties.—(1) *Simple*, when unaccompanied by an open wound leading to the broken bone; (2) *Compound*, when an open wound communicates with the seat of fracture. A fracture may be rendered compound at the time of injury by the violence causing the fracture, either lacerating the tissue or forcing the end of one of the fragments through the skin; in other cases a fracture, at first simple, may become compound from sloughing or ulceration of the tissues over the seat of injury.

A fracture is *complete* when it involves the entire thickness of the bone, and *incomplete* when it affects a portion only of its thickness; the former variety is the more common, the latter being met with in cases where a bone is partially fissured, as is sometimes seen in the vault of the skull, or in the so-called "*greenstick*" fracture, an injury often occurring in young subjects, where the shaft of a long bone is bent and partially broken, the fracture only involving the bone on the convexity of the curve; in these cases the periosteum often remains untorn, and there is little or no displacement of the fragments. Other forms of incomplete fracture are the *splintered*, where a small portion or splinter of bone is separated, and the *perforated* or *punctured*, the result usually of a gunshot wound.

A fracture, again, may be *single*, a single line of fracture involving a single bone; *multiple*, two or more fractures involving the same or different bones.

When the bone is broken into several fragments, the fracture is *comminuted*. A fracture is described as *transverse*, *oblique*, *longitudinal*, *spiral*, *T-shaped*, *stellate*, and *dentate*, according to the direction which the line of fracture takes; *impacted* when one fragment is driven into and fixed in the other.

When occurring in the neighborhood of a joint, *e. g.*, the hip or shoulder, the terms *intracapsular* and *extracapsular* are employed, as the line of fracture is internal or external to the capsular ligament. A fracture is *complicated* when it is accompanied by injury to some other important part, *e. g.*, by a dislocation or wound of a neighboring joint, or by wound of a large blood vessel, or of some internal cavity or organ; a simple fracture may be complicated by an external wound, the fracture not being compound unless the wound in the soft parts leads down to or exposes the bone.

Separation of the epiphyses; these injuries, which occur only in young subjects before ossification is completed, may involve the ends of any of the long bones, the upper and lower epiphyses of the humerus being those which are, perhaps, most frequently separated; less frequently the epiphyses of other bones are involved, *e. g.*, those of the os calcis, acromion, olecranon, etc.

Causes.—(1) *Predisposing.*—Include all conditions, constitutional or local, in consequence of which the osseous tissue becomes unusually fragile, weakened, or diseased; *e. g.*, old age, rickets, certain nervous affections, such as locomotor ataxy, general paralysis of the insane, etc., caries or necrosis, malignant tumors of bone, osteo-malacia, atrophy of bone from any cause, absorption of bone from pressure of tumors, or syphilis, when the bone becomes the seat of gummatous deposits.

Other predisposing causes are the male sex, in consequence of their more constant exposure to violence, and the shape and situation of particular bones, the long ones of the extremities being more frequently involved than short, thick bones like the bones of the vertebræ, etc.

(2) *Exciting* causes are (a) external violence, which is the more common, and may act directly or indirectly. When due to *direct* violence the fracture takes place at the part struck, *e. g.*, when a blow on the nose fractures the nasal bones; in these cases the soft tissues covering the bone are frequently bruised, or torn and lacerated, as the result of the force causing the fracture, so that an open wound is produced which leads down to the bone, and the fracture is consequently often compound. When due to *indirect*

violence, the force acting at one spot is transmitted, and causes a fracture at a distance from it, *e. g.*, when a person falling upon the hand or shoulder fractures the clavicle.

(b) *Muscular action* is not a common cause of fracture when the bones are in a healthy condition, except in the case of the patella, which is often broken by the contraction of the powerful quadriceps extensor in an attempt to save the body from falling backward. Less frequently some of the other bones, *e. g.*, the olecranon, os calcis, etc., are fractured as the result of sudden violent contraction of the muscles inserted into them. When the bones are in a softened or diseased condition, fracture of any of them, even the long ones of the extremities, may be produced in the same way; most of the so-called *spontaneous fractures* belong to this class, being due to muscular action acting upon bones which are weakened from some of the causes predisposing to fracture.

In the same way separation of the epiphyses of the long bones is not uncommon in infants the subjects of congenital syphilis, owing to changes of an inflammatory character taking place at the junction of the shafts with the epiphyses; a somewhat similar condition is occasionally met with in children who are affected with "acute rickets" or "infantile scurvy," in consequence of effusions of blood taking place between the epiphyses and shafts, and also beneath the periosteum.

Intra-uterine fracture.—Fractures occasionally occur in the fetus, in some cases as the result of external violence, *e. g.*, a fall or blow on the abdomen of the mother; in other instances, in consequence of abnormal contraction of the uterus, or even of the muscles of the child itself. The fracture, which may be either simple or compound, may or may not have united at birth. Intra-uterine fractures must not be confounded with those occasionally produced as the result of violence sustained during delivery.

Symptoms.—The general symptoms are abnormal mobility, deformity, crepitus, and loss of power, with more or less pain, swelling, and ecchymosis at the seat of injury; occasionally the patient is sensible of a distinct crack or snap produced by the giving way of the bone at the moment the fracture occurs.

All these symptoms are not, however, present in every case, being modified by various conditions.

Abnormal mobility, owing to the loss of continuity in the broken bone, can usually be detected by grasping the limb on either side of the seat of fracture, and then moving the fragments to and fro, or rotating them on one another. It is not always present, for it is wanting in impacted fracture, and cannot be detected when a short or flat bone is broken, *e.g.*, in the bodies of the vertebræ, vault of the skull, etc.

Deformity, owing to displacement of the fragments of the broken bone, is, when present, an important sign of fracture. It may be the direct result of the violence that causes the fracture; *e.g.*, in impacted fracture of the lower end of the radius or neck of the femur; or, as is usually the case, it may be due to subsequent muscular contraction; *e.g.*, in oblique fracture of the tibia when the lower fragment is drawn upward above the upper by the action of the muscles of the calf; or the result of the weight of the limb dragging upon one of the fragments; *e.g.*, in fracture of the clavicle, when the outer fragment is drawn down by the weight of the arm. The particular deformity will depend upon the direction of the line of fracture and also upon the nature of the displacement of the fragments; thus it may be angular, or transverse or lateral, or one fragment may over-ride, or be rotated on, or widely separated from the other. In all cases the injured part should be compared with the opposite side of the body, as it is often only by a careful comparison made in this way that the deformity, if slight, can be detected.

Deformity is not always present; it is often absent when one of two parallel bones is broken; *e.g.*, in fracture of the fibula, the tibia, acting as a splint, often prevents any displacement of the fragments from taking place. Again, when a short or flat bone is involved, there is often no displacement and no deformity.

Crepitus is applied to the rough grating produced when the ends of a broken bone are rubbed against one another. When present, it is a valuable sign of fracture, but is often absent; *e.g.*, in incomplete fracture, or when the fragments are impacted, or widely separated, so that they cannot be brought into contact.

It is also wanting if a portion of blood clot, muscle, or other tissue, is interposed between the fragments; or if the fracture is not recent, and the ends of the bone have become covered over with inflammatory exudation. When a short or flat bone is fractured, it is often difficult to detect crepitus, as also in cases where one of two parallel bones is broken; *e.g.*, in fracture of the fibula.

The true or bony crepitus met with in fracture must be distinguished from false or "silken" crepitus, which frequently accompanies inflammation of the sheath of a tendon; in the latter case there is simply a fine crackling very different to the rough grating of fracture. When in the neighborhood of a joint, care must be taken not to mistake the crackling, which often accompanies effusion into its interior or into an adjacent bursa, for the crepitus of fracture.

Loss of power or interference with function is usually present to a greater or less extent in the part where the fracture is situated; more or less *pain* will usually be complained of, and in the most instances *swelling* and *ecchymosis* will sooner or later show themselves at the seat of injury.

In cases of *separation of an epiphysis*, the general symptoms are identical with those of fracture, except that crepitus is absent or less distinct, owing to the fact that the line of separation runs through cartilage rather than bone; for the same reason, the ends of the fragments are more smooth and rounded, not so sharp and irregular as in fracture.

General treatment.—There are three indications to be, if possible, carried out.

1. *The reduction or setting of the fracture, i. e.*, the restoration of the fragments to their proper position, should always be effected with little delay, otherwise the muscles, as the result of the irritation to which they are subjected, become rigidly contracted, and considerable force will be required to overcome the spasm. Great care should always be employed in manipulating the limb, for if it is roughly handled there is a risk of converting a simple into a compound fracture.

In ordinary cases, *e.g.*, in fracture of the long bones of the extremities, reduction is effected by the employment of extension and counter-extension. The surgeon makes extension by drawing

steadily and without jerking upon the limb below the seat of fracture, while an assistant makes counter-extension; viz., fixes the limb on the proximal side of the fracture. In this way the extending force, which acts only on the lower fragment, is maintained until the ends of the bone are drawn opposite to one another; by a little manipulation, as, for example, by pressing gently on one or both of the fragments, they can usually be brought into proper position, and means must then be adopted to maintain them so. Inasmuch as spasm of the muscles is the chief cause of displacement in fracture, reduction will often be facilitated by the adoption of measures which tend to produce muscular relaxation. In some this can be effected by attention to the position of the part; *e. g.*, in fracture of the tibia and fibula, by bending the knee so as to relax the muscles of the calf; occasionally division of the tendons may be required before reduction can be effected; *e. g.*, tenotomy of the tendo Achillis is occasionally necessitated in the same fracture. Anæsthetics will often be useful in similar circumstances, for when the patient is under their influence muscular spasm at once disappears.

Reduction is occasionally impossible, as in certain cases of firmly impacted fracture, when it is often better not to attempt it, preparing the patient for the deformity which will be permanent.

2. *The maintenance of the fragments in their proper position* after the fracture has been set has next to be attended to, and this may be effected by means of splints, bandages, or some form of special apparatus. Splints composed of many different kinds of material are employed for this purpose; *e. g.*, wood, tin, zinc, wire, guttapercha, felt, mill-board, leather, etc.

Bandages containing some material, *e. g.*, plaster of Paris, starch, gum and chalk, paraffin, silicate of sodium, etc., which hardens when dry, forming a firm, solid application accurately molded to the part, are much used; if necessary, they can be strengthened by the insertion of pieces of iron, tin, felt, or mill-board, between the layers of bandage.

Some surgeons at once put up the fracture in one of the different varieties of solidifying apparatus; *e. g.*, a plaster of Paris bandage; others apply some form of splint, *e. g.*, the ordinary wooden ones,

for a few weeks, and then, when repair is well advanced, to replace with a stiff bandage. One great advantage of splints is that the seat of injury can be left exposed, whereas if a stiff bandage is employed the fracture is concealed from view, unless the bandage is interrupted, or slit up along its whole length after it has set, so as to allow of its removal from time to time.

As a rule, splints should be employed in cases where the soft tissues are much swollen, bruised, or ecchymosed, or where there is much displacement of the fragments and difficulty is experienced in reducing and maintaining them in position, care being taken that in the former case the bandages which fix the splints are not applied too tightly. The seat of injury being left uncovered, some evaporating lotion can be applied, the condition of the part can be examined from day to day without removing the apparatus, and if any displacement of the fragments takes place, it will at once be evident and can then be corrected. If some form of stiff bandage is applied when the parts are much swollen, it will become loose when the swelling subsides and consequently allow of movement and displacement of the ends of the fractured bone.

A stiff bandage may, however, frequently be applied at once with very good results, if none of the conditions just mentioned are present; and in the case of the lower extremity it possesses the additional advantage, that, being light, it does not necessitate confinement to bed, and the patient, with the assistance of crutches, will often be able to get about in the course of a few days.

A very useful modification of the latter method is recommended in cases of fracture of the lower extremity. A double layer of coarse flannel, shaped to fit the limb and form a kind of lateral splint, is applied to each side of the leg and foot, the outer layer having been previously saturated with a solution of plaster of Paris and water of the consistence of thick cream. A muslin bandage is applied outside the flannel so as to maintain it in close contact with the limb while the plaster is setting, and at the same time care must be taken that the fracture is kept in proper position. After the bandage has set, it is cut up along its center, viz., in front of the limb at the line of junction of its two lateral halves,

so as to allow of its removal from time to time for the purpose of examining the fracture and the condition of the limb.

In the application of splints there are certain rules which should be observed: 1. The splints should be well padded, especially where they press upon points of bone. 2. They should, if possible, include the joints above and below the fracture, so as to completely fix the limb. 3. No bandages should be applied beneath them. 4. The seat of fracture should be left uncovered. 5. The extremities of the limb, *e.g.*, the fingers or toes, should be left exposed to view. When plaster or other forms of solidifying bandages are used, care must be taken not to apply them too tightly, otherwise, when they set, constriction of the limb may be produced; to prevent this, first envelope the limb in a layer of cotton wool, or apply dry next to the skin several layers of an ordinary flannel bandage.

Whatever form of apparatus is employed, the fracture should always be examined the day after it has been put up, and subsequently from time to time; if the limb is found to be painful and swollen, and especially if the toes or fingers are cold, numb, congested, or œdematous, the bandages or splints should be eased or removed, and re-applied, otherwise there is a risk of gangrene supervening, for the occurrence of these symptoms shows that too much pressure has been used and that the circulation through the limb has become impeded.

The fracture bed, in cases of fracture of the lower extremity, should be flat and firm; if it tends to sink in the center, a piece of board should be introduced between the mattress and the bedstead. Care should be taken that the sheets do not crease, and, if possible, a strong cord with a short stick attached to its lower end should be suspended over the bed, to assist the patient in rising or moving his body when requisite.

Treatment of Compound Fractures.—The limb may be put up in a similar manner either in splints or in some form of stiff bandage; if the latter method is employed, an opening, or “window,” should be cut in the bandage exactly over the fracture, or the bandage should be interrupted at the same spot with strips of iron hoop or pieces of strong wire, which are inserted between its layers as it is applied, in order to allow of the

wound being examined and dressed. As regards the treatment of the wound itself, this will depend upon the nature of the injury.

If there is a mere puncture in the skin caused by the sharp end of one of the fragments, it may often be closed at once with a pad of lint dipped in the compound tincture of benzoin or collodion; under this the wound will often rapidly heal, and the fracture being, as it were, converted into a simple one, will in many cases quickly unite without any suppuration. Under this treatment, if the temperature rises and the parts about the seat of fracture become hot, red, painful, and swollen, the pad of lint should be removed, and if there is any evidence of suppuration, the wound should be opened, and free vent having been afforded to the pus, it should be treated in the manner next described, or this method may be adopted from the first.

If the wound is of some dimensions, and its edges lacerated and the surrounding tissues bruised and swollen, no attempt should be made to close it. If seen within the first twenty-four hours (all bleeding having been arrested), the wound should be carefully cleansed and then thoroughly syringed out with a solution of carbolic acid (1 in 20) or some other antiseptic lotion, care being taken that the fluid comes well into contact with all its recesses. If a longer period has elapsed, a stronger solution should be used, *e.g.*, one consisting of carbolic acid and spirit (1 in 5).

Some means must then be provided for efficient drainage; one or more of the ordinary drainage tubes may be inserted, and the wound should be dressed and afterward treated according to the Listerian method.

In cases where the ends of the bones are much comminuted, the fragments, when of small size or lying loose and separated from the periosteum, should, if possible, be removed, for if left they will probably necrose. If the wound is small and the bone projects through it, it is sometimes necessary to enlarge the opening before reduction can be effected; and if it is still impossible, the projecting portion of bone should be removed with a saw. When difficulty is experienced in maintaining the ends in apposition, it will sometimes be necessary to bring them together with sutures of silver wire.

The wound must be treated on general principles, care being taken to prevent any accumulation or burrowing of pus, and the dressing changed when necessary with as little disturbance of the fracture as possible. In cases of severe compound fracture, amputation of the limb is occasionally required; that is, as a rule, indicated when there is very extensive laceration and destruction of the soft parts with much splintering of the bone, and especially if the main vessels of the limb are wounded, or an adjacent large joint (*e. g.*, the knee) laid open. The age and constitution of the patient should be taken into account, as well as the situation of the injury. A severe compound fracture in a young person of sound constitution may often be successfully treated, whereas in a person advanced in years, or broken down in health, the attempt to save the limb will be useless and often attended with danger to life; so also the prospect of recovery is always much greater in the upper than in the lower extremity, owing to the greater reparative power of the former.

Complications. — During treatment, various accidents or complications may arise. *Edema and swelling* of the limb are among the most common; they may be due to bruising and extravasation of blood, mingled with more or less inflammatory effusion, or to simple passive congestion from tight bandaging. Under these circumstances the limb becomes tense and swollen, and in many instances large blebs or bullæ appear on its surface, containing a clear or blood-tinged serum. In such cases the bandages should be slackened and some evaporating lotion applied; if the soft tissues are much bruised, the skin should be painted over every day with tinct. benz. co.; when bullæ form, they may be pricked and their contents allowed to escape, or left to themselves, for they generally burst or dry up and disappear in the course of a few days.

Ulceration and sloughing of the soft tissues over the seat of injury may ensue, and a simple fracture become converted into a compound one. *Ulcers* of a troublesome nature are also apt to form over bony prominences, when the splints are not well padded; and unless care is taken, *bed-sores* may also appear over the sacrum, buttock, hips, etc., especially in old or debilitated subjects, when the

fracture involves long confinement in the recumbent posture.

Spasm of the muscles of an obstinate nature is sometimes present, and considerable difficulty is often encountered in keeping the fracture in position. As a general rule, it can be overcome by moderate pressure by means of bandages, though in exceptional cases tenotomy may be required.

Gangrene of the limb is occasionally met with, as a rule the result of improper treatment, *e. g.*, too tight bandaging. The part should be frequently examined, especially during the first few days after the fracture has been put up, and if there is any evidence of coldness, numbness, lividity, or swelling of the limb, or of the fingers and toes, the bandages should be relaxed, if unrelieved gangrene is liable to supervene. Less frequently gangrene is due to laceration of the main artery of the limb by one of the fragments, or to the vessels being nipped between or pressed upon by the ends of the bone.

Venous thrombosis and embolism. — In most cases of fracture, thrombosis doubtless occurs to a greater or less extent in some of the veins in the neighborhood of the injury. In rare cases a portion of clot may become detached, and, acting as an embolus, be carried onward by the stream of blood until it reaches the heart or one of the branches of the pulmonary artery; there it may become arrested and give rise to sudden death from asphyxia.

Fat embolism is a condition met with as a complication of simple, though much more frequently of compound, fracture, in which the capillaries of the lung, kidney, brain, spinal cord, or of almost any part of the body have been found plugged with fatty emboli or globules of liquid fat. It may occur to a slight degree in all cases of fracture, but especially so in severe cases accompanied by much crushing of the bone and its medullary cavity, when fluid fat is set free in large quantities. Under these circumstances the oil globules, gaining access into the venous circulation through the opening in the vessels about the seat of the injury, act as emboli and are carried on by the blood stream until they become arrested in the capillaries of the various tissues and organs.

The symptoms are obscure; coming on as a kind of secondary shock from

twenty-four to forty-eight hours after the occurrence of the injury, and consisting of dyspnoea with irregular action of the heart, and pallor, or cyanosis of the face; occasionally slight hemoptysis has been observed; the temperature may be lowered or run somewhat high; in fatal cases the patient rapidly becomes collapsed, and sinking into a condition of coma, death may be preceded either by convulsions or paralysis. When recovery takes place, the fatty matter appears to be eliminated by the kidney, for its presence in the urine has been detected for several weeks after the injury.

Treatment.—Intravenous injections of ether might be of service along with artificial respiration; when cyanosis is a prominent symptom, venesection might give relief.

In cases of compound fracture, other complications frequently appear. *Necrosis* often results, small pieces of bone, which have been detached or stripped of their periosteum, subsequently dying. *Suppurative periostitis* or *acute osteomyelitis* with extensive suppuration may ensue, and large portions of bone necrose. In these cases union will be retarded, the dead bone, which is often long in separating, interfering with the process of repair. *Extensive sloughing of the soft tissues* may also result, and, as in other injuries, *erysipelas* may attack the wound.

The general complications which are common to all varieties of fracture are: *shock*, *traumatic delirium*, especially in persons of intemperate habits; *hypostatic congestion of the lungs*, in old persons as the result of confinement in the recumbent position. *Retention of urine* for some days after the accident is not uncommon, in some cases as the result of shock, in others in consequence of confinement to bed; *tetanus* may occur as after other injuries, but is a rare complication.

In cases of compound fracture there is, in addition, the risk of *severe traumatic fever*, and this may run on to *septicæmia* and *pyæmia*, complications which frequently prove fatal. After union has been effected, and the splints have been removed, other complications are met with.

Edema of the limb is often present for a time, with *stiffness* of the joints above and below the seat of fracture, the latter being due to long confinement in a fixed

position, and to the formation of adhesions around the tendons and between them and their sheaths. As a rule these conditions will gradually disappear if the limb is used, and friction with some stimulating liniment employed along with passive movement. If the œdema persists, an india rubber bandage will be found useful.

Pain about the seat of fracture, of a somewhat rheumatic character, is frequently complained of for a considerable period, especially in the case of old people; this will gradually disappear; but when severe and obstinate, relief may be obtained by the internal administration of iodide of potassium, and counter-irritation over the seat of fracture by painting with tincture of iodine, or, if much thickening is present, by the application of some mercurial ointment.

Paralysis of the limb is occasionally met with, especially in the upper extremity, from implication of the nerves in the callus which is formed at the seat of fracture, when it is sometimes necessary to cut down upon the fracture to liberate the nerve.

Crutch paralysis, *i. e.*, loss of power in the arm from the pressure of the crutches upon some of the nerves, is often met with in fracture of the lower extremity, if the patient is allowed to walk about on crutches without hand-bars, or the arm-pieces of which are not well padded. Any or all of the nerves supplying the arm may be involved; paralysis of the musculo-spiral is perhaps most common, the patient then presenting evidence of wrist-drop.

Shortening of the limb often ensues, in many cases as the result of improper treatment, *e. g.*, allowing the ends of the bone to overlap. After separation of an epiphysis it is sometimes met with as a result of actual arrest of growth, the epiphysial cartilage being so injured that the development of the bone is afterward interfered with.

Morbid growths springing from the bone, and usually of a sarcomatous or cartilaginous nature, may in rare cases develop at the seat of fracture, at a variable period after the injury.

Process of repair.—The uniting material by which union is effected is termed *callus*; this consists, in the early stage, of simple inflammatory exudation or lymph, and the process of repair in simple

fracture is essentially identical with that which occurs in the healing of wounds by first intention in the soft parts, except that the lymph subsequently develops into bone instead of remaining as ordinary cicatricial tissue. As the immediate result of the injury, extravasation of blood takes place into the tissues round about and between the ends of the bone, the periosteum being torn and the adjacent muscles lacerated to a greater or less extent. Inflammation rapidly ensues, and there is an exudation of lymph into the adjacent parts poured out by the vessels of the bone, periosteum, and surrounding tissues. The consequence is, that between and around the ends of the bone, as well as into the medullary cavity, there is poured out a quantity of plastic matter which mingles with the blood clot already present; in the course of a few days this gradually consolidates, the blood clot becoming either absorbed, or remaining and assisting in forming the callus, the term applied to the uniting medium, as it becomes firmer and fibrous. At the same time, the periosteum at the seat of injury gradually disappears, becoming lost in the mass of callus, which as it consolidates, forms a fusiform sheath or natural splint round the ends of the bone.

The term *provisional* or *temporary* callus is applied to that which is poured out around the bone and within its medullary cavity; while that which is formed between the broken ends is described as *definitive* or *permanent* callus.

As the process continues, a new periosteum is formed from the outer or superficial layer of callus, which, after developing into fibrous tissue (and occasionally in children into cartilage or fibro-cartilage), subsequently ossifies and forms new bone, a deposition of lime salts taking place in its substance. Ossification usually commences about the end of the first, and is often considerably advanced by the end of the third week.

In the course of four to eight weeks the ends of the bone become firmly united by a mass of newly formed osseous tissue, which at first is spongy and cancellous, and can often be felt as a distinct swelling surrounding the bone at the seat of injury.

The last stage consists in the disappearance of the provisional callus; this,

after becoming dense and compact, undergoes a process of absorption, and in the course of some months more or less completely disappears, so that the bone resumes its natural form, and the medullary canal is restored. By the time this is effected, the permanent callus poured out between the ends of the fragments will have acquired sufficient strength to maintain the continuity of the bone; hence it would appear that it is the function of the former to support the fragments and to keep them in apposition, acting the part of a temporary splint, until union is effected.

The amount of provisional callus which is formed depends upon the nature of the fracture and also upon its after-treatment. If there is no displacement nor comminution of the fragments, and they are kept in a state of complete rest, it may be entirely absent. If they are much splintered, or not in perfect apposition, or if some movement is allowed, then it is often considerable in amount, being poured out around the splinters or ends of the bone. In fracture of certain bones, *e. g.*, the ribs and clavicle, provisional callus is, for obvious reasons, always present, and, as one would expect, is more frequently met with in children than in adults, owing to the difficulty often encountered in keeping the fracture completely at rest.

In the case of *compound fractures*, when the external wound, being of small size, is at once closed or sealed, and the fracture is, as it were, converted into a simple one, repair may take place in a similar manner.

In many cases, and especially when the wound is large and accompanied by much laceration of the soft tissues or splintering of bone, union is effected by a process of suppuration and granulation, identical with what occurs in healing by second intention in the soft tissues. Suppuration is excited at the seat of injury, and granulations spring up from the ends of the bone, as well as from the adjacent soft parts; the whole of the interior of the wound becoming lined with a layer of granulation tissue secreting pus, which bathes the ends of the bone.

By the growth and development of these granulations into fibrous tissue the cavity of the wound is gradually filled up, and union effected. The subsequent changes are identical with those which

occur in simple fracture, the fibrous tissue undergoing ossification, so that the ends of the bone become surrounded and united by a mass of callus, which, after developing into bone, is more or less completely absorbed. The process is frequently complicated by necrosis; small portions of bone, which have been separated at the time of injury, or had their supply of blood interfered with, often die; or the ends of the bone themselves, having been stripped of the periosteum, or injured to such an extent that their vitality is destroyed, subsequently necrose.

Under these circumstances the wound will not heal so long as the dead portions of bone are present, for, acting as sources of irritation, they keep up suppuration. If of small size, they may make their way externally; but when of some dimensions, it may be necessary to enlarge the wound and extract with forceps. When the ends of the fragments themselves necrose, the process is usually a tedious one, for then separation is slow, the dead portions of bone often becoming ensheathed by new osseous tissue thrown out round about them; then they will frequently have to be removed by sequestrotomy.

The *length of time* required for union varies in the different bones, and also depends upon the nature of the fracture and the patient's age. In simple fractures of the lower extremity occurring in healthy adults, the average is from eight to twelve weeks; in the case of the upper extremity, four to eight weeks. In the case of children, where union is more quickly effected, the time required is somewhat shorter, in old persons longer. In severe compound fractures the period will often be three or four times that required in simple fracture.

Defects in the process of union.—The process of repair may in certain cases be delayed beyond the usual period, and occasionally it is not effected by means of bone, or does not take place at all; under the latter circumstances the fracture is said to be ununited. Delayed union may be due to any of the causes which give rise to non-union.

Treatment is partly constitutional, partly local. Attention should be paid to the general health, and an attempt made to promote union by stimulating the reparative process, *e. g.*, by rubbing the ends of the bone gently together; shampooing the limb around the seat

of fracture; “hammering” the limb, *i. e.*, surrounding it with a piece of felt, and then percussing it forcibly with a mallet over the seat of fracture; blistering the limb, or painting with tincture of iodine over the same spot, etc. Where the patient has been confined to bed in splints for the usual period, union often results if he is allowed to get about on crutches with the limb in a stiff bandage. When the fracture has not been kept in a state of complete rest, repair will often take place if some immovable apparatus is used.

Non-union may appear under three different forms. 1. In *ligamentous union*, the most common variety, the ends of the bone are merely united by fibrous tissue, so that some movement is possible between them. 2. In *false joint*, or *pseudarthrosis*, the movement is more free, the ends of the bones becoming smooth, rounded, and inclosed in a kind of capsule formed of fibrous tissue, not unlike that of a joint. In well-marked cases their surfaces, of which one is often convex, the other concave, may be invested with a layer of imperfect cartilage and lubricated by a serous secretion resembling synovial fluid. 3. In *true non-union* the ends of the bone are quite separate, there being an entire absence of any uniting material.

The causes are (1) *Constitutional*; including all conditions which, by inducing a low state of health, interfere with the healthy nutrition of the tissues, and, with the process of repair, *e. g.*, various acute affections, such as fevers, syphilis, the cancerous cachexia, phthisis, scurvy, chronic kidney disease, etc. Old age, pregnancy, and lactation sometimes interfere with union, but their influence is very slight. (2) *Local*; mobility of the fragments, the most common. This may be due to the splints or bandages being applied too loosely, or in consequence of their removal before repair is completely effected. Separation of the fragments, which may be due to muscular action, as in the case of the patella, or interposition of a portion of muscle or tendon between the ends of the bone. In cases of compound fracture, non-union is often due to actual loss of bone, removed either at the time of injury, or subsequently for necrosis. Interference with the circulation of the blood may also prevent repair from taking place; *e. g.*, non-union is apt to occur

in cases where the nutrient artery of the bone is injured by the line of fracture running through it; or where blood is not freely supplied to both fragments, as in fracture of the neck of the humerus or femur; or in cases where a congested and œdematous condition of the limb is produced as the result of tight bandaging, or from extensive bruising of the soft parts accompanied by venous thrombosis.

Treatment is both constitutional and local. Attention should be paid to the general health, and any constitutional condition which is present should be treated on ordinary principles. Measures similar to those recommended in the case of delayed union should be tried, and if they fail, more vigorous ones should be adopted, the object being to set up a more active inflammation at the seat of injury. This may be attempted by the introduction of acupuncture needles, or of a seton between the ends of the bone; by the subcutaneous division with a tenotome of the fibrous tissue which unites them; by electro-puncture; or by the injection of some stimulating liquid in the neighborhood of the fracture. If they fail the ends of the bone should be exposed, and ivory pegs driven into holes bored in the bone with a drill; or the ends of the bone removed with a saw (the periosteum being as far as possible preserved) and the fragments brought together by metallic screws or sutures of silver wire. The latter method, "wiring the fragments," is commonly adopted, and as a rule with good results, the sutures being either removed after several weeks or cut short and left permanently. When non-union is due to actual loss of osseous tissue, as in some cases of compound fracture, attempts have been made to fill up the gap by transplanting bone.

When operative treatment has proved unsuccessful, and the limb is useless and an incumbrance to the patient, amputation may be indicated, but even under these circumstances, and especially in the upper extremity, some form of apparatus can often be adapted to the part, so that, though its usefulness is impaired, it will be more serviceable than an artificial limb.

Union with deformity.—Union is sometimes accompanied by considerable deformity, and the function of the

limb seriously impaired. This condition, "vicious union," may be owing to restlessness of the patient, or to unskillful treatment, *e. g.*, imperfect reduction of the fracture; improper application of splints, in consequence of which the fragments are not kept in position or at rest; removal of the splints before union is completely effected and subsequent yielding of the callus, etc. Under these circumstances, union is often accompanied by considerable projection of one or both fragments. Another form of vicious union is seen in cases where two contiguous bones become united by callus thrown out between them, *e. g.*, in the fore-arm, leg, or ribs; this deformity is, however, of little importance except in the fore-arm, when the movements of pronation and supination become interfered with.

Treatment will depend on the nature of the deformity and the length of time which has elapsed since the fracture occurred. When there is projection of the fragments and the callus is not yet firmly ossified, the deformity will often disappear under firm pressure properly applied by well-padded splints, or the limb may be forcibly straightened at once under anæsthesia. If, however, a considerable period has elapsed, and firm bony union has taken place, it will often be necessary to refracture the limb, either by manual force or by the employment of a strong clamp, known as the osteoclast.

In other cases, before the bone can be straightened, it may be necessary to divide it subcutaneously, or remove a wedge-shaped piece of bone from the projecting angle. The sharp end of one of the fragments, if projecting beneath the skin, may be treated as an exostosis and sawn off, but it will usually be found that, if allowed to remain, it will wear down and become rounded off, so that in course of time it may gradually disappear to a great extent. The limb, after it has been straightened by any of these methods, should be put up again in splints and treated as a recent fracture, care being taken to prevent any recurrence of the deformity.

Wounds of bone are closely connected with compound fracture. It will sometimes happen that a kind of incised wound is produced, the periosteum and a portion of the thickness of a bone being divided as the result of a blow with some

cutting instrument. As the injury to the bone is always accompanied by an open wound, the general treatment will be that of compound fracture.

Contusions of bone are of common occurrence, being often met with in those that are superficial and exposed to external violence, *e.g.*, the subcutaneous surface of the tibia, vault of the skull, etc. The injury is often followed by inflammation of the periosteum, evidences of which will be present, and when the process is limited, the localized swelling, which frequently results, is described as a "traumatic node." In other cases, *e.g.*, as a result of a fall on the hip, the cancellous tissue of the neck of the femur may become more or less bruised or contused; inflammatory changes of a subacute or chronic nature may subsequently ensue, occasionally followed by an interstitial absorption of the osseous tissue, in consequence of which the limb may become permanently shortened.

Special Fractures.—The Face.—Nasal bones.—Fracture of the nasal bones is often the result of direct violence, it is usually attended by bruising or laceration of the soft tissues, and in many cases considerable swelling, sometimes accompanied by emphysema, speedily sets in, so that unless seen soon after the receipt of the injury, the detection of the fracture may be difficult. The fragments may be displaced backward, or to one side, the bridge of the nose being either flattened or deflected laterally. If the fracture also involves the *lachrymal bone* there may be obstruction to the flow of tears, and epiphora, owing to injury to the lachrymal sac or nasal duct. Fracture through the septum nasi, or separation from its attachment to the vomer, may occur alone, or accompany a fracture of the nasal bones; in some cases the cartilaginous septum is simply bent to one side, giving rise to a troublesome and characteristic deformity.

Treatment.—When displacement of the fragments is present, an attempt should be made to correct it as speedily as possible, for if allowed to remain, union rapidly takes place, and considerable difficulty will afterward be experienced in treating the deformity. This may be effected by means of an ordinary pair of polypus forceps, introduced into the nostril; on using them as a lever, or on separating the blades, the displaced frag-

ments can usually, with a little manipulation, be guided back into the normal position, especially if the patient is anæsthetized. When once replaced, they will often remain so; if, however, there is any tendency for the displacement to return, it can sometimes be prevented by the patient wearing in the nostril a short piece of gum-elastic catheter, or some form of plug.

When the nose is bent to one side, it may be necessary to make lateral pressure from without, and for this purpose a "nose truss," consisting of a pad adjusted by cog wheels and attached to a steel band which passes round the head, will be found useful.

When the septum is deflected, it may be straightened under anæsthesia, by means of forceps (strong forceps with flat parallel blades), and at the same time the nasal bones, if depressed, can be raised. As the deflection is apt to recur, the patient should for a time wear some apparatus to retain the septum in position.

Upper jaw and malar bone.—Fracture of the upper jaw is sometimes met with as the result of direct violence, its alveolar process being the part more commonly involved; less frequently, the fracture takes place through the body of the jaw or one of the other processes, and it may also involve the *malar bone* and *zygomatic arch*. The fracture, which is often compound and accompanied by bruising and swelling of the cheek, may be attended by displacement of the fragments, when the anterior wall of the antrum is driven in, considerable deformity is often produced, and when the alveolus is involved, there will be loosening and irregularity in the line of the teeth.

Various complications may attend, *e.g.*, emphysema; severe hemorrhage from a wound of the internal maxillary artery; loss of sensation in the cheek from injury to the infraorbital nerve; in cases of compound fracture involving the antrum, a sinus often remains which is slow in healing.

Treatment.—When any displacement of the fragments is present, an attempt should be made to correct it as soon as possible; the depressed bone being raised from the mouth, or, if this is not possible, by means of an elevator introduced through a small opening in the cheek.

When the alveolar process is involved, the fragments may be kept in position by

one of the methods of treatment mentioned in the case of the lower jaw; a jaw bandage should afterward be applied so as to prevent, as far as possible, any movement of the part, and the patient fed on liquid food for several weeks.

Lower jaw.—Fractures of the lower jaw are almost always compound, sometimes from external wound, but more frequently from laceration of the gum by the broken fragments. Any part of the bone may be broken, the commonest situation being through the body, at that spot where it is specially weakened by the mental foramen and the deep socket for the canine tooth; fracture through the symphysis is rare owing to the strength of bone at this point.

Body.—In fracture through the body the symptoms are usually well marked, especially when the bone is broken on both sides of the symphysis, for the central portion is then drawn down by the muscles attached to the hyoid bone. There is mobility of the fragments, with crepitus, loosening and irregularity in the line of the teeth, dribbling of the saliva from the mouth, and impairment of speech.

When the fracture is compound, there is also laceration of and bleeding from the gums; under these circumstances suppuration generally results, the discharge making its way into the mouth and mingling with the saliva gives to the breath an offensive odor; where an abscess forms at the seat of injury, necrosis of a portion of the jaw frequently results. The inferior dental nerve usually escapes, but if it happens to be torn across by the fracture, there will be loss of sensation in the lip on the corresponding side.

Angle or lower part of ramus.—In this situation the displacement of the fragments is usually slight, for the muscles on either side (masseter and internal pterygoid) maintain them in position.

Neck.—In fracture through the neck of the jaw, the condyle is drawn inward and forward by the external pterygoid; crepitus is produced and pain is experienced upon attempting to open the mouth.

Coronoid process.—The fractured coronoid process is drawn upward and backward by the temporal muscle, so that it produces an undue prominence in the temporal fossa.

Treatment.—In cases where there is not much displacement of the fragments, they can often be kept in position by a four-tailed bandage, or by a guttapercha splint, molded to the jaw, and fixed by a similar bandage. Any teeth which are completely loose and lie between the fragments should be removed, for their presence interferes with repair; those which are only partially loose should, if healthy, be allowed to remain, for they will, as a rule, soon become firmly adherent. When difficulty is experienced in keeping the fragments in position, as often happens when the fracture is compound, other means may be required. Ligaturing the teeth, *i. e.*, binding together those which lie on either side of the fracture, with wire or silk, is sometimes adopted, but has this disadvantage, that it tends to loosen the teeth, which are often already somewhat loose in their sockets. The ligature is also liable to slip.

The fragments may be wired together, by means of sutures of silver wire, which are passed through openings drilled in the bone on each side of the fracture, or through the bone on one side and between the teeth on the other; as the wire, if tied or fastened with a cross twist in the ordinary way, soon becomes loose, it is twisted with a key in three or four coils, which can be tightened up from time to time as they become slackened. Various forms of interdental splints are also employed, *e. g.*, molds of guttapercha, vulcanite, or metal caps, etc., which fit on to the teeth for some distance on either side of the fracture.

Moon's interdental splint consists of two parts, an external splint adapted to the chin and attached by rods to a metal cap, which fits the teeth of the fractured jaw.

Hammond's wire splint is made of a framework of iron wire, adjusted so as to encircle, on a level with their necks, all or several of the teeth on either side of the fracture.

As it is important that the fracture should, as far as possible, be kept completely at rest, talking should be prohibited, and the patient fed on liquids, or on soft food which requires no mastication. The mouth should, especially in cases of compound fracture, be frequently washed out with some disinfectant. Union takes place in from three to five

weeks, though the process will be somewhat retarded if suppuration takes place, or if necrosis results.

The Clavicle may be fractured in any part of its course, more commonly about its middle, less frequently at either its sternal or acromial extremity. Though fracture may be produced as the result of direct application of force, *e. g.*, a severe blow, or even of muscular action, *e. g.*, a sudden and forcible swing of the arm, it is more frequently the result of indirect violence, *e. g.*, a fall on to the shoulder or hand when the arm is extended.

Shaft.—In fracture through the shaft the bone usually gives way at its weakest point, about its center, or a little external to it, the junction of the two curves. The fracture, which is of very common occurrence in young subjects, is often of the incomplete or “greenstick” nature, the bone being bent, or only partially broken, the periosteum frequently remaining un-
 torn.

When complete, the line of fracture is sometimes transverse, but more commonly, especially when due to indirect violence, it is oblique, when the amount of displacement is often considerable. The inner fragment usually remains unaffected, being retained in its place by the antagonistic action of the sterno-mastoid above, and the pectoralis major and subclavius muscles, and rhomboid ligament below; though, in many cases, it appears to be displaced forward, owing to the depression of the inner end of the outer fragment backward and behind it.

The outer fragment, owing to the weight of the arm, which drags upon it, is usually drawn downward, while by the action of the muscles passing to it from the chest it is drawn somewhat inward and forward; hence, its outer or acromial end, with the shoulder, is displaced downward, inward, and forward, while its inner or fractured end is drawn inward and backward, so that it lies behind and usually beneath the fractured end of the inner fragment; less frequently it is found above, and in rare cases it may be anterior to it.

Symptoms.—Flattening and lowering of the shoulder, which is also drawn forward and inward, being approximated to the middle line; pain at the seat of injury; impaired movement of the arm; inclination of the head and neck to the affected side; the elbow is often supported

by the opposite hand to take off the weight of the limb; if the finger is laid over the seat of fracture, crepitus can generally be detected on raising and rotating the shoulder, and at the same time pain will be produced; the prominence formed by the fractured end of the inner fragment will generally be plainly perceptible beneath the skin; in cases of transverse fracture, where the displacement of the fragments is often slight, there may be an entire absence of any deformity.

Sternal end.—Fracture of the sternal end of the clavicle, either internal or external to the attachment of the rhomboid ligament, is an injury of rare occurrence; in the latter case the displacement is often considerable, the outer fragment being drawn downward and forward; in the former case, which is less common, there is not, as a rule, any marked displacement of the fragments.

Acromial end.—Fracture of the acromial end is of more frequent occurrence, and two varieties are met with, as the bone is broken between or external to the conoid and trapezoid ligaments. When the fracture is between the ligaments there is little, if any, displacement of the fragments; on rotating the shoulder crepitus is produced, and perhaps slight irregularity will be felt at the seat of injury. When the fracture is external to the ligaments there is a marked displacement of the outer fragment, its articular surface being turned forward and inward, with a slight inclination downward, so that it lies nearly at a right angles with the rest of the bone, the position of which is not materially altered.

Separation of the epiphysis of the clavicle, a thin plate of bone at its sternal extremity, is a rare injury. These fractures, when the result of direct violence, may be compound or comminuted; in these rare injuries, the neighboring large vessels, *e. g.*, jugular or subclavian veins, etc., are liable to be wounded. A simple fracture is occasionally followed by partial paralysis of the arm. Owing to the difficulty of keeping the fracture in a state of complete rest, union is invariably attended by the formation of provisional callus, and where treatment has been neglected, or there is much displacement of the fragments, this is often excessive in amount, giving rise to a considerable swelling surrounding the bone at the seat of injury.

Treatment.—In the common form of fracture through the shaft there are three main indications. 1. To raise the shoulder, the arm should be supported in a sling which reaches well under the elbow, or by strapping or bandages which pass beneath the elbow and over the opposite shoulder.

2. To draw the shoulder outward, a thick, wedge-shaped pad, with its broad end upward, should be placed high up in the axilla, where it is kept in position by a strap which passes over the opposite shoulder. The arm being then bandaged to the side, the pad acts as a fulcrum, and the humerus as a lever; the result is that the shoulder and outer fragment are drawn forcibly outward. In applying the pad, care must be taken that too much pressure is not made upon the axillary vessels and nerves, or the arm will become swollen, and either numb or painful.

3. To carry the shoulder backward, several different plans may be adopted. The elbow may be carried forward, and the hand raised toward the opposite shoulder, so that the humerus may bear across the pad, and its upper end along with the shoulder be forced backward; or a figure of 8 bandage may be applied to the shoulders and tied behind. In order to prevent the bandages from slipping, the turns may be stitched together, or stiffened with plaster of paris or starch. If there is any tendency to swelling of the arm, it should first be bandaged from the fingers up to the axilla.

Sayre's method of treating this fracture is as follows: A loop at the end of a broad band of adhesive plaster is passed round the upper part of the arm, and the elbow having been drawn backward, the strapping is carried transversely behind the back and round the chest. A second piece is then carried obliquely across the body, over the sound shoulder, and beneath the elbow on the injured side, a slit being cut in it to receive the elbow and prevent it from slipping. By the first strip the shoulder is drawn backward and outward, while by the second it is raised.

If a patient will submit to confinement to bed, it will be found that the deformity more or less completely disappears in the recumbent posture, for the weight of the limb being removed, the displacement downward is prevented; at the same

time, the shoulder falling back and carrying with it the outer fragment, the displacement forward and inward is also counteracted, so that the ends of the bone usually fall well into position. Mr. Bryant recommends that an attempt should be made to imitate what takes place when the patient is in the supine position, by placing a pad over the blade of the scapula below its spine, and then binding the bone firmly to the thorax by broad strips of strapping, which obliquely encircle the chest on the affected side and reach from the spine to the sternum. The arm should also be supported in a sling, and the hand drawn upward toward the opposite shoulder.

In cases where no displacement of the fragments is present, as may occasionally happen in fracture through the shaft, or in fracture internal to the rhomboid, or between the conoid and trapezoid ligaments, all that is often necessary is to keep the arm fixed to the side and supported in a sling.

In fracture external to the conoid and trapezoid ligaments, in addition to a thick pad in the axilla, it will often be found necessary to apply a figure of 8 bandage behind the shoulders, in order to overcome the displacement forward of the shoulder with the outer fragment. Union is, as a rule, effected in from three to four weeks.

The Scapula.—Fracture of the scapula may involve its body, neck, acromion, or coracoid process.

Body.—Fracture through the body is usually the result of direct violence, and is often associated with injury to the subjacent ribs. It is not of common occurrence, for the thick layers of muscles which lie both over and beneath the bone form soft pads which serve to protect it. The fracture usually affects the infraspinous portion of the bone, running across it in an oblique or transverse direction; or it may extend in a vertical direction right through the spine.

Abnormal mobility and crepitus can generally be detected on moving the shoulder and upper part of the scapula with one hand, while the other is laid upon, or made to fix, the lower portion of the bone. In muscular subjects, and when the fracture involves the infraspinous fossa, there will often be slight, if any, displacement of the fragments; when, however, it runs across the spine,

some irregularity in its course can usually be detected.

Acromion.—Owing to its exposed position, forming as it does the tip of the shoulder, the acromion is more frequently fractured than any other portion of the bone, and usually as the result of direct violence. Abnormal mobility and crepitus can be readily detected on raising and rotating the shoulder; more or less deformity is present, the shoulder becoming flattened and somewhat depressed. On running the finger along the acromion, an irregularity can be felt at the seat of fracture; pain is present, and the movements of the arm are interfered with.

There are two affections which simulate fracture of the acromion, viz., non-union of the acromial epiphysis, and certain cases of rheumatic arthritis of the shoulder joint, in which osteophytic deposits about the acromion are found lying loose and movable beneath the skin; under these circumstances, crepitation can usually be detected.

Coracoid process.—Fracture of this process is rare, lying as it does in a hollow protected by the clavicle above, the thorax internally, and the head of the humerus externally; it is usually the result of direct violence. The only symptoms present will be mobility of the broken fragment, with pain and crepitus on manipulation; if the coraco-clavicular ligament is ruptured, the fractured process may be drawn downward by the action of the biceps and coraco-brachialis muscles.

Neck.—In fracture through the surgical neck the line of fracture runs across the constricted portion of the bone opposite the notch in the superior costa, the coracoid process being included in the detached piece. If the coraco-clavicular and coraco-acromial ligaments are not ruptured, there may be very little deformity; if they give way, the broken fragment along with the arm is displaced downward, so that the symptoms are similar to those of subglenoid dislocation of the humerus; flattening and lowering of the shoulder, with prominence of the acromion and a depression beneath it; the arm lengthened and somewhat separated from the side; the head of the humerus can be felt in the axilla.

The injury differs from dislocation in that the coracoid process is displaced and moves with the arm, which is ab-

normally mobile; crepitus can readily be detected; on raising the arm, the deformity disappears, but returns when the arm is allowed to drop; an irregular mass of bone, formed by the neck of the scapula, can be felt in the axilla, very different to the smooth, rounded prominence formed by the head of the humerus, which alone is present in cases of dislocation.

In fracture through the anatomical neck the glenoid process only is separated from the rest of the bone; the symptoms will be very similar, except that the coracoid process preserves its normal relation and does not move with the arm.

Treatment.—In fracture through the body the fragments should be brought into position, and maintained so by a pad of lint, secured by strips of strapping which encircle half the chest. The arm should be fixed to the side by a body bandage and the elbow supported in a sling.

In fracture through the acromion the elbow should be well supported by a sling, or by a broad strip of strapping (as in the case of the clavicle) which passes beneath it and over the opposite shoulder. A pad should be fixed in the axilla and the arm bandaged to the side. In fracture through the neck treatment is similar.

In fracture through the coracoid process the forearm should be flexed and carried across the chest, so that the hand rests on the opposite shoulder, in order to relax the biceps and coraco-brachialis muscles; the elbow should also be supported in a sling.

The Humerus.—Upper extremity.—Fractures usually produced by direct violence, *e. g.*, a fall or blow upon the shoulder; less frequently they follow falls upon the hand or elbow.

Anatomical neck.—Fracture through the anatomical neck, *i. e.*, above the tuberosities and within the capsule of the joint, is not common; it may be:

1. *Impacted.* The small upper fragment is usually driven into the wide surface of cancellous tissue at the upper end of the lower one.

Symptoms.—The axis of the humerus is altered, being directed somewhat inward toward the coracoid process, the elbow slightly separated from the side; the arm shortened and the shoulder somewhat flattened; the acromion is more prominent than usual, and there is a slight depression beneath it; the head

of the humerus can be felt in the glenoid cavity, and in many instances some alteration in its shape can be detected ; crepitus is absent, unless the impaction is forcibly broken down. There is loss of power, with pain, stiffness, and swelling about the shoulder.

2. *Non-impacted.* Less deformity is present ; a slight projection can be felt on the inner aspect of the joint, caused by the upper end of the lower fragment ; crepitus can be detected on rotating the arm, which is slightly shortened. When osseous union takes place the callus is mainly thrown out by the lower fragment. When the union is merely fibrous, considerable atrophy of the head of the bone is often produced.

Treatment.—In impacted fracture all that is required is to keep the part at rest, by bandaging the arm to the side and supporting the elbow in a sling. Care should be taken not to break down the impaction by the employment of any force. If the soft parts about the shoulder are bruised and swollen, some evaporating lotion should be applied.

In non-impacted fracture it is sometimes necessary to fix a small pad in the axilla, and fit a gutta-percha or felt cap to the shoulder, so as to keep the parts in apposition and completely at rest.

Surgical neck.—Fracture through the surgical neck is the variety most commonly met with about the upper end of the humerus, the bone being usually broken below the tuberosities and above the insertion of the pectoralis major and latissimus dorsi ; the fracture may be either impacted or non-impacted.

In the *non-impacted*, the more common, there is considerable displacement. The upper fragment is rotated outward, and slightly elevated under the coraco-acromial ligament by the muscles inserted into the two tuberosities. The lower fragment is drawn forward, upward, and inward beneath the coracoid process, by the muscles passing from the trunk to the arm, and by the flexors of the arm ; at the same time the lower end of the shaft is thrown obliquely outward from the side by the action of the deltoid.

Symptoms.—The lower fragment forms a distinct prominence beneath the coracoid process, most marked when the elbow is raised ; the head of the bone can be felt in the glenoid cavity ; consequently there is no hollow immediately

below the acromion, though a slight depression is often present just below the end of the upper fragment ; the axis of the limb is altered, being directed upward and inward toward the coracoid process ; crepitus can be detected on extending and rotating the limb ; the arm is shortened and abnormally mobile ; owing to irritation of the branches of the brachial plexus by the lower fragment, pain is often present shooting down the arm.

In the *impacted* form the lower fragment is usually driven into the upper. The symptoms are chiefly of a negative character, the usual signs of fracture being absent ; slight shortening is present with impaired movement, deformity, and alteration in the axis of the limb ; crepitus is absent unless the impaction is broken down. The circumflex nerve, owing to its close relationship to the neck of the humerus, is liable to be wounded at the time of the fracture, or it may afterward become included in the callus by which repair is affected, when paralysis of the deltoid, followed by atrophy, is liable to occur.

Treatment.—In impacted fracture same as in the case of the anatomical neck.

In non-impacted there is the triple displacement of the lower fragment to be remedied ; the displacement inward may be counteracted by placing a thick pad in the axilla and bandaging the elbow to the side ; the displacement forward, by bandaging the elbow to the side of the chest in front of the lateral median line, so as to throw backward the upper end of the shaft ; the displacement upward by supporting the hand only (not the elbow) in a sling, so that the weight of the arm may act on the lower fragment and drag it down. To insure the part being kept completely at rest, a gutta-percha or felt cap may be fitted to the shoulder, and if there is any tendency to swelling of the limb, it should be bandaged upward from the fingers. In fractures of the neck of the humerus, union takes place in four to five weeks, when passive movement should be begun ; in the impacted form the patient should be warned of the stiffness and deformity which will be permanent.

Separation of the great tuberosity may occur alone, but more commonly in connection with a dislocation forward of the humerus ; under these cir-

cumstances the detached portion of bone is drawn backward by the muscles inserted into it, so that it lies under or external to the acromion process, while the head of the humerus is drawn forward beneath the coracoid process.

Symptoms.—There is an increase in the breadth of the shoulder; a projection formed by the detached tuberosity can be felt at the outer and back part of the joint, while between this and the head of the bone, which lies beneath the coracoid process, a distinct gap or vertical sulcus is evident; crepitus is absent unless the fragments are brought into apposition with one another.

Treatment.—An attempt should be made to bring the fragments into contact, and maintain them so by pads of lint and strapping, a cap being also molded to the shoulder. An axillary pad will often be found useful, and the arm should also be supported in a sling and bandaged to the side.

Separation of upper epiphysis.—Separation of the upper epiphysis of the humerus, which includes the head and both tuberosities, is often met with in young subjects; occurring, as it does, just above the usual situation of fracture through the surgical neck, the symptoms of the two injuries are very similar. In separation of the epiphysis, however, the lower fragment is smooth and rounded instead of being sharp and irregular as in fracture; crepitus is absent or much less distinct, owing to the fact that the line of separation runs through cartilage and not through bone.

Treatment same as in fracture through the surgical neck.

Shaft.—Fracture through the shaft is often met with as the result either of direct or indirect force; usually occurs about the middle of the bone.

If the fracture is above the insertion of the deltoid, the upper fragment is drawn inward by the pectoralis major, latissimus dorsi, and teres major; the lower fragment is drawn upward by the coracobrachialis and biceps, and outward by the deltoid; consequently, shortening is present along with deformity, the lower fragment projecting above, behind, and to the outer of the upper one.

If the fracture be below the insertion of the deltoid, the displacement is often slight when the line of fracture is transverse; when oblique, the lower fragment

is drawn upward by the biceps and triceps so as to overlap the upper one. The musculo-spiral nerve, owing to its close relationship with the middle of the shaft of the humerus, is liable to be wounded at the time of the fracture, or it may subsequently become included in the callus; under these circumstances, if paralysis of the nerve accompanies or follows the injury, the patient will present evidences of "wrist-drop," with loss of power of extension and supination in the forearm.

Non-union is more frequently met with as a complication of fracture through the shaft of the humerus than in the case of any other long bone. Various theories have been advanced to account for this: (1) Interposition between the fragments of the muscular tissue which surrounds, and is directly adherent to, the shaft of the bone. (2) Non-apposition of the fragments from imperfect support to the arm. (3) Injury to the nutrient artery of the bone. (4) Imperfect fixation of the shoulder-joint. (5) The tendency to movement at the end of fracture, when, the elbow-joint being fixed in splints, the forearm is flexed or extended.

Treatment.—A rectangular splint reaching from the axilla to the fingers should be applied to the inner side of the limb, care being taken that it is well padded where it presses over the inner condyle, and also at its upper end, which must not reach too high in the armpit; three short splints, reaching from the shoulder to the elbow, should be applied to the anterior, posterior, and the outer aspects of the upper arm. In most cases the hand and wrist only should be supported in a sling, the elbow and forearm being allowed to hang, so that the weight of the latter, by dragging on the lower part of the shaft, may counteract the tendency to overlapping of the fragments, which usually exists. A triangular wedge-shaped pad is often useful in cases of compound fracture; it is interposed between the chest-wall and arm in such a way as to form a support for the limb, the elbow resting upon its thick end. Union, as a rule, takes place in five to six weeks.

Lower extremity.—Four different forms of fracture are met with about the lower end of the humerus, viz.: transverse supracondyloid, T-shaped, separation of either condyle and of the lower epiphysis.

Transverse supracondyloid.—In this variety the shaft is broken across, just above the condyles; the line of fracture, though transverse, is generally somewhat oblique from above downward and forward, so that the lower fragment is drawn upward behind the upper one by the biceps, brachialis anticus, and triceps. The symptoms are very characteristic; there is an irregular projection in front of the joint above the bend of the elbow formed by the upper fragment, which pushes forward the brachial artery, and another behind, formed by the lower fragment and bones of the forearm. Crepitus and abnormal mobility are present along with pain and swelling about the joint. The deformity can be easily reduced, but at once reappears when extension is left off. The distance between either condyle and the olecranon will be normal, while between either condyle and the acromion it will be diminished.

If the line of fracture runs in the opposite direction the position will be reversed, the lower fragment being drawn upward in front of the upper one. This fracture is liable to be mistaken for dislocation of the radius and ulna backward; for in both injuries, which are common in the young, there is a prominence in front of the elbow and another behind, with loss of power, and pain and swelling about the joint. The diagnosis of fracture can be made by the presence of crepitus and increased mobility about the lower end of the humerus; the fact that the anterior projection, which is formed by the upper fragment, is rough and irregular, and above the bend of the elbow, not below as in dislocation, where, being formed by the articular end of the humerus itself, it is broad, smooth, and rounded; the fact that there is no increase in the distance between either condyle and the olecranon, while shortening is present on measuring from the acromion to either condyle; the fact that the deformity is readily reducible, but at once returns when extension is discontinued.

T-shaped fracture into the joint.—In this there is, in addition to a transverse fracture above the condyles, a vertical crack or fissure running between them and involving the elbow-joint. Swelling about the joint, owing to effusion into its interior, is always a prominent symptom,

often rendering the diagnosis of the injury somewhat difficult; the lower end of the humerus will probably appear to be somewhat increased in width, and crepitus can, as a rule, be readily detected on flexing and extending the forearm, or on grasping the two condyles and moving them upon each other.

Separation of either condyle.—Either condyle of the humerus may become separated by a simple crack or fissure, running obliquely across the lower end of the bone. In separation of the outer, or the whole of the inner condyle, the elbow-joint is necessarily opened. In the case of the inner condyle, its tip, more prominent and more liable to fracture, is often separated without the joint being involved. There is not, as a rule, much displacement of the fractured condyle, though at times it is drawn down by the muscles attached to it, so that the characteristic projection on either side of the joint is lost. The elbow becomes painful and swollen, its movements are impaired, and crepitus can readily be detected.

In fracture of the external condyle the musculo-spiral nerve or its subdivisions (more especially the posterior interosseous), and in fracture of the internal condyle the ulnar nerve, may become wounded at the time of injury, or afterward included in the callus by which repair is effected, when symptoms of paralysis of these nerves will accompany or follow the fracture.

Separation of lower epiphysis.—Separation of the lower epiphysis of the humerus, of the two condyles with the trochlea and capitellum, is often met with in young subjects, as the result of a fall upon the elbow. Occurring almost in the same situation as the transverse supracondyloid fracture, the symptoms are very similar to those met with in that injury. In separation of the epiphysis, however, the fragments are more smooth and rounded than in fracture, and for this reason, crepitus is less distinct or absent. The line of separation is also just above the joint, nearer to it than is often the case in fracture.

In rare cases the trochlea and capitellum only are separated, the condyles being left attached to the shaft of the bone, the so-called "infracondyloid separation of epiphysis."

Treatment.—Most cases of fracture of

the lower end of the humerus may be treated with an internal rectangular splint, reaching well up the arm and down the fingers; the elbow should be kept at a right angle, and the forearm, in a position midway between pronation and supination, be supported in a sling. Some cooling lotion should be applied to the joint when evidences of synovitis are present.

In separation of the lower epiphysis and in transverse supracondyloid fracture, when the fragments cannot be kept in position by this treatment, it is recommended to apply an angular splint, fitting the bend of the elbow to the front of the limb, and a straight splint to the back of the upper arm, so as to push the upper fragment backward, and the elbow with the lower one forward; or the position of the splints may be reversed, the angular one being applied behind, and the straight one, reaching to the bend of the elbow, in front; care should always be taken that too much pressure is not employed, otherwise there is a risk of the super-vention of gangrene from compression of the brachial artery between the shaft of the humerus and the anterior splint. At the end of two or three weeks passive movement should be cautiously commenced, the splints being removed and reapplied daily. When the joint is involved, it is sometimes advisable, especially with children, to commence at an earlier period, *e.g.*, as soon as ten days after the accident. In most cases, more or less stiffness will remain for a time, and where the elbow-joint is implicated, the patient should be prepared for the impairment in its movements, which is often permanent. Union will, as a rule, take place in from four to six weeks.

In cases of compound fracture involving the elbow-joint, an attempt should be made to save the limb, unless the soft tissues are extensively lacerated and there is much splintering of bone; any loose fragments should be removed, and occasionally a primary excision of the joint, either partial or complete, may be required. A plaster of Paris splint, interrupted at the elbow with pieces of strong wire, iron hoop, etc., will be found a useful apparatus in these cases, as it allows access to the wound for dressing, and at the same time keeps the part in a state of perfect rest.

The Forearm, Radius, and Ulna.—

Fracture of both radius and ulna is often met with, generally as the result of direct violence, a fall upon the hand being more commonly followed by fracture of the radius alone than of both bones. The usual situation is through their middle or lower third, their upper third being better protected by the thick covering of muscles. The line of fracture is usually transverse, both bones are broken on the same level, or nearly so. The upper fragments are drawn forward by the action of the biceps, pronator teres, and brachialis anticus, the radius being somewhat approximated to the ulna. The lower fragments are drawn together by the pronator quadratus, and upward, either in front of or behind the upper fragments, by the flexor and extensor muscles.

There is more or less shortening of the forearm, with, in many cases, considerable deformity, the lower fragments, which usually overlap the upper, forming a projection on either the anterior or posterior surface of the limb; crepitus can be readily detected, and abnormal mobility is also present.

Treatment.—The forearm should be bent to a right angle and placed in a position midway between pronation and supination, *i.e.*, with the thumb pointing upward. Two straight splints, reaching from the elbow to the fingers, should be applied to the anterior and posterior surfaces of the limb. In this position the radius and ulna will be parallel with one another, and the interosseous space be preserved. The splints should be slightly broader than the limb, so that the bandages may not press upon the arm and force the bones together. In some cases it may be necessary to apply a narrow pad along the interosseous space, in order to keep the radius and ulna apart; otherwise they might become united together by callus thrown out across the space, which would interfere with the movements of pronation and supination. Union is generally effected in from three to four weeks.

Radius.—Fracture of the radius alone may take place through its neck, shaft, or lower end, the latter situation being the most common.

Neck.—Fracture through the neck of the radius is an uncommon injury, and one that is difficult to detect, owing to the fact that very little displacement of the fragments is present, the bone at this

spot being surrounded by a layer of muscle. The movements of the forearm, especially supination and pronation, are interfered with; on placing the finger over the fracture and rotating the hand, crepitus can be detected, and unless the fragments are interlocked, the head of the radius will not rotate with the shaft of the bone.

Treatment.—See Shaft.

Shaft.—Fracture through the shaft of the radius is more common than fracture of the ulna alone, for, being situated on the outer aspect of the limb, it is more exposed to direct violence; moreover, its shaft is not so strong as that of the ulna, and it also has a more direct connection with the wrist. It may be due to direct violence or to a fall upon the hand. The usual seat of fracture is about its middle; if above the insertion of the pronator teres, the upper fragment is flexed by the biceps and fully supinated by the supinator brevis; if below, the upper fragment will be in a position midway between pronation and supination, the action of the supinator brevis being more or less counteracted by that of the pronator teres. The lower fragment is pronated and drawn toward the ulna by the pronator quadratus.

Symptoms.—A prominence is formed on the front of the upper part of the forearm by the upper fragment, and there is a depression at the seat of fracture, both fragments being drawn inward toward the ulna. Crepitus is produced on pressing the fragments together, or on rotating the hand, and there is loss of power of pronation and supination, with abnormal mobility.

Treatment.—Same as in fracture of both bones of the forearm. When, however, the radius is broken high up, it is sometimes necessary to keep the forearm well supinated by means of an angular splint applied to the back of the upper arm and forearm, for, the upper fragment being fully supinated, the proper axis of the limb will not be maintained if the lower one is kept in a position midway between pronation and supination, as in the ordinary method.

Lower extremity.—Fracture of the lower end of the radius is common, one variety being known as “Colles’ fracture.” It is generally the result of a fall upon the palm of the hand when the arm is extended, and though met with at all ages

and in both sexes, is more common after middle life, and especially in females.

The seat of fracture is usually half an inch to one and a half inches above its lower end, at the weakest portion of the radius, where the shaft begins to expand into the broad articular extremity, mainly composed of cancellous tissue, covered with a layer of compact bone much thinner than that of the shaft itself. The line of fracture is generally transverse, but may be oblique from side to side, or from before backward; in some cases there is comminution of the lower fragment, and the fracture is frequently impacted, the compact tissue of the shaft being driven into the cancellous tissue of the lower fragment by the same force that causes the injury. The amount of displacement varies; in some cases scarcely any is present; more commonly it is considerable, and a very characteristic deformity is usually produced.

The lower fragment, carrying with it the hand, is driven upward and backward behind the upper one by the direction of the force and the combined action of the supinator longus extensors of the thumb, and radial extensors, so that a prominence is formed on the back of the wrist, with a depression above it.

The upper fragment projects forward, often lacerating the pronator quadratus, and is drawn by this muscle toward the ulna, forming a prominence on the front of the forearm just above the wrist from the flexor tendons being thrust forward. When the deformity is permanent, and cannot be made to disappear, impaction is probably present; when the fracture is readily reducible, impaction is absent.

Symptoms.—Pain and swelling about the wrist, with impaired movement, especially of pronation and supination. On viewing the limb sideways, its posterior surface presents a distinct prominence (formed by the lower fragment) just above the wrist; a little higher up a marked depression will be seen. Its anterior surface presents a depression above the wrist, corresponding in position with the dorsal projection, and most marked on its radial margin; while higher up, and corresponding with the dorsal depression, a distinct prominence is seen, formed by the projection forward of the upper fragment.

On viewing the back of the limb it will be seen that the hand is drawn over

to the radial side, so that its ulnar border is somewhat convex; the styloid process of the ulna (or, when this is fractured, the lower end of the ulna itself) is unusually prominent; the radial border of the wrist is slightly concave. When the styloid process of the ulna is not fractured, the tips of the two styloids will often be found on the same level.

When the fragments are not impacted, crepitus can be readily detected, the deformity made to disappear, and the bones brought into good position. If impaction is present, crepitus is absent, and the deformity is permanent, unless the fragments are forcibly loosened from one another.

Treatment.—An attempt should be made to reduce the fracture, and when impaction is absent, or not very firm, this can usually be effected, the deformity then disappearing more or less completely. If, however, the ends of the bone are so fixed that they cannot be disengaged by the employment of moderate force, union will take place between the impacted fragments, and the wrist will remain stiff and deformed.

In its treatment many different forms of apparatus are employed. Two straight splints may be used, a palmar one reaching from the elbow to the lower end of the upper fragment, and a dorsal from the same point to the ends of the fingers. A thick pad should be placed over the end of the upper fragment, and another over the lower fragment so as to press them into position. At the end of a week a shorter dorsal splint, reaching only to the knuckles, should be substituted, so as to leave the fingers free.

Nélaton's pistol splint is curved at one end like the handle of a pistol, so as to draw the hand over to the ulnar side; it is usually applied to the back of the forearm and hand (less frequently to the front) in conjunction with a short straight splint reaching from the elbow to the lower end of the upper fragment, applied to the front of the arm. The pistol splint should be thickly padded where it presses on the lower fragment, and the palmar one where it presses on the radial border of the forearm and lower end of the upper fragment.

Carr's splint is applied to the palmar surface of the hand and arm in the prone position, the fingers grasping the cross bar which lies beneath the metacarpo-

phalangeal joints; a short straight splint is also applied to the dorsal surface of the forearm.

Care should be taken that the fingers are left free, and the patient made to exercise them after the first week. The splints may generally be removed at the end of three or four weeks, and gentle passive movement of the wrist-joint commenced, otherwise more or less stiffness of the part will remain. In many cases, and especially in old people, in spite of the most careful treatment, the wrist-joint will never quite recover its normal shape or movement.

Ulna.—Fracture of the ulna alone may occur through the olecranon, shaft, or styloid process, and in rare cases through the coronoid process.

Olecranon.—Fracture of the olecranon is not uncommon as the result of direct violence, *e. g.*, falls, or blows on the back of the elbow; more rarely it is due to sudden and violent contraction of the triceps muscle. More or less deformity is generally present, the broken fragment being drawn upward by the action of the triceps. The nearer the fracture is to the tip of the process, the greater is the displacement, often to the extent of an inch or more. When the fracture is near its base, very little separation is often present, the fractured process being then retained in position by the periosteum and fibrous tissue which invest it.

When separation of the fragments is present, the prominence of the elbow is replaced by a depression, which is increased when the forearm is bent. Swelling rapidly ensues from effusion into the joint. The power of extending the forearm is lost. Crepitus is absent unless the fractured process is drawn down into contact with the surface of the ulna. When no separation of the fragments has occurred, the depression at the back of the elbow will not be present; there will only be slight loss of power in the arm, and crepitus can readily be obtained.

Union is usually effected by fibrous tissue, which may afterward yield and allow of considerable separation of the fragments; so that the arm is often left considerably weakened, the power of extending the forearm being more or less impaired.

Treatment.—A straight splint should be applied to the front of the limb, thickly

padded where it fits the bend of the elbow, so that the joint may be very slightly bent; it will generally be found that the fragments come into more accurate contact in this position than if the arm is kept perfectly straight.

When separation of the fragments is present, the upper one should be drawn down by strapping, and a figure-of-eight bandage, as in the case of the patella. As the fracture usually involves the joint, and is followed by effusion into its interior, it will often be necessary to subdue the swelling by some evaporating lotion before the fracture can be put up. Union generally takes place in four to six weeks, and at the end of this period passive movement should be commenced, otherwise ankylosis of the joint may take place.

In cases where separation of the fragments subsequently occurs from yielding of the fibrous tissue by which union is effected, a similar plan of treatment to that of the patella may be adopted—opening the joint and wiring the fragments; a few cases of recent fracture have also been treated in the same way.

Coronoid process.—Fracture of the coronoid process is extremely rare, except as a complication of dislocation backward of the ulna. The broken fragment may be drawn upward by the brachialis anticus.

Treatment.—The limb should be put up in splints at a right, or even at an acute, angle, in order to relax the muscle which tends to displace the separated process.

Shaft.—Fracture of the shaft usually occurs through its lower third, this being the weakest part of the bone; it is most commonly the result of direct violence. The lower fragment is drawn toward the radius by the pronator quadratus, the upper fragment retaining its normal position, or being slightly displaced forward by the brachialis anticus. A slight irregularity is present in the course of the bone at the seat of fracture, crepitus can be detected, and the movements of the forearm are impaired.

Treatment.—Same as in fracture of both bones of the forearm.

Styloid process.—Fracture of the styloid process sometimes takes place, often occurring in cases of Colles' fracture.

Hand.—Carpus.—Fractures of the carpal bones are of rare occurrence; when

present, they are usually due to direct violence, *e.g.*, a severe crush or blow. Owing to their numerous ligamentous connections, very little displacement takes place, though crepitus is generally a prominent symptom.

Metacarpus.—Fractures of the metacarpal bones are common as the result of direct violence, the usual situation being through their middle or distal third. The displacement of the fragments may be slight, or considerable, the head of the bone dropping or sinking forward toward the palm, and the fractured ends being displaced backward so as to form an angular projection on the back of the hand.

Treatment.—In many cases an anterior splint with a palmar pad is all that is required. When there is much displacement of the fragments, a palmar pad pressing upon the head of the bone, and another one over the dorsal projection with anterior and posterior splints, will often be found useful. Bending the fingers over a ball or thick pad, and then bandaging them in this position, is another plan of treatment sometimes adopted. Union generally takes place in three or four weeks.

Phalanges.—Fractures of the phalanges can readily be recognized by the presence of crepitus, abnormal mobility, and displacement of the fragments.

Treatment.—A narrow splint should be applied to the anterior surface of the finger.

Pelvis.—Fracture of the bones of the pelvis is usually the result of severe direct violence, and when complicated, as is often the case, with injury to the bladder, urethra, and other contents of the pelvis, is always of a serious nature.

1. **Through crest of ilium.**—Fractures separating only a portion of the crest of the ilium are not generally attended by much danger. The nature of the injury is usually evident, for, in addition to more or less pain and bruising about the seat of fracture, there will be mobility of the broken fragment, with crepitus on manipulation.

2. **Through pelvic basin.**—Fractures involving the pelvic basin are more serious, owing to the fact that the viscera contained in it are so liable to injury. In many cases the fracture is multiple; *e.g.*, it may involve both rami of the pubes, and sometimes, in addition, both rami of

the ischium, so that the central portion of the pelvis is entirely separated; or it may involve the rami of the pubes and ischium in front, and the ilium behind, close to the sacro-iliac synchondrosis, so as to separate one-half of the pelvis.

Symptoms.—In addition to the bruising of the soft parts, there is severe pain, especially upon any attempt at movement, with inability to stand or sit erect: a line of ecchymosis is often present, extending along Poupert's ligament and the crest of the ilium, with discoloration of the skin over the sacrum and in the perineum; crepitus and abnormal mobility can often be detected on grasping the iliac spines or crests and attempting to rotate or move them on each other; in some cases the displacement of the fragments will be evident, especially on examination by the rectum or vagina.

When the bladder or urethra is injured there will also be evidence of these complications.

3. Through acetabulum.—Fracture may take place through the rim or floor of the acetabulum owing to the head of the femur being driven violently against it.

(a) *Through floor.*—Fracture through the floor may occur as a simple crack or fissure, or there may be extensive splintering of the pelvic bones. In the former case there may be no very evident symptoms, with the exception of pain, especially on attempts to move the limb or stand erect, or upon pressure on the pubes; at first there is not any alteration in the length of the limb, but after a time slight shortening may ensue, probably owing to changes taking place in the cartilage of the head of the femur and acetabulum, and leading to absorption of the articular surfaces of the bones. In the latter case, crepitus can be readily detected on any movement of the limb, and if the head of the femur is driven into the pelvic cavity, there will be shortening of the leg with inability to move it, deformity of the hip, and probably evidences of injury to the contents of the pelvis.

(b) *Through rim.*—In fracture through the rim of the acetabulum, it is usually its upper and posterior part that gives way; the head of the femur is liable to slip out of its socket, and the injury is frequently accompanied by a dislocation of the thigh on to the dorsum ilii. In this case, the symptoms are obvious; in

addition to those of dislocation, there will be distinct crepitus, and the dislocation can easily be reduced, but will at once return when extension is discontinued.

4. Through sacrum.—Fracture through the sacrum is of rare occurrence except as the result of gunshot injury; when due to other causes, *e. g.*, severe crushes, etc., it is usually associated with fracture of the other pelvic bones, evidences of which will be present.

5. Through coccyx.—Fracture through the coccyx, or dislocation of this bone from the sacrum, is sometimes met with as the result of direct violence, or occurring during the straining efforts of parturition. The symptoms are pain at the part, increased on sitting, walking, and during the act of defecation; crepitus and abnormal mobility will sometimes be present, and on introducing the finger into the rectum a slight projection will probably be felt on its posterior wall. In some cases this injury is followed by persistent pain ("coccydynia") in the region of the coccyx.

Treatment.—The patient should be kept in the recumbent position, and a broad bandage, padded belt, felt or gutta-percha splint, molded to the part, applied to the pelvis so as to keep the parts completely at rest; in many cases it will also be advisable to tie the knees together.

In fracture of the acetabulum, extension should be employed by means of an outside splint, as in fracture of the thigh; this is especially necessary when its rim is involved, in order to prevent the head of the femur from becoming displaced. Any complication which may be present, *e. g.*, rupture of bladder or urethra, must be treated on ordinary principles. In favorable cases, repair will be effected in from six to eight weeks.

Femur.—Neck.—*Intracapsular fracture* is an injury of advanced life, being rarely met with in persons under fifty; it is especially common in the female sex, usually the result of slight indirect violence, catching the foot and tripping up, missing a step in going down stairs, etc.; consequently it is not, as a rule, attended by any bruising or apparent injury to the soft parts about the hip. Its frequent occurrence in old people is owing to the alterations in structure and shape which take place in the neck of the bone as age advances. Not only is nutrition impaired, as shown by the fatty

degeneration of the cancellous and the thinning of the compact tissue, but the neck of the bone itself also becomes more horizontal, being set almost at a right angle to the shaft; consequently, becoming weakened from both these causes, it is liable to snap and give way as the result of the application of a very slight degree of violence. The fracture may be either impacted or non-impacted, the latter being the most common.

Non-impacted.—The amount of displacement of the fragments varies; in most cases the lower fragment is drawn upward, above and to the outer side of the upper one, and at the same time rotated outward, so that its fractured surface looks more or less directly forward, while the upper fragment, being unacted upon by any muscles, retains its normal position. In cases where the periosteum and reflection of capsule, which invest the neck of the bone, are not torn through at the time of the injury, the separation of the fragments may at first be very slight.

Symptoms.—1. Alteration in the shape of the hip, which is somewhat flattened.

2. Alteration in the position of the trochanter major, which is less prominent than usual, and approximated to the antero-superior iliac spine and also to the median line of the body. On rotating the limb it will also be found that the trochanter moves through a smaller segment of a circle than on the sound side.

To verify the altered position of the trochanter major, the following tests may be employed.

(a) *Nélaton's line.*—In fracture of the neck, as in a dorsal dislocation of the femur, the upper border of the trochanter will lie above a line drawn from the antero-superior iliac spine to the tuber ischii. In the normal condition, the upper border of the trochanter should just touch this line.

(b) *Bryant's ilio-femoral triangle.*—This consists of three lines: (1) Drawn from the antero-superior iliac spine to the upper border of the trochanter major, corresponding in the normal state to the upper part of Nélaton's line; (2) drawn from the iliac spine at right angles to the horizontal plane of the recumbent body; (3) drawn at right angles from 1 to 2, where it touches the top of the trochanter. The line 3, the base of the triangle, is the test line for fracture of the neck; in the

normal condition it will, in an adult, measure about two and a half inches; in cases of fracture, when the trochanter is drawn up it will become shortened, and measure about an inch less on the injured than on the sound side of the body.

(c) *Morris's bi-trochanteric or transverse measurement* “consists in measuring the distance from the median line of the body to the antero-posterior line at right angles to the long axis of the body, through the top of the trochanter on each side. The distance is always less on the side of the fracture.”

3. Crepitus, sometimes indistinct, but usually perceptible on drawing down the limb and rotating it inward, so as to bring the fragments in apposition.

4. Pain on pressure, and especially on the movement of rotation.

5. More or less swelling about the joint, especially in the groin, but usually without any evidence of bruising.

6. Shortening of the limb, varying from half to two and a half inches. In some cases this symptom is absent at first, only showing itself after an interval of a few days; probably due to the fact that the periosteum and reflection of the capsule, which invest the neck, were untorn at the time of the accident, but subsequently gave way as the result of some movement of the fragments, or owing to inflammatory softening of their structure; or the fragments, which were originally impacted, may have become loosened and separated.

7. Eversion of the limb, the result partly of muscular action, but mainly of the weight of the leg, which causes it to fall or roll outward; in exceptional cases the limb is found to be inverted.

8. Loss of power in the limb, which is usually complete. Occasionally, when the periosteum and reflection of the capsule which invest the neck of the bone are untorn, the patient may be able to raise the limb and even stand or walk about, though with considerable pain and difficulty.

Union in this fracture is, as a rule, simply fibrous, or it does not occur at all, a false joint forming between the ends of the bone; in most cases, osseous union only occurs if impaction is present; owing probably to the following causes: 1. The difficulty of keeping the fragments in perfect apposition and in a state of

complete rest. 2. The presence of the synovial fluid between the fragments. 3. The small supply of blood to the upper fragment, only through the ligamentum teres. The age and feebleness of the patient, and the atrophy and impaired nutrition of the neck of the bone may also conduce toward the same result.

In the *impacted* fracture, which is much less common, the lower fragment is usually driven into the upper one, the neck of the bone into the head.

Symptoms.—There is less eversion and less loss of power in the limb, so that the patient sometimes stands or walks, though with difficulty; crepitus is absent, and the shortening, which is present to the extent of $\frac{1}{4}$ to 1 inch, cannot be made to disappear on extension, unless the impaction is broken down and the fragments separated. Union in this fracture usually takes place by osseous tissue, and the deformity is in most cases permanent.

Extracapsular fracture of the neck of the femur is usually the result of direct violence, and though it may occur at any age, is most frequently met with in males under fifty years of age. The bone is broken at, or just outside, the line of insertion of its capsular ligament, and in most cases more or less splintering of the great trochanter is present, for the same force that causes the fracture also drives the neck of the bone into the cancellous tissue at the base of the trochanter and breaks it into fragments. The fracture may be either impacted or non-impacted, the former being most common, for the neck very frequently remains firmly wedged into the trochanter and osseous tissue at the base of the neck. From the fact that the fracture is generally the result of direct violence, a fall on the hip, considerable bruising and swelling of the soft parts is usually present about the joint.

In the *non-impacted* variety, crepitus is very distinct, and can be readily felt on laying the hand over the trochanter, especially if the limb is rotated at the same time; shortening is present to the extent of from 1 to $2\frac{1}{2}$ inches, but can be made to disappear on making extension on the leg; the limb is everted.

In the *impacted* variety, crepitus is absent, unless considerable force is used and the fragments are separated; shortening is present, but does not usually ex-

ceed an inch, and cannot be made to disappear on making extension, unless the impaction is broken down; the limb is almost always everted; there is less loss of power about the hip, the patient being sometimes able to stand, or even walk, though with considerable pain and difficulty.

Diagnosis.—An *impacted* fracture differs from a *non-impacted*: 1. Crepitus is absent. 2. Shortening is less marked and does not disappear on traction unless the fragments are separated. 3. There is less loss of power in the limb, and the patient can often raise it, and even stand or walk, though with difficulty. 4. Evidence of direct injury to the soft parts about the hip is more commonly present. 5. Inversion of the limb, though rare, is more common in the impacted than in the non-impacted variety.

Severe *contusions* of the hip, accompanied by eversion and loss of power in the limb, may simulate very closely a fracture of the neck of the femur; but the presence of shortening, the altered position of the great trochanter, and the presence of crepitus (unless impaction has taken place), will usually distinguish a fracture from a contusion. In exceptional cases, and especially when occurring in old persons, a contusion of the hip may be followed after a time by interstitial absorption of the neck of the femur, and under these circumstances slight shortening of the limb may gradually be produced.

From a *dislocation* of the hip a non-impacted fracture may be distinguished by the presence of crepitus, the mobility of the limb, and the fact that the head of the bone cannot be detected in any of the situations in which it would be found in that injury. In impacted fracture with inversion of the limb, the injury may be confounded with a dorsal or sciatic dislocation of the femur, as there is an absence of crepitus, the movements of the joint are restrained, and the position of the leg is somewhat similar. The absence of the head of the bone from the dorsum ilii or sciatic notch, and the free movement of the limb, especially under anæsthesia, will, however, usually distinguish a fracture.

Treatment.—In *non-impacted intracapsular fracture* an attempt should be made to bring the fragments into apposition, and to maintain them so, in the

hope that osseous union will occur. To effect this, extension should be applied to the limb by means of a weight, as in case of fracture through the shaft; the patient should be kept in bed for six or eight weeks, and some form of support or stiff bandage afterward worn for about the same period. As this injury is usually met with in old persons, who in many cases will not bear long confinement in the recumbent position, owing to a tendency to the formation of bed-sores or the supervention of hypostatic pneumonia, it will often be necessary after two or three weeks, or even less, to allow them to get about on crutches, wearing a stiff bandage; the union will probably be fibrous, and the patient will in consequence be left with a weak or shortened limb, more or less lame for the remainder of life. Some, instead of employing any special apparatus, support the limb on pillows, or between sandbags; others make use of the double inclined plane.

In *non-impacted extracapsular fracture*, extension by means of a weight should be employed, and in cases where there is much splintering of the ends of the bone, a bandage round the hips will often be found useful in keeping the fragments in apposition. Firm osseous union will almost always take place.

In *impacted fractures of the neck* no attempt should be made (especially in the intracapsular) to loosen the fragments and restore the limb to its proper length. Osseous union generally results, even in old people, but the limb is left permanently shortened, and usually somewhat everted. All that is necessary is to keep the part at rest by means of a long outside splint, no extension being required, unless with the object of keeping the limb level and parallel with its fellow.

Great trochanter.—Separation of the great trochanter is met with as an independent injury, and as a complication of extracapsular fracture. When occurring by itself, the symptoms of this injury are mobility of the trochanter, with crepitus, which is usually distinct, unless the trochanter is drawn upward and backward on to the dorsum ilii, where it may form a distinct projection; more or less pain and swelling are present about the hip, as the fracture is always the result of direct violence. If accompanied by fracture of

the neck of the femur, evidence of that injury will also be present.

Treatment.—A bandage round the hip, or some form of cap molded to the part, will be found useful in keeping the fragment in position; the limb should also be kept at rest by means of a long outside splint.

Shaft.—The shaft may be fractured at any part of its course, its middle third at a variable level being the commonest situation. The line of fracture may be either transverse or oblique, and, in exceptional cases, longitudinal and almost parallel with the long axis of the bone, or even of a spiral nature. The injury, which is usually the result of indirect violence, is accompanied by well-marked symptoms: considerable shortening with eversion of the limb, loss of power, increased mobility, and crepitus, and more or less deformity.

In the upper third, where the line of fracture is often oblique, the upper fragment is drawn forward, outward, and everted, while the lower one is drawn upward and inward, so that its fractured end lies above, behind, and to the inner side of that of the upper one; rotation outward of the lower fragment is always present.

In the middle third the displacement is often much the same, though it will vary somewhat with the obliquity of the fracture.

In the lower third the upper fragment is drawn slightly forward and inward, the lower one upward and backward, behind the lower end of the upper fragment.

Treatment.—Extension by a weight is a plan generally adopted. A long strip of plaster is applied to each side of the leg as high as the knee, a loop being left beneath the sole of the foot; it is kept in place by short pieces of strapping which encircle the leg transversely, and over these a bandage should be carried from the toes up to the knee, in order to fix the strapping and at the same time prevent any swelling of the foot. To prevent the strapping from chafing the skin, a thin flannel or domette bandage may be applied to the limb beneath it. To obtain a firmer hold on the limb, some surgeons carry the longitudinal strips of strapping above the knee, but not so high as the seat of fracture; to fix them, several turns of a bandage, or one or two pieces of strapping (not too tightly), are then car-

ried round the lower part of the thigh, just above the patella. By this means there is less chance of the strapping slipping, and as extension is made from the lower part of the thigh as well as from the leg, there is less strain on the knee than if extension is made from the leg alone.

A piece of wood (in length from one to two inches greater than the distance between the maleoli) should be fixed transversely in the loop left beneath the sole, so as to form a kind of stirrup, and take off all pressure from the sides of the foot and ankle. A strong cord is fastened by one end to the center of the stirrup, and carried over a pulley arranged at the foot of the bed. A weight, varying in an adult from five to twelve pounds or more, is attached to the other end of the cord; this, if it acts in a line with the axis of the limb, will make extension on the lower fragment, and thus overcome the contraction of the muscles, which tend to draw it upward. Counter-extension may be made by a perineal band attached above to the head of the bed, but in most cases the weight of the patient's body will be sufficient, if the foot of the bed is slightly raised. To steady the limb, a long, straight, outside splint should be applied, reaching from the side of the chest to the foot, and three short splints, fixed by means of straps (so they are readily removable for the purpose of examining the fracture) to the front, back, and inside of the thigh, will also be useful in assisting to maintain the fragments in position. The tendency to eversion of the limb should be prevented, either by fixing a horizontal cross-bar to the lower end of the long splint, or by laying a sandbag along its outer side.

Elastic extension is a modification of the preceding method; one end of a piece of strong india-rubber tubing being attached to the stirrup, the other end to the lower extremity of a Liston's long splint, counter-extension being made by a perineal band, as in the manner next described.

Vertical extension is useful in the case of young children, where it is always difficult to keep the apparatus employed free from contact with urine and fæces. In this method, both limbs are swung at a right angle to the trunk from a bar fixed over the bed, the weight of the body acting as a counter-extending force.

The double inclined plane will often be found useful in fracture through the upper third of the shaft, where the upper fragment is tilted forward; and again in fracture through the lower third, where the lower fragment is drawn backward.

Another plan, sometimes adopted, consists in flexing the thigh upon the trunk almost to a right angle, and the leg upon the thigh; the limb is then laid on its outer side on an angular splint, which reaches from the hip to the ankle, and several short splints are also applied round the thigh.

Erichsen advocates putting up the limb at once in some immovable apparatus, *e. g.*, a starch bandage with a thick layer of cotton wadding beneath; this should be cut up and trimmed on the second or third day, and then reapplied. The advantage of this method is that the patient may leave his bed and get about on crutches after three or four days.

Hodgen's splint, where the limb is supported on a cradle composed of cotton sacking attached to two lateral bars of strong wire, which reach from the upper part of the thigh to beyond the foot; the cradle is swung from an upright post at the foot of the bed, and traction is made upon the cradle, which, in its turn, makes extension on the leg by means of strapping attaching the leg to the lower cross-bar of the cradle, which projects for some inches beyond the sole of the foot.

Thomas's splint, one similar to that used in cases of disease of the knee-joint being sometimes employed, along with four short splints round the thigh itself.

Hammond's double splint, consisting of two long straight splints, applied to the outside of both limbs, and connected by a cross-bar below the feet.

In fracture through the shaft, union is generally effected in about eight weeks in the case of adults, but it is, as a rule, advisable to wear some form of stiff bandage for at least twelve weeks. In many instances some slight shortening of the limb will remain, even after the most careful treatment.

Lower extremity.—Fracture through the lower end of the femur may be *supra-condyloid*, just above the condyles and not involving the knee-joint. The symptoms are very similar to those of fracture through the lower third of the shaft, the lower fragment being drawn backward by the gastrocnemius, so that its fractured

end forms a projection at the upper part of the popliteal space.

Very frequently the joint is involved, the line of fracture being oblique, and running across either condyle, or through the intercondyloid space; or it may be T-shaped, running transversely above the condyles and also between them into the joint; considerable swelling of the joint is usually present, owing to effusion of blood and fluid into its interior; crepitus and abnormal mobility can be detected on moving the joint, or upon grasping the condyles and moving them upon one another; when the condyles are separated, some increase in the breadth of the lower end of the femur is often apparent; in addition there will be pain, loss of power, etc., in the limb.

Separation of the lower epiphysis is sometimes met with in young subjects; the symptoms are identical with those of supracondyloid fracture, except that crepitus is less distinct or absent, owing to the smoother nature of the surface of the fragments. This injury is liable to be followed by some arrest in the growth of the lower end of the femur.

Treatment.—In supracondyloid fracture, or in separation of the epiphysis, when the lower fragment is drawn backward, the double inclined plane, or a Macintyre's splint, will be found useful; when the deformity cannot be overcome by flexing the knee in this way, division of the tendo Achillis, as recommended by Bryant, may be required in order to relax the gastrocnemius, the limb being afterward put up in the same manner, or with extension by a weight, as in fracture through the shaft.

In fracture through the condyles involving the knee-joint, the limb should be fixed on a straight back splint, and the accompanying synovitis treated with some cooling lotion; lateral pressure, by means of side splints, will often assist in keeping the fragments in apposition. Passive movement should be commenced in about six weeks, otherwise considerable stiffness of the joint will probably result.

In compound fracture involving the knee-joint, amputation will often be required; the surgeon must, however, be guided by the age and general condition of the patient, as well as by the severity of the local injury.

Patella.—Fractures of the patella may

be transverse, oblique, vertical, or star-shaped, and comminuted.

Transverse, the commonest variety, is generally the result of muscular actions, the bone being snapped across the condyles of the femur by a sudden and forcible contraction of the quadriceps extensor, when the knee is bent, as during an attempt to save the body from falling backward; in many cases the line of fracture is not directly transverse, but somewhat oblique.

Vertical and comminuted fractures are due to direct violence, *e. g.*, a fall or blow.

Symptoms.—In transverse and slightly oblique fracture, more or less separation of the fragments, increased on bending the knee, the upper one being drawn away from the lower by the muscles attached to it; directly after the accident, a distinct gap or depression may be found in front of the joint between the fragments, and at the bottom of this the condyles of the femur can be sometimes felt. There is inability to stand and extend or raise the leg; crepitus cannot be distinguished unless the upper fragment is drawn down and brought into apposition with the lower one. If some hours have elapsed, an effusion of blood or synovial fluid, or a mixture of both, takes place into the interior of the joint, which becomes swollen and distended, and the depression between the two fragments, which become more widely separated, disappears, and may be replaced by a distinct bulging; at the same time the joint becomes more or less hot and inflamed, and evidence of synovitis appears. In exceptional cases, where there is no laceration of the periosteum and fibrous tissue investing and overlying the patella, separation of the fragments may not occur. In vertical and comminuted fractures there is usually little separation of the fragments, and under these circumstances crepitus can be readily detected.

Mode of union.—In vertical and comminuted fractures, and in transverse, when, owing to the periosteum remaining untorn, there is little or no separation of the fragments, osseous union readily takes place. Difficulty is experienced in keeping the fragments in immediate apposition, owing to: 1. The contraction of the quadriceps extensor drawing away the upper fragment. 2. Accumulation of fluid (blood or synovial) in the joint, dis-

tending it and tending to separate the fragments. 3. Interposition of blood clot, or of the fibrous and aponeurotic structures which overlie the patella, between the fragments.

Union is generally effected by fibrous tissue, and as this tends to yield and stretch, the fragments of bone become, after a time, separated from one another, often to the extent of several inches, so that a weakened, and in some cases a more or less useless, limb remains. In exceptional cases, when the fracture is treated in the ordinary way by means of splints, true osseous union may occur; but this is extremely rare unless the joint is opened and the fragments wired together.

Treatment.—In vertical and comminuted fractures, where there is not much separation of the fragments, the limb should be kept on a straight back splint, and some cooling lotion applied over the knee.

In transverse fracture, where the fragments are widely separated, they must be brought into apposition and maintained so, in the hope that close fibrous, if not osseous, union will result.

The leg should be extended on the thigh, and the thigh flexed on the trunk, by means of a long back splint with a foot piece, having the lower end raised, to relax the rectus muscle, which helps to draw away the upper fragment. Some surgeons keep the limb in a horizontal position, believing that the muscle soon becomes relaxed and ceases to act.

If seen immediately and before effusion has taken place, the fracture may be put up at once; if some interval has elapsed and the joint has become swollen and painful, the necessary pressure could not at once be borne, and an ice bag or an evaporating lotion should be applied to the knee, and when the inflammatory symptoms have subsided, some means may be adopted to bring the fragments into apposition.

The usual plan is to draw down the upper fragment by a broad bandage carried across the limb just above it, and diagonally down and forward round the splint; a pad of lint being interposed between the bandage and the limb above the upper fragment, so as to assist in pressing it downward and at the same time prevent ulceration of the skin from the pressure of the bandage upon it.

Another strip of bandage should be carried in the reverse direction round the lower fragment and splint, and in this way the two fragments can be brought into apposition with one another.

To fix the band a figure-of-eight bandage should be carried above and below the knee, and to prevent both from slipping, notches may be cut, or two nails fixed, on either side of the splint above and below the center of the joint. In cases where the edges of the fragments tilt forward and tend to separate, a third band carried transversely round the limb, directly over the fragments, with a pad of lint intervening, will be found useful.

The splint should be applied for six to eight weeks, when it may be left off, and the patient allowed to get about on crutches, wearing a stiff bandage to prevent any flexion of the joint. This should be worn from three to six months; and then, if firm union appears to have taken place, the patient may very gradually begin to bend the knee. As the knee will be more or less weakened, a leather knee-cap will support and materially increase the usefulness of the limb.

Many other plans may be adopted to bring the fragments into apposition; instead of an ordinary bandage, india-rubber bands are sometimes used; leather straps may be passed transversely round the limb above and below the fragments, and approximated by means of longitudinal straps; a bandage may be fixed round the limb above the upper fragment, and traction downward made by means of elastic extension, or a cord and weight suspended over a pulley at the bottom of the bed. Another method consists in applying a long strip of strapping to the front of the limb, and fixing it by transverse slips and a bandage, a loop being left free over the knee; pads of lint are placed beneath the strapping, above and below the fragments of the patella. A piece of stick is passed through the loop, which is then twisted up until the fragments are drawn into apposition.

Malgaigne's hooks are not often employed on account of the pain, irritation, and suppuration they often produce. They consist of a pair of double hooks, which are passed through the skin, fixed in the two fragments, and then approximated by means of a screw worked with a key. A modification of this plan consists of hooks fixed into pieces of strap-

ping passed round the limb above and below the fragments, instead of into the skin and bone itself.

Some surgeons put up the limb at once, as soon as the swelling has subsided, in a stiff bandage, the fragments having been brought together in one of the ways described. This does not necessitate confinement to bed, the patient being able to get about on crutches after a few days.

When the joint is distended, the fluid may be drawn off with an aspirator, instead of waiting for it to become absorbed. Care should be taken that the instruments used are perfectly clean, and the operation performed with careful antiseptic precautions.

Subcutaneous division of the insertion of the quadriceps extensor into the patella, as well as of the ligamentum patellæ, has been adopted in a few cases with the object of insuring perfect apposition of the fragments.

Laying open the joint and wiring the fragments has been adopted in a large number of cases with considerable success.

The operation, which should be carried out under the most careful antiseptic precautions, is performed as follows: A longitudinal incision is made over the center of the joint, which is opened and the fragments of the patella exposed; any blood clot present in the joint or between the fragments turned out, and the fragments themselves cleared of aponeurotic and fibrous tissue, found lying between and over their broken surfaces. Each fragment is then bored obliquely with a drill, taking care not to reach its cartilaginous surfaces. Sutures of silver wire are passed through the drill holes, and the fragments having been drawn together, the ends of the wire are twisted, cut short, and then hammered down on the bone, where they may be allowed to remain permanently, without causing any irritation. Free drainage should be provided for by the insertion of tubes in openings made at the back of the joint on either side.

If all goes well, firm bony union will result, and the movements of the joint will be more or less completely restored. The operation is one which should not be lightly undertaken, nor without the most careful antiseptic precautions; it should be borne in mind that the usual plans of treatment, if carefully carried out, give, as

a rule, very fair results. Wiring the fragments has in several cases been followed by suppuration in the joint, and the limb and the patient's life have been lost, or if, after this complication (*i. e.*, suppuration), recovery has taken place, the knee has been left ankylosed.

The operation is more applicable for old cases of fracture, where the fibrous tissue, by which union has been effected, having given way, the fragments have become separated, and the limb rendered useless.

The Leg.—Tibia and fibula.—Fractures of the tibia and fibula are frequent, it being more common for both bones to be broken than for one. In indirect violence, which is the most common cause, the tibia usually gives way at its weakest part, about its lower third, and the fibula at a slightly higher level. In direct violence, the bones are broken at the spot where the violence acts. In cases especially involving the upper part of the bone, the line of fracture is transverse and the displacement of the fragments is often slight. Commonly the line of fracture is oblique from above and behind, downward and forward, and from without inward, so that the upper fragment projects forward under the skin (often piercing it and rendering the fracture compound), the lower fragment being drawn upward behind it by the muscles of the calf.

Symptoms.—In transverse fracture there is often little deformity; in oblique, there will be sharp projection of the upper fragment beneath the skin, with mobility, crepitus, pain, and loss of power in the leg.

In fracture of the tibia alone, which is often the result of direct violence, the line of fracture is frequently transverse, and the symptoms may not be obvious, for the fibula, remaining unbroken, acts as a splint, and tends to prevent such displacement; in most cases crepitus can be detected on manipulating the limb, and upon running the finger along the subcutaneous edge of the tibia some slight irregularity can usually be detected at the seat of fracture.

Fracture of the internal malleolus is a common complication of Pott's fracture of the fibula.

Fracture of the fibula alone is met with as the result of indirect violence, the bone giving way through its lower third;

less frequently from direct violence, the fracture then taking place at the spot where the force acts.

Symptoms.—Obscure, for there is very little displacement of the fragments, and the patient can occasionally walk without much pain or difficulty. Crepitus and mobility can usually be detected, if pressure is made alternately on either side of the suspected seat of fracture, or if the foot is rotated with one hand, while the fingers of the other are placed over the point where the bone is broken.

Pott's fracture.—A fracture of the lower end of the fibula, associated with a dislocation outward of the foot at the ankle-joint, usually the result of a sudden slip or twist of the foot outward. The bone is broken from two to four inches above its lower extremity, the ends of the fragments being driven inward; the articular surface of the astragalus displaced from the tibia, and the foot dislocated outward at the ankle-joint; in some cases the inner malleolus of the tibia is fractured, in others the internal lateral ligament is ruptured.

The signs of this injury are obvious; a well-marked depression at the seat of the fracture of the fibula; the foot is twisted outward, and its sole is everted by the peronei, the fibula no longer offering any resistance to their contraction; the inner malleolus, if unbroken, projects prominently beneath the skin; if separated the detached fragment can be readily felt, with a depression above it, and crepitus is easily obtained; the heel is drawn up by the muscles of the calf.

Dupuytren's fracture of the fibula is a rare injury, in which there is not only fracture of its lower extremity, but also laceration of the strong inferior tibio-fibular ligaments (remain intact in Pott's fracture); in some cases, a slip of the tibia is torn off with the ligaments, remaining connected with the lower fragment of the fibula. In addition, the foot is displaced upward and outward, and the tibia is sometimes forced through the skin on the inner side of the ankle, so that the fracture is rendered compound.

Treatment.—Most cases of fracture of the tibia and fibula, or of either bone alone, may be treated on a straight back splint, with a foot-piece for the sole at right angles to it, and two side splints; in the application of these, there are certain rules which should be observed, viz.;

1. The joints above and below the seat of fracture, the knee and ankle, should be fixed by the splints.
2. The inner border of the patella, the internal malleolus, and the inner side of the great toe should be in the same line.
3. There should not be any irregularity in the crest of the tibia.
4. The foot should be kept at right angles with the leg.
5. The heel should never be allowed to drop nor raised too high, and its under surface should be well in contact with the foot piece.
6. Pressure should be taken off the back of the heel by means of an opening in the back splint beneath it, and by a pad placed between the limb and the splint, just above it.
7. The seat of fracture and the toes should be left uncovered.
8. No bandages should be applied beneath the back splint.

The fracture should be kept in splints for three or four weeks, and some form of stiff bandage afterward worn for about the same period. When there is not much displacement of the fragments, and an absence of bruising or swelling of the soft tissues, the limb may at once be put up in some form of stiff bandage, *e. g.*, plaster of Paris, or a Croft's splint, and the patient in two or three days allowed to go about on crutches.

Some use Cline's splints (lateral splints with foot-pieces); if employed, care should be taken that the foot-piece is at right angles with the side-piece, not at an obtuse angle, as is generally the case, otherwise, the foot being kept fixed with the toes pointed, considerable weakness and stiffness of the ankle will afterward remain from the stretching of its anterior ligament.

The "fracture box," or "box splint," is useful when the soft tissues are much bruised and swollen, also in some cases of compound fracture; it consists of a board with a foot-piece and movable sides, forming a kind of box in which the limb is supported on a pillow. If the limb, after being put up in splints, is suspended in a swing, it will be more comfortable, as the patient will be able to move it as he lies in bed without disturbing the fracture; it may be swung by straps or bandages from the bed-cage, which should be used in order to keep the weight of the bedclothes off the limb. If the limb is not suspended, sandbags should be laid on the bed, on either side of it, in order to steady it.

When there is much displacement of the fragments, and difficulty is experienced in keeping them in position by any of these methods, laying the limb on its outer side with the hip and knee bent may prove successful, for in this posture the muscles of the calf, the chief agents in producing the deformity, become relaxed. Occasionally subcutaneous division of the tendo Achillis may be required with the same object.

In *Pott's fracture* there is, in addition to fracture of the fibula, the dislocation outward of the foot, which has to be corrected. Some treat this fracture with a back splint and two side splints; but when put up in this way there is a tendency for the deformity to recur.

When the displacement of the foot is well marked, it is safer to use a straight wooden splint, notched at its lower end, and reaching from the head of the tibia to about four inches below the sole of the foot. This is applied to the inner aspect of the limb; a thick pad, not extending below the inner malleolus, being interposed between the lower part of the splint and the leg. The upper end of the splint having been bandaged to the limb, the thick pad is made to act as a fulcrum, across which the foot is drawn to the lower part of the splint; to this it is fastened by a figure-of-eight bandage carried round the ankle and foot and through the notches at its lower end. This bandage should not be carried round the ankle higher than the external malleolus, otherwise it would press the fragments of the fibula inward, and defeat the object of this plan of treatment, which is to draw the foot inward and throw the broken ends of the fibula outward. If the knee is bent, and the limb is either swung or laid on its outer side, the muscles of the calf will be relaxed, and in this way the tendency for the heel to be drawn up will be counteracted.

A modification is sometimes employed with good results. It consists of an inside splint, with a foot-piece at right angles to it, for the sole. The foot is first bandaged to the splint, care being taken that the sole and heel are well in contact with the foot-piece. The upper part of the splint is then drawn across the thick pad (which, being fixed above the internal malleolus, acts as a fulcrum), and bandaged to the leg below the knee. The advantage of this splint is that the

foot, by means of the foot-piece, is maintained at a right angle with the leg, instead of becoming extended, as is frequently the case when the common splint is employed; and the stiffness and weakness of the ankle-joint, from stretching of the anterior ligament, and from the long-continued faulty position of the foot, are to a great extent prevented.

Pott's method consists in flexing the knee to a right angle and laying the limb on its outer side; for this purpose an outside splint with a lateral foot-piece may be employed, the pad of the latter being thicker than that of the leg-piece, so as to press the foot inward; to the inner side of the limb a straight splint is applied, reaching not lower than the ankle, the two splints being bandaged or strapped together. In cases of Pott's fracture, where the displacement of the foot has not been completely corrected, considerable improvement will often follow subcutaneous division of the fibula and forcible straightening of the foot, the case being then treated as one of recent fracture.

When both tibia and fibula are broken, union, as a rule, takes place in from six to eight weeks, some form of apparatus being usually required from eight to ten weeks; in the case of fracture of a single bone, six weeks is generally sufficient.

The Foot.—Fractures of the bones of the foot are rare, except as the result of severe crushes; when several are usually involved, and the fracture is often compound.

Simple fracture of the os calcis is sometimes the result of a fall on to the heel; if broken transversely behind the attachments of the strong interosseous ligament, the detached fragment may be drawn up by the contraction of the muscles of the calf. In many, no displacement occurs, the strong ligaments maintaining the fragments in apposition, the only symptoms then being pain and swelling about the heel, with crepitus on grasping the posterior part of the os calcis, and moving it from side to side. When the fracture is comminuted, the mobility of the fragments and the ready detection of crepitus will at once point to the nature of the injury. In some cases, as the result of sudden and forcible contraction of the muscles of the calf, the epiphysis, or even the posterior part of the os calcis, may become separated and drawn away.

Simple fracture of the astragalus, as the result of indirect violence, is rare, as are fractures of the other tarsal bones. Fractures of the metatarsal bones and phalanges are always the result of direct violence, and resemble in their general symptoms the fractures of the corresponding bones of the hand.

Treatment.—When the posterior portion, or the epiphysis, of the os calcis is separated and drawn away by the muscles of the calf, an attempt should be made to relax the latter and bring the fragments into apposition, by placing the limb on an outside splint, with the knee flexed and the foot extended. In fracture of any of the other bones, the foot should be kept at rest, either on a back splint with a foot-piece, or by means of a stiff bandage.

F. A. SOUTHAM.

FRACTURES, AMBULANT TREATMENT OF.—The fracture is reduced and the skin of the leg and foot cleansed with soap and water. Then, with the foot fixed at a right angle to the leg, a flannel bandage is smoothly and evenly applied from the toes to just above the knee. This bandage includes beneath the sole of the foot a padding of six to eight layers of surgical cotton wadding, making a pad about an inch thick when compressed by moderate pressure of the bandage. Over this is applied a plaster bandage from the base of the toes to just above the knee, especial care being taken that the application is made smoother and firmer than the ordinary plaster cast. The layers of the bandage are well rubbed as it is applied, to obtain the greatest amount of firmness with the smallest amount of bandage. The sole is strengthened by incorporating with the circular turns an extra thickness of ten or twelve layers of bandage well rubbed in together and extending longitudinally along the sole. The bandage is applied with special firmness about the enlarged upper end of the tibia, and here is made somewhat thicker. As it dries it is pressed in to conform more closely to the legs just below the heads of the tibia and fibula. An assistant at the foot of the table supports the leg and makes the traction or pressure required to keep the fragments in position while the plaster is being applied. The operation requires about twenty minutes, and by the time

the last bandage is applied the cast should be fairly hard. When the bandage has become hardened the leg is suspended. When the patient steps upon the sole of the plaster cast the thickness of the cotton beneath the foot separates sole of the foot so far from the sole of the cast that the foot hangs suspended in its plaster shoe and the weight of the body is borne by the diverging surface of the leg above the ankle.

FRAMBOESIA (Yaws; Pian; Endemic Verrugas). See YAWS.

FRECKLES are minute, regularly shaped accumulations of the normal pigment of the skin, varying in color from fawn-yellow to deep brown. They never occur in very young children or in advanced age. They generally first appear in summer and partially disappear in winter. Freckles frequently give rise to considerable disfigurement, but cause no subjective symptoms.

The *treatment* is that of CHLOASMA.

FREMITUS.—Vocal fremitus is the thrilling sensation conveyed to the hand when applied to the chest of a person during phonation.

The nature of the sensation perceived will depend upon the character of the voice. The deep tones of a man's voice are always much better conducted than the higher-pitched voice of a woman or child. The amount and kind of the tissues interposed between the hand and the lung also influence the vocal fremitus, which is usually more marked in lean persons. Any condition which produces consolidation of the lung increases the vocal fremitus, provided the bronchi be patent: while the presence of fluid between the lung and the chest-wall diminishes, or prevents its being felt.

The vocal fremitus beneath the right clavicle is normally more distinct than on the opposite side. If, the vocal fremitus be equal on the two sides, and well marked, it is probably increased at the left apex, and a presumption arises that the left upper lobe is the seat of disease. If the fremitus be more marked at the left apex than the right, the presumption that the left upper lobe is affected is still stronger. If, on the other hand, the vocal fremitus beneath the clavicles be equal, but less marked than normal, probably the voice conduction is dimin-

ished at the right apex, and the condition of the right upper lobe must be carefully investigated in the further course of the examination. This applies equally to the supraspinous fossæ.

Rhonchal fremitus is felt when the vibrations produced by the passage of air through a large bronchial tube, narrowed by the presence of mucus, are sufficiently intense to reach the hand applied to the chest. It is often present in bronchitis, especially frequent in children suffering from that disease.

Friction fremitus.—The vibrations produced by the rubbing together of two dry surfaces of the pleura, or of the pericardium, may sometimes be appreciated by the hand. It is commonly present in dry pleurisy.

Tussive fremitus is felt when the hand is placed upon the chest while the patient coughs. It is sometimes of use in diagnosis in the case of children, and in adults when the condition of the voice prevents the conduction of the vocal fremitus.

Hydatid fremitus is the sensation occasionally elicited by percussion over the site of an hydatid tumor, usually of the liver. Three fingers are placed over the site of the tumor, and the middle one is sharply percussed, when a thrilling sensation may be perceived by the other two. This sign is present in only a very small proportion of cases, and is therefore of comparatively little value in diagnosis.

J. K. FOWLER.

FRICTION SOUND.—The rubbing, crepitant, or creaking sound heard on auscultation over the large serous sacs when their ordinarily smooth surfaces are roughened, usually by an inflammatory exudation.

In the case of *the pleura*, apart from the rubbing nature of the sound, its evidently superficial character, and the fact that it is usually audible both with inspiration and expiration, help the diagnosis; but it is often difficult to decide whether a sound having a crepitant character is of pleural or pulmonary origin. If the sound be audible only at the end of a deep inspiration, if it remain unchanged by cough, and if there be localized pain increased by inspiration, it is probably due to the presence of a patch of recent lymph on the underlying pleura, or of fine fibrous adhesions. The pleural origin of a crepitant sound is often indi-

cated by the discovery of a “rubbing” friction sound in its immediate neighborhood.

A pleural friction sound in the precordial area may acquire a “to and fro” character under the influence of the movements of the heart. Such a sound usually ceases when the lung is fixed by holding the breath after a deep inspiration.

Pericardial friction sound may be single or double, occurring with either systole or diastole of the auricles or ventricles, or with both. It may be distinguished from a valvular murmur, for which it is liable to be mistaken, by its rough and superficial character, by the fact that it is most distinct at the normal sites of maximum intensity of valvular murmurs, and often from its want of exact synchronism with the systole or diastole of the ventricles (*see* PERICARDIUM).

Peritoneal friction sound is most often heard over the region of the liver, as the organ moves during respiration, and indicates the presence of perihepatitis, which may be either a local affection or part of a general inflammation of the peritoneum. It may be occasionally distinguished over other areas of the abdomen when the serous membrane is roughened by inflammation, or from the presence of morbid growths.

J. K. FOWLER.

FROSTBITE is a form of inflammation of the skin and deeper parts produced by prolonged exposure to cold, and tending to terminate in gangrene; parts chiefly affected are fingers, toes, tips of the ears, and nose, where the circulation is weak and a large extent of surface is exposed to the air. Anæmic persons are specially prone to suffer, and a temperature above freezing-point may be sufficiently low to cause frostbite.

Symptoms.—For milder forms see CHILBLAIN. In more severe forms, the part attacked is at first pale, wax-like, or mottled, and senseless; afterward, it becomes covered with bullæ, the contents of which are often hemorrhagic. The accompanying general phenomena are those produced by excessive cold: stupor, somnolence, coma. When thawing is complete, an inflammatory line of demarcation between the healthy and gangrenous parts shows itself. Days, or weeks.

may elapse before the amount of tissue which has been actually destroyed can be determined.

Prognosis.—Should be somewhat guarded, especially in infants and old persons. Death often results from phlebitis and septicæmia.

Treatment.—Milder form, see CHILBLAIN. In severe cases, amputation must be performed after the formation of a distinct line of demarcation.

J. J. PRINGLE.

GALACTORRHŒA.—A continuous flow of milk from the breast during lactation, or a continuous secretion of milk in a non-nursing woman. The disease, which is often intractable, may be due to insufficient tone of the nipple, morbid stimulation of the gland, or debility.

Treatment.—In the first variety, astrigent applications to the nipple; tannic acid lotion and gentle friction may be useful; the nipple should from time to time be drawn out with a breast-pump. In the second class, applications of belladonna to the breast, with the internal administration of iodide of potassium, iron, and other tonics.

Symptomatic Indications.—*Belladonna* is the principal remedy for this condition; when this does not succeed *pulsatilla* or *calcareia* may be useful.

GALL BLADDER, DISEASES OF.

—**Dropsy.**—When the cystic duct becomes occluded by a gall stone or a parasite, or as the result of inflammation or of some morbid growth, no bile can find its way into the gall bladder, which may become distended with a clear watery mucus secreted by its lining membrane. This is called dropsy of the gall bladder, and the result is the formation of a pyriform elastic tumor, to be felt on the right of the middle line, in the normal position of the gall bladder, or possibly much lower down in the abdomen.

Symptoms.—Apart from the presence of tumor, negative. There may be *pain*, which is generally the case when the condition comes under notice.

Treatment.—Is only called for when pain is present, and in such cases cure has followed the operation of opening the gall bladder after abdominal section and stitching its walls to the edges of the wound. A fistulous opening may re-

main for some time, but generally closes eventually.

Inflammation.—Acute catarrh is generally caused by extension of a similar inflammation from the duodenum; chronic catarrh, often occurs in chronic congestion of the liver, as in heart disease. May be caused by direct irritation of the cystic mucous membrane, by abnormal bile, gall stones, or parasites in its cavity. These last are apt to set up a form of inflammation in which the lining is covered with false membranes, or may even cause phlegmonous inflammation, with suppuration and ulceration. Phlegmonous inflammation may be caused by extension from an abscess in the liver. Ulcerative inflammation is apt to pass on to gangrene.

In all these conditions the affection is but part of a complex of symptoms. These are described under the diseases to which they properly belong, with which their prognosis and treatment are necessarily involved.

Ulceration may lead to the formation of *biliary fistulæ* communicating either with the intestine or the internal surface of the body.

New formations.—Cancer of the gall bladder is so often associated with the presence of gall stones (*q. v.*) that it is probable that the irritation they set up determines its occurrence. The gall bladder may also become involved in cancer of the stomach, intestine, bile ducts, or liver.

Parasites.—The gall bladder may be invaded by various parasites, especially by *distoma hepaticum*, *ascarides*, and *hydatids*. The presence of any of these may give rise to symptoms of obstruction of the cystic duct, or may cause inflammation and even ulceration of the cystic mucous membrane.

ROBERT SAUNDBY.

GALL STONES.—*Structural character and mode of origin.*—Gall stones probably result from precipitation from the bile, either as the effect of a diminished amount of cholate of soda or as a concretion around inspissated mucus or blood clot.

Composition.—Cholesterine, bile pigment, and earthy matter; the center is often black, from which radiate lighter lines. When composed of pure cholesterine, the concretions are translucent and

crystalline. When packed in the gall bladder in large numbers they become polygonal and faceted from mutual pressure.

Symptoms.—Distention of the gall bladder with calculi.—The tumor is hard, nodulated, and resisting, imparting, on palpation, a crackling sensation. Usually movable, and sometimes the seat of much pain, the swelling increases in bulk very slowly. Jaundice and biliary colic are of common concurrence. Vomiting may occur, and is occasionally difficult to check. Attacks of agonizing colic sometimes occur at regular intervals. Mental depression and hypochondriasis, and symptoms of disease in distant structures, are apt to be met in nervous subjects. If ulceration be set up, localized peritonitis with acute pain must be looked for.

During the attacks of gall-stone colic the pulse is generally small, and the condition of the system indicates prostration. The severe griping pain which a single calculus sometimes causes during its transit down the bile duct often suddenly ceases on its escape into the duodenum.

Treatment.—The attacks of spasmodic pain and vomiting require for their relief the application of poppy-head fomentations, and, perhaps, belladonna ointment over the hepatic area; or subcutaneous injections of morphine; hydrocyanic acid, with chloric ether, may be given internally; and cautious inhalation of chloroform may be tried in severe cases. Where there is a possibility that the distention of calculi may prove fatal by the alarming constitutional disturbance caused, operative measures will be necessary.

Cholecystotomy.—The operation designed for the extraction of impacted gall stones by incision of the gall bladder, does not include the dilatation of fistulous openings.

Methods of operation.—Maunder's.—The gall bladder, having been stitched to the parietes, is not opened until adhesions have had time to form.

Marion Sims's.—The cyst is stitched and opened at one operation.

An incision from three to four inches long is made either in the linea alba or over the outer border of the right rectus, or over the prominence of the tumor parallel to the linea alba. All bleeding must be stopped before opening the peritoneum. The gall bladder on being ex-

posed should be emptied of its fluid contents by the aspirator, and incised at the point of puncture, so as to readily admit the finger. The cut edges must be held well up into the external wound to prevent any of the contents of the cyst escaping into the peritoneal cavity. The interior of the cyst should be well cleansed with minute pieces of sponge on holders, and any movable calculi extracted with ring forceps. The edges of the wound should be stitched with the continuous suture to the upper end of the abdominal wound, leaving the opening in the gall bladder quite free. The rest of the abdominal wound should be closed in the usual way, and dressed in the manner elsewhere described.

The points specially requiring caution are: 1. No part of the wall of the gall bladder should be cut away, else troublesome hemorrhage may ensue. 2. Great caution must be used in any attempt to dislodge stones impacted in the neck of the gall bladder or its duct, or encysted in its walls, lest perforation should allow bile to escape into the peritoneum. 3. If the calculus is adherent to the mucous membrane of the gall bladder, extreme care and delicacy of manipulation are necessary; avoid laceration of the cyst wall. 4. No attempt should be made to close up the incision in the gall bladder, so as to return the viscus to the abdomen. 5. The operation should not be too long delayed.

HENRY MORRIS.

GANGLION.—There are two varieties. It may arise from a cystic enlargement of a cell in one of the fringes of synovial membrane lining the sheath of the tendon or may be originally a partial "hernia" of the sheath of the tendon. It is rarely found communicating with a tendon sheath at all. It is a fibrous sac, containing a fluid, usually jelly-like, sometimes quite serous in consistence. It is most frequently found over extensor tendons at back of radial side of wrist, appearing as a globular, hard or fluctuating, transparent swelling. It causes feeling of weakness, and often pain.

Treatment.—1. Rupture. Place patient's wrist on your knee, steady it with your fingers, and squeeze, with ends of both thumbs, the ganglion against a ridge of bone beneath it. 2. Iodine paint or blistering. 3. Pressure. 4. Subcutan-

eous puncture. Follow the first and last with pressure by pad and bandage.

Compound palmar ganglion is a dilatation of a considerable part of several tendon sheaths.

Situation.—Palm of hand and lower part of forearm just above annular ligament. Similar compound ganglia are occasionally found in foot.

Signs.—Fluctuating swelling above and below anterior annular ligament; crackling from melon-seed bodies usually contained within.

Treatment.—1. Puncture with a trocar large enough to let melon-seed bodies pass through its canula. Wash away these bodies by injection with warm water. Inject tinct. iodini 3js+aquæ $\frac{3}{4}$ js. Let injection escape after two minutes. Then apply compress, splint, and bandage. 2. Incisions above and below annular ligament. These should be longitudinal. Antiseptic dressing very advisable. Gently remove melon-seed bodies by syringing with weak carbolic lotion.

C. B. KEETLEY.

GANGRENE.—Death of a part of the soft tissues of the body. The dead part is called a "slough," and the term "sloughing" is often applied alike to the diseased action which results in the slough and to the reparative process by which the slough is afterward cast off.

Varieties.—Two main classifications: 1, dry and moist; 2, traumatic and idiopathic.

Causes.—*a.* Of *traumatic gangrene*.—1. mechanical violence, *e. g.*, crushing and disintegrating action of a cart wheel passing over a limb; 2. mechanical pressure, *e. g.*, bed sore, and strangulation of a limb by a tourniquet; 3. chemical, *e. g.*, the effects of corrosive acids, or excessive heat or cold, or of extravasated urine. *b.* *Idiopathic gangrene* has for its remote causes the following: 1. General anæmia, *e. g.*, gangrene has been known to follow excessive venesection; 2. Arterial obstruction from embolism or thrombosis in cases of atheroma. This form usually occurs in old people, and is called senile gangrene. 3. Specific fevers and their sequelæ, especially typhus, typhoid, and septicæmia. 4. Certain diseases, mostly inflammatory, *e. g.*, carbuncle, phagedæna. 5. Poisons, *e. g.*, ergot of rye, serpent's poison, etc. Many of the above

causes, probably all, act either by diminishing the supply of blood to the part, or by obstructing its escape from the part, or by both combined. Gangrene produced purely by diminished blood supply is dry; that caused partly or wholly by obstructed return of blood is moist. Inflammation is an aggravating element in most cases and an essential element in many. Two or more of these causes are frequently combined; *e. g.*, senile gangrene results often from a wound of the toe of an old person with atheromatous arteries.

Pathology.—The appearances are primarily those of a region where the vessels are either almost empty or else distended with stagnant blood. Then, in the part itself, if blood can pass through it at all, but always in its immediate neighborhood, inflammation occurs. If the part is exposed to the air, it next begins to decompose, and most of the so-called appearances of gangrene, *e. g.*, foul odor, are really signs of putrefaction in the gangrenous tissues. For a time, the inflammatory and gangrenous process spreads. When it reaches its limits, the inflammation on its borders produces granulations between the living and dead regions, which granulations, as it were, push off the dead structures. In gangrene of embolic origin, emboli are found in the arteries. The line where the gangrenous process stops and the wall of granulations is formed is called the line of demarcation.

Symptoms and course.—(1) *Dry gangrene.* First appearance often a brown spot on one toe; this spreads, the parts affected gradually shriveling up, the skin wrinkling and becoming brownish black. This process is called "mummification." (2) *Moist gangrene* begins with signs of inflammation. Then the swelling becomes boggy, skin mottled or violet. Bullæ. Discoloration spreads and deepens. Local insensibility. Fall of temperature locally. Emphysematous crackling. Foul odor. Extent of process varies from part of toe to a whole limb. Either of above series of symptoms observed in senile gangrene. Traumatic gangrene is always more or less moist and inflammatory. If patient survives, the dead parts are cast off, the tendons and fasciæ giving way last but one, and the bone last. Process of spontaneous separation of any segment of a limb occupies months.

In *traumatic gangrene* there is great prostration and fever of a low type. In *senile gangrene* these may be very slight, but usually there is chronic septicæmia, viz., gradual exhaustion, feeble pulse, dry tongue, nervous sensibility dulled; etc.

Symmetrical gangrene of the extremities is sometimes developed independently of any lesion of the circulatory apparatus under the influence of cold, moral emotions, or menstrual difficulties; paleness of the skin, with feeling of tumefaction at the points attacked, is a symptom, or the skin may be covered with bluish spots and becomes dry, tense, parchment-like. Mortification is evidenced by extremely sharp burning pains.

Diagnosis.—Distinguished from ecchymosis caused by blows, and from lividity the result of exposure to cold.

Prognosis.—Unless part affected is small or a line of demarcation has formed, unfavorable. Worse when from constitutional than purely local causes.

Treatment.—When only a small part, *e. g.*, the end of a finger, is affected, and when the cause is traumatic, treatment is purely local, otherwise it is also constitutional. 1. To promote detachment of the gangrenous parts; 2. prevent the gangrenous parts from decomposing, and thus infecting the patient and his chamber. Use absorptive compresses of tow or oakum, wet, but not too wet, with chlorine water or carbolic lotion. Charcoal powder and iodoform are useful. Remove sloughs gently when they are fully formed. After separation of dead parts, treat like an ordinary granulating wound.

It is a very safe rule in civil practice never to amputate till a line of demarcation has formed. Leave single toes to fall off. "If the whole foot or leg be affected, do the amputation so that it may be merely an aid to the normal process of detachment, *i. e.*, on the borders of the healthy parts. Dissect up only enough skin to cover the stump, and saw the bone as near as practicable to the line of demarcation."

Relieve pain with opium (up to gr. 1-2 every three hours) or morphia, subcutaneously. If these disagree, use chloral (gr. xx. 6tis horis) or some other anodyne. Extent to which you give or withhold stimulants and nourishment depends on relative importance you attach to remediable weakness and inflammation, respect-

ively, as factors in extending the gangrene. Nourishing food, quinine, acids, gentian, camphor, or ammonia, are used as a rule, but Syme declared that in senile gangrene he got the best results from comparatively low diet.

For gangrene threatening from excess of tension, use free incisions. If from arterial obstruction, apply local warmth. If from venous obstruction, elevation of limb, supported by gentle, even bandaging. (*See BEDSORES.*) In severe crushes, where gangrene seems inevitable, it is better to amputate before reactionary fever has set in, unless indeed the limits of the parts hopelessly injured cannot be sufficiently made out.

C. B. KEETLEY.

Symptomatic Indications.—*Arsenicum* is the principal remedy for gangrenous inflammation and most forms of gangrene, with burning pains, restlessness, debility, emaciation, unquenchable thirst. *Lachesis*, in traumatic gangrene, is very serviceable; *carbo. veg.* in senile gangrene, with coldness and purple color of the parts.

GARGLES.—Liquids used for local application to the fauces. A small quantity—about a tablespoonful—is taken into the mouth, and, the head being thrown well back, the fluid is agitated by means of the air expelled from the larynx so as to bring it into contact with the mucous membrane around. Many persons cannot permit the fluid to go beyond the uvula without immediately swallowing it. The use of sprays and lozenges, or brushing the throat with an astringent solution, is rapidly superseding the gargle in the direct treatment of affections of the fauces.

GASTRALGIA.—See GASTRODYNIA.

GASTRITIS.—Idiopathic gastritis is rare; but inflammation, tending to exudations and destruction of parts, or condensations of tissue, especially about the pyloric orifice of the stomach, the consequence of direct injury from irritant or corrosive poisons, and especially the use of raw spirits, is not uncommon. The simplest and most frequent form of inflammation of the stomach characterized by active congestion and an excessive secretion of mucus—gastric catarrh—is similar in character to that of the air-

passages. In the acute form the mucous surface is reddened in spots by a fine injection, its tissue relaxed, and its surface covered by a layer of tough mucus. There are also certain morbid states of the stomach resulting out of forms of inflammation, expressed by : (a) softening of the tissue ; (b) granular degeneration of the proper mucous substance ; (c) congestion. The symptoms of abnormal states of the stomach are expressed : (1) Vomiting, associated often with lesions of other organs ; (2) deficient secretion of gastric juice ; (3) fermentative processes (alcoholic, butyric, or lactic), tending to the development of entophytes, such as sarcinal ; (4) indigestion, associated with and depending upon : (a) morbid states of those viscera which are conjoined with the stomach in the processes of digestion, as the liver, pancreas, and small intestines ; (b) imperfect action of the kidneys, as in Bright's disease ; (c) defective or diminished morphological changes during the processes of nutrition in the tissues, generally expressed by altered secretions and excretions, as in many constitutional diseases ; (d) indigestion, associated with pyrosis and increased secretion of the juices of the stomach and salivary glands and with cutaneous disorders, such as urticaria ; (e) indigestion, associated with drunken habits.

The diseases of the stomach with which one or more of these organic or functional states may be associated are : Gastric catarrh and gastritis, chronic ulcer, hæmatemesis, perforation, dilatation, stricture, gastric fistula, hernia, cancer, colloid tumors (non-malignant), sarcinæ, injuries, laceration, dyspepsia, gastrodynia, pyrosis. The symptoms of gastric catarrh usually take a form commonly called a "disordered stomach," expressed by headache, especially across the forehead, increased on stooping, and then associated with flashes before the eyes, and a sensation of tightness, as if the head would burst. Nausea and sickness exist, with sensations of heat and of cold, distaste for food, the sight or smell of which is apt to produce sickness, retching, and vomiting. The food in the stomach undergoes an abnormal decomposition ; lactic, butyric, and acetic acids are produced, and fetid gases are set free. Eructations into the mouth of sour and rancid matters are common. The tongue is generally coated with a white creamy fur ;

the breath is offensive, the mouth feels clammy, and the taste is bad. Gastritis from poisoning causes general depression, so great in some cases as to simulate perforation. The pain generally spreads from the epigastrium over the abdomen, and is accompanied with vomiting of mucus or of bloody mucus, which may be followed by purging of similar evacuations, preceded by severe colicky pains, and followed by collapse, small pulse, cold skin, and clammy sweat.

Treatment.—Emetics are required where the stomach has been overloaded ; and it is certain, from the gases and fluids causing prominence over the stomach, that it contains decomposing food. One scruple of ipecacuanha with one grain of tartrate of antimony, is the safest and most efficient emetic. When injurious matters have passed into the bowels, causing flatulence and colicky pains, mild laxatives, such as rhubarb, or compound infusion or mixture of senna, or fluid magnesia, in small doses, may be given every hour or two hours, followed by five to ten grain doses of bicarbonate of soda. In acute gastritis, mercurial purgatives by calomel are of service. Three to five grains may be given to an adult, followed by a dose of castor oil or the compound senna mixture. Where it is not desirable to act so searchingly on the small intestines, blue pill, with compound colocynth or rhubarb pill used in equal parts (aa grs. ii), combined with one grain of ipecacuanha powder, is a mild and gentle laxative. Iced water to drink in small quantities, or small pieces of ice in the mouth, tends to allay thirst, and to relieve pain ; and the continuous use of hot-water fomentations over the region of the stomach, as hot as the patient can bear them, is of great benefit.

WM. AITKEN.

Symptomatic Indications.—The principal remedy in the acute form is *arsenicum* ; it is especially indicated by vomiting, burning pain, agonizing distress, unquenchable thirst, with quick pulse. *Nux vomica* is useful in many forms, with headache, constipation, and nausea. *Ipecacuanha* may be required when in the acute form there is much nausea and vomiting. In the chronic form *pulsatilla* does good service, especially when the disease is not attended with severe pain ; the tongue is coated white, and there is much eructation. *Hydrastis*

is very valuable in chronic gastric catarrh, when there is much mucus formed and vomited. *Aconite* in simple gastritis from cold, when febrile symptoms are present, may do good service. *Antimonium crude* is often useful in acute gastritis when there is much nausea, eructations with taste of food, thickly coated, milk-white tongue. *Cinchona* in chronic gastritis, with drowsiness and oppression after eating, much distention from flatulence.

GASTRODYNIA.—A painful neuralgic affection of the stomach, especially of females, at about the time of puberty, or when the menstrual functions are declining. The conditions with which the complaint is mainly associated are physical exhaustion and debility, anæmia, hysteria, hypochondriasis, nervous exhaustion from depressing emotions, anxiety or excessive mental effort, gout or rheumatism, and uterine or ovarian derangements, including pregnancy. Sedentary habits, with habitual constipation and excessive use of hot tea, have considerable influence in originating this affection. Occasionally it results from the action of malaria, and in rare instances depends on central nervous disease.

Symptoms.—The prominent symptom is epigastric pain, varying much in severity and character, usually paroxysmal, and coming on either at regular or irregular intervals, though in many cases there is never complete relief. During the paroxysms the suffering may be extreme, especially in cases of hysteria or gout. Food frequently gives decided relief, the pain returning as the stomach becomes empty. Sometimes indigestible substances afford more ease than those which are digestible and soothing. Some suffer intensely when they take anything, or after particular articles, such as hot tea. Various curious sensations are often complained of in the epigastrium. During the severe attacks of pain, spasmodic movements of the stomach and bowels may be observed, with cramps of the abdominal muscles. Dyspeptic symptoms are habitually present in most cases, such as acid and gaseous eructations, flatulency, heartburn, or pyrosis. The tongue may be fairly natural. In hysterical cases chronic vomiting is sometimes a distressing symptom, and not uncom-

monly a morbid craving exists for improper and indigestible articles of food. The bowels are generally constipated. Frequently other nervous disturbances are observed. In some instances there is considerable emaciation, especially if food is not taken; but it is remarkable what a slight degree of wasting may attend the chronic vomiting of hysteria. Aortic pulsation is often present.

F. T. ROBERTS.

Treatment.—Pressure generally relieves, especially when made firmly and continuously, but there may be some superficial tenderness.

Symptomatic Indications.—*Nuxvomica* is useful for spasmodic pain and constipation, especially in persons of sedentary habits. *Arsenicum* for neuralgic pains, burning after eating, vomiting. *Argentum nit.*, when there is much heartburn; dull pains in the stomach; sensitiveness to pressure. *Lobelia* when the pain is of nervous origin.

GASTROTOMY.—A term applied to two distinct operations: 1, opening the stomach; 2, opening the abdominal cavity only.

Gastrotomy, or operation of making an opening into the stomach. Called "Gastrostomy" when done for disease of the esophagus.

Indications.—1. When a foreign body has entered the stomach, and cannot safely either pass through the pylorus or be vomited or extracted by the mouth. 2. When an impervious stricture of the esophagus is of traumatic origin. Indication is then imperative. 3. In cases of cancer of esophagus. In these, though death has always speedily followed operation, yet patient's sufferings have been much relieved.

Prognosis.—Usually followed by speedy death when done for disease of the esophagus, but safe (1 death in 11) when done for foreign body. In former case, death more from advanced disease than from operation.

At present there are two modes of operating in favor: by the first the operation is completed at one sitting; by the second method the operation is divided into two stages.

If the opening is made for obstructive disease of the esophagus, it should be limited to about one-sixth of an inch in extent; but if made for the removal of a

foreign body in the stomach, the incision into the organ must be proportionate to the size and shape of the foreign body.

The upper end of the linea semilunaris offers the best situation for the section of the abdominal wall in relation to the stomach, and it has been attempted to construct a contractile orifice in the edge of the rectus muscle.

It is most convenient to open the stomach at the part of the organ which can be drawn with the least tension into the parietal wound, and this is generally somewhat nearer the pyloric than the cardiac end. For a similar reason the puncture is made a little nearer the lower than the upper border.

By proceeding in two stages, and by this means securing the union of the visceral and parietal peritoneum of the parts before opening the stomach, the peritonitis is restricted to the desired extent and quality.

The first stage or part of the operation may be subdivided into three steps; first, the incision through the abdominal wall; secondly, the finding and fixation of the stomach; and thirdly, the dressing.

The choice lies between the vertical incision between the outer fibers of the rectus, as advocated by Howse, and the curved incision below the lower border of the ribs. We will adopt the latter. This curved or oblique incision should be made about an inch below and parallel with the margin of the left ribs. In length it should extend about an inch and a half on each side of the linea semilunaris. The skin, muscles, and fasciæ are to be severally and equally divided down to the peritoneum. Bleeding is to be completely arrested, and the wound cleared, before the peritoneum is cut and its cavity opened. This opening should be restricted to an inch and a half in extent if possible. Antiseptic measures should be scrupulously observed at this period.

The stomach may present at the wound, or may have to be searched for; its omentum may be taken as a guide from below, or the liver from above. The stomach is to be caught and held firmly but gently by the finger and thumb, or a pair of ring forceps, while a couple of loops of ligature silk are passed through the two outer layers of the walls of the organ, a space being left between the right and left loops. These give a very

useful hold of the stomach during the rest of the operation and subsequently. Next the stomach is to be sutured to the opening. There are two ways of doing this; one way is by a carefully inserted single row of sutures, radiating from a circle of about an inch in diameter. By the other way the sutures are arranged in two rows, an outer being inserted before an inner one.

The first way is the more quickly and easily performed. From five to eight sutures will be required; they may be passed first through the stomach walls, including its two outer coats for about half an inch, and then passed through the parietal peritoneum, including half an inch of it and of the skin, but less of the muscles. The second way has the merit of more thoroughly securing the stomach to the abdominal wall, both mechanically and by primary union of the serous surfaces. The outer row of sutures is to be inserted about one and a half inches from the point at which the stomach is to be subsequently punctured, and this row is to be arranged circularly, and, therefore, at right angles to the second or radiating set of sutures. Each loop should traverse about five-eighths of an inch of the stomach wall without penetrating the mucosa; they should also be passed through the entire thickness of the abdominal wall, about three-quarters of an inch from the cut edges. These should be about half an inch apart in the stomach wall. It is better not to tie them until all have been passed, and they should be tied over bougies or leaden buttons. Carbolized silk of medium thickness is the best material, and a strong curved needle in needle-holder is the best instrument. Sutures may be needed to close the wound at its extremities. The wound is to be cleaned, and the exposed portion of stomach is to be drawn well into view, by means of the loop or loops of silk, and these fixed by plaster or fine sutures to the skin. Dry absorbent antiseptic material, such as iodoformed or carbolized gauze, is recommended as a first dressing. The same gauze soaked with carbolized oil forms a convenient application. A wide compress of salicylic wool and a few turns of gauze bandage serve to retain the dressings in place. These applications must be changed if they become in any degree soiled from the wound, but may be left

for three or four days if they keep pure and in position.

By the end of the fourth, or beginning of the sixth day, if the single row of sutures has been employed, the adhesive aseptic inflammation may be expected to have securely united the sutured serous surfaces, and the second stage of the operation may be undertaken.

The stomach is to be gently drawn forward by aid of the silk loops, and a puncture made in its walls, to the extent of about one-sixth of an inch. The yielding nature of its coats will allow of the introduction of a piece of rubber tubing of the caliber of a No. 10 catheter. This tube should be corked, have a collar attached to it, and be secured against slipping. Next the loops of silk may be dispensed with, and during the ensuing three or four days the sutures may be taken out. If two rows have been inserted the outer row should be removed first.

Immediately after the first stage of the operation, and during the following three to six days, the patient is to be fed by the rectum, with properly prepared nutrient and stimulant enemata, and the stomach preserved at rest as far as is possible. When after the second stage the feeding tube has been successfully secured in its place, thickened fluid nutriment may be regularly introduced into the stomach by the help of a funnel or syringe. The fluids should be duly pancreatized or peptonized. Later, when the fistula has been established, the tube may be withdrawn after the feeding. A light dry compress should be applied in the intervals. Gradually the patient learns to feed himself, and acquires power of digesting solid food most gratifying to himself.

By this method of operating the risks of peritonitis from the extravasation of septic products from the wound or the opened stomach are most efficiently prevented, but it is not always possible to prolong the operation into two stages, or even to subject the patient to a single long procedure. If disease and emaciation have reached an advanced stage, the attempt to administer nourishment by the stomach cannot be delayed. The organ must be opened at once, though this act enormously increases the risks of a speedily fatal result. In this case experience has shown that a very limited puncture of the stomach, after a careful antiseptic,

but quick operation, leaves the patient exposed to the least amount of risk.

There is little doubt but that the gravity of the operation of gastrostomy depends rather upon the condition of the patient than upon the circumstance of the procedure. A greater evil is effected by delay than by the surgeon's knife, and as soon, therefore, as the need of the artificial opening is recognized, the operation should be undertaken without loss of time.

JOHN CROFT.

GASTRIC FEVER.—A popular term having no precise scientific meaning. It is used indiscriminately by the laity for any febrile ailment of a not very transient character in which abdominal symptoms are prominent. In a good many instances the malady is enteric fever, in not a few it is tuberculosis; while in many cases it is a condition of catarrh or febricula not coming under any of the well-recognized visceral disorders.

GASTRIC FISTULÆ.—Fistulæ of the stomach may either communicate with other hollow viscera, or open externally, in which case they may be termed gastro-cutaneous.

Causes.—Gastric fistulæ may be caused by mechanical injury, or result from disease. Mechanical injury which may lead to fistulæ:

1. Incised, punctured, or lacerated wounds of the abdomen penetrating the stomach.

2. Gunshot wounds; the shot directly penetrating the stomach, and causing a fistulous opening; or the fistula being subsequently established by the sloughing of the part of the wall of the viscus in contact with the parietal wound.

3. A blow over the stomach, which, by causing parietal abscess, leads to adhesion of the stomach and subsequent fistula.

4. Ulceration from external pressure.

The diseases leading to fistula are cancer and simple perforating ulcer of the stomach. These may induce it: 1. By gradual extension of ulceration through the area of the abdominal parietes to which the affected portion of the stomach is adherent. 2. By exciting around the ulcerated area a circumscribed abscess, which ultimately discharges its contents through the abdominal wall.

In cases resulting from disease, the place of the external opening depends somewhat on the region of the stomach in which the ulcer commences. If the disease is near the pylorus, the opening is generally near the umbilicus. If the ulcer is on the anterior surface, or near the fundus, the opening will be in the epigastric or left hypochondriac region. The margins of the opening, usually hard and rounded, are, when caused by cancer, ragged or gangrenous; the orifice is sometimes deeply retracted. The skin round the edges is red, tender, and often excoriated. The size of the opening ranges from something less than an inch to two inches. If very small, fluids only pass out; if large, whatever is swallowed escapes.

Symptoms.—The general health is comparatively but little affected, the chief troubles being thirst, increased appetite, obstinate constipation, deficient urinary secretion, and amenorrhœa. The hunger is sometimes very distressing; vomiting is exceptional.

Prognosis.—Patients have lived for many years with an open gastric fistula. If a gastro-cutaneous fistula be of cancerous origin, life must necessarily be short; if the cause be a wound or simple ulcer, life may last for years. A traumatic fistula may last a few months and then close, or it may remain permanent.

Treatment.—1. The escape of the ingesta must, if possible, be prevented by the application, not of a plug, but of a suitable flat compress. 2. The surrounding skin must be carefully cleansed and dried before applying zinc ointment or oiled lint round the opening. 3. Granulation and cicatrization must be encouraged by the approximation of the edges of the wound by the use of some well-adjusted compressing bandage, and the occasional employment of a stimulating application. Should nature's efforts fail, the following operation, which will necessitate the patient being fed by the rectum for many days, is recommended: A flap of skin is dissected off the neighboring part, turned with its cuticular surface inward, and nicely fitted to the orifice, whose edges have been previously freshened.

Biliary Fistulæ.—**External or cutaneo-biliary** fistulæ are the result of (1) gunshot wounds; (2) blows over the liver, leading to parietal adhesion of that

organ, and then abscess; (3) hepatic abscess of non-traumatic origin; (4) gall stones sometimes, after leading to adhesions of the gall passages, and being discharged externally.

The gall bladder is the part usually affected. The fistula, when of traumatic origin, usually communicates with the liver; when the result of disease, with the gall bladder. The fistulous channel may be many inches long, very circuitous in its course, and may open either over the fundus of the gall bladder or in any part of the right hypochondrium, in the inguinal region, or at the umbilicus; to the latter point it is directed by the suspensory ligament.

Symptoms.—The discharge is not always pure bile; it generally consists of muco-pus, mingled with bile or blood. The quantity varies from eight ounces to two pints daily. If the cystic duct is obstructed, no bile can flow by the fistula; if the common duct is occluded, the jaundice which precedes the fistula generally subsides after the opening is established; in rare cases the gall ducts are patent, and bile escapes both by the fistula and with the stools. When the amount of bile lost is great, the patient dies marasmic. During the formation of a fistula due to gall stone, there is often great suffering, especially during the passage of the calculus, but the patient may enjoy good health before the fistula closes.

Prognosis.—The duration of these fistulæ is various. When the cause of the fistula is gall stone it usually closes soon after all the calculi have come away; when, however, the calculi are numerous and the fistula long and tortuous, the opening has continued for years, during which every now and then it shows a disposition to close, which is prevented by succeeding calculi. The fistulous openings are inconvenient rather than dangerous. In a large proportion of cases due to disease, fair health is enjoyed for years. The most unfavorable cases are those due to cancer or parenchymatous hepatic abscess. Complete healing may be anticipated when the calculus is single, the opening directly over the gall bladder, the discharge free from bile, and if there is no jaundice.

Treatment.—The opening and surrounding structures should be kept scrupulously clean. Operative measures

are not advisable, save where there is much weakness from continual loss of bile, and then only when there is no obstruction to the common bile duct. If a calculus plug the fistula or can be felt near the orifice, it will be necessary to open up the fistula to allow of extraction of the calculus. A permanent fistula may sometimes be prevented by cholecystotomy. When biliary calculi remain behind, the fistula should be kept open to allow of their discharge at a future time.

Internal biliary fistulæ.—Fistulous communications may occur between the biliary passages and adjacent organs, as the stomach, duodenum, and colon, by a process of ulceration set up by gall stones.

Fistulæ have formed between the gall bladder and pelvis of the kidney, vagina, and portal vein. Cystico-duodenal fistula is likely to lead to impaction of the calculus and intestinal obstruction. Cystico-colic fistula is generally associated with cancer of the gall bladder.

The symptoms of cystico-gastric and intestinal fistulæ due to gall stones are usually obscure. Jaundice is rarely present. Vomiting, with colic, and tenderness in the region of the gall bladder, are the commonest signs, with occasionally hematemesis and bloody stools.

HENRY MORRIS.

GENERAL PARALYSIS OF THE INSANE (General Paresis; Paralytic Dementia; Paretic Dementia).—A disease of the nervous system especially affecting the brain, characterized by progressive loss of power and sensation, and by mental deterioration, tending invariably to dementia, though often for a time presenting exalting and expansive ideas; almost invariably fatal, and generally presenting post-mortem evidence of organic changes in the brain and its tunics.

General paralysis may be divided into (1) a period of mental alienation, associated with fibrillar tremblings, chiefly noticeable in the tongue and facial muscles; (2) a period of chronic mental failure and bodily decay; (3) a stage of complete mental ruin, in which the patient is fatuous, and exhibits entire failure of the bodily functions—motor, sensory, and nutritive. The essential feature of the disease is a progressive de-

cay of both the mental and bodily powers.

First stage.—During the early period there is often considerable difficulty in deciding as to the nature of the disease, there being generally alteration in the moral nature before the friends notice any bodily defect, so that a gradual alteration of character may take place, and lead the patient into legal difficulties, and render him liable to prosecution for such criminal acts as incendiarism or rape, or cause him to become the prey of designing persons, before the insanity is recognized. The principal mental symptoms to be noticed at this period are alterations in demeanor, conduct, temper, and disposition; enfeeblement of memory and loss of power in the highest acquirements, especially if the latter be of a nature demanding much skill and originality; childishness and emotional display; excessive sexual desire, often accompanied by loss of power; lascivious acts, untruthfulness, stealing (often without any attempt at concealment); mental depression, with some consciousness of impending failure of powers, or a gay, hilarious, reckless, expansive feeling of well-being, with benevolence.

With these symptoms great changeability and inability to fix the attention are often associated. Insomnia is common, or there may be excessive drowsiness at unusual times of the day. Acts of violence may occur, or a fortune may be squandered, or the patient may enter into schemes which lead to his own ruin and that of others.

The principal bodily symptoms and signs in the early period are some defect of sight, hearing, or smell, which may exist long before the disease declares itself; headache, a feeling of confusion in the head, neuralgia, and diminished cutaneous sensibility. Occasionally there is ocular paralysis, and the pupils are frequently irregular or minutely contracted. Fibrillar tremors of the tongue and lips are often present, especially when the patient attempts to speak. Feebleness of gait may be noticed, while in some cases definite locomotor ataxy precedes for a long period the mental symptoms. The handwriting in the early period is characterized by the omission of terminal letters or syllables, the repetition of words, careless or untidy penmanship, or perhaps actual shakiness in

the formation of letters; but in some cases the handwriting of a naturally careless penman will improve from the fact that he becomes conscious of the necessity for effort in writing. The speech may be hesitating, or slow and monotonous; words may be omitted or repeated. Occasionally retention or incontinence of urine or fæces occurs early in the attack. Finally, the occurrence of epileptiform or apoplectiform seizures may call attention to the disease.

The early phenomena may pass imperceptibly into a definite mental alienation characterizing the first stage, or there may be some acute mental disturbance marking its distinct onset.

Any clinical form of mental disturbance may occur, so that the onset may be maniacal, melancholic, stuporous, or of the nature of dementia, the physical signs in some cases not being manifested for many months. If the onset be maniacal, the attack may be attended by all the violence, sleeplessness, destructiveness, and mental confusion of a severe attack of acute mania, but with this there will be associated delusions of an ambitious or expansive nature.

Delirium of exaltation in which the patient has exaggerated ideas of his wealth, strength, position, and powers, often of the most extravagant nature, but varying from day to day, and being always confused and contradictory, in contrast to the fixed ideas of grandeur in some cases of monomania, is a frequent and most important symptom. Formerly this was looked upon as *sine qua non* for the diagnosis of general paralysis, but it is now well recognized that many cases commence with, or are characterized mainly by depression. This may vary from hypochondriacal delusions, such as that the bodily organs are lost, rotten, or obstructed, or that the patient is dead (necromimesis), to melancholic sadness with hallucinations. Food may be refused, and there may be a suicidal tendency, or even a condition resembling melancholia with stupor.

If the attack be characterized by dementia at the onset, the symptoms are more likely to be a gradual loss of memory (first that for recent events), of reason, and will-power, with failure of the moral faculties, and perhaps slight temporary excitement or extravagance, and a sense

of well-being. Incontinence of urine and fæces are apt to occur.

Whatever be the form of onset, dementia is the natural tendency of the disease, and even in the melancholic form, loss of memory and dirty habits are likely to occur with much greater certainty than in ordinary melancholia. In rare cases, attacks of excitement and depression alternate, the disease being then known as *general paralysis of the double form*.

The characteristic motor signs may be masked at the onset by maniacal excitement or stupor, or may not be exhibited till long after the mental symptoms. When present, some of the following will be found: An increase of the difficulty of speech, which may occur very early and is principally noticeable in the attempt to articulate words containing many consonants or syllables, some of which may be omitted. There may also be stoppage or stuttering, or great effort to get words out, associated with marked twitching of the lips or face.

In the expansive and maniacal forms there will frequently be great loquacity, but amnesia is most often seen in the variety commencing with dementia. The affection of speech is more marked as the patient becomes fatigued with talking. The tongue is protruded with difficulty, or jerked out, and is often rested on the lower lip as if for support, and shows marked fibrillar tremors. Sucking or swallowing or masticatory movements are common. There is usually a loss of expression in the lower part of the face, the lines becoming smoothed out. The occipito-frontalis muscle, however, is frequently observed to be contracted so as to produce an aspect of surprise, or the expression of different parts of the face may vary so as to give an incongruous effect.

There is impairment in manual dexterity, the writing showing a similar condition to the speech—omission of words and syllables—or the result may be a confused jumble of inconsequent sentences. Obscene remarks or allusions to his wealth or powers are frequently found. The grasp of the hands becomes feeble, unequal and tremulous. The gait may be ataxic, with absence of the knee-jerks or spastic, with exaggerated reflexes, or else simply awkward, clumsy, and tottering, with a tendency to trip against ob-

stacles. Occasionally the knee-jerks are different on the two sides. The pupils may be equal, and react to light normally, but in a large number they are unequal in size or irregular in shape, and sluggish in reaction to light, or they may exhibit extreme contraction. The skin is generally coarse, greasy, or muddy-looking; in some there is great pallor, in others a florid condition of the cheeks; sudden flushings of the head and face may occur, and there may be herpetic or other eruptions.

With regard to sensory symptoms there may be defect of color-sense or defective vision; the latter is sometimes associated with atrophy of the optic disks. There may also be hallucinations of any one or of all the senses. The muscular sense is perverted, giving rise to feelings of increased size or shrinking. There is sometimes cutaneous hyperæsthesia, but more frequently a general dulling of sensibility.

At the end of the first stage a remission in some cases makes its appearance and lasts for months, the mental health being apparently almost normal or exhibiting merely slight feebleness. Remissions are of varying degrees of completeness, and are generally associated with obesity.

In the **second stage** of the disease the physical signs become more marked and the speech more and more incomprehensible. The tongue, perhaps, cannot be protruded at all, or only for a moment. The appetite may be voracious, and the manner of eating gross and gluttonous; mastication is imperfect, and deglutition almost impossible from anæsthesia of the pharynx, the result being that food passes into the larynx. The face becomes expressionless, the gait feebler, and the action of the hands more impaired.

The general condition becomes worse. Having been perhaps unduly fat toward the end of the first stage, or after the cessation of the initial excitement, or during a remission, he now wastes again, and becomes cachectic. He may bruise easily, or suffer from hematoma auris, or be subject to abscesses of large size, or to carbuncles. Hematuria, melæna, and diarrhea are all at times met with.

Epileptiform, apoplecticform, or paralytic seizures are now apt to appear, and in one of them death may occur. Varying degrees of paralysis, from slightly in-

creased weakness of one arm or leg to definite hemiplegia or to general flaccidity of the limbs, are associated with these attacks, which are usually accompanied by a marked rise of temperature. The paralysis may be temporary or permanent, or end in coma. Consciousness may be retained during the fit. The patient now leads a merely vegetative existence; he has to be washed, dressed, and fed like a child. Bed-sores may form if not carefully guarded against, and there is a tendency to gangrene, resulting from the low state of the general nutrition.

The mental condition in this stage is one of marked dementia, the memory being almost entirely gone, and the patient utterably unable to care for himself; but even the most demented cases may still chatter vaguely about "millions" when their speech is almost incomprehensible, and there may be a constant restlessness, leading them to destroy their clothing or bedding. In some cases markedly hypochondriacal ideas are present.

There is great diminution of visual and auditory power and failure of common sensibility, pain being apparently only slightly felt. Patients in this state will, however, occasionally present for a few hours an amelioration of their condition, there being a temporary recovery of memory and other powers.

In the **third stage** the extreme of mental and physical deterioration is reached. The patient is bedridden, cannot stand or do anything for himself, flexion of the limbs with rigidity makes its appearance, the reflexes, superficial and deep, tend to disappear, the mouth opens mechanically at the approach of a spoon or any other object, and there is constant dripping of urine and incontinence of fæces. The patient grinds his teeth, he may never attempt to speak, his limbs waste, he may suffer from bed-sores, and if not carried off in a fit, he may die of some lung, intestinal, or bladder complication or from simple exhaustion. The bones are frequently extremely brittle from diminution of the earthy constituent and increase of fatty material, and hence fracture of the ribs may easily occur from any slight violence, and perhaps give rise to pyæmia or pleural inflammation.

Duration.—Severe acute cases may end in death in a few weeks; the average

duration of most cases, however, from the time of recognition of the disease is, roughly, between two and three years. If, however, all the prodromal symptoms be included, the average duration will be found to be longer. Some cases last as long as fifteen years, but this is very rare. The average duration is longer in females than in males, in quiet demented cases than in those with excitement, and in those with hereditary tendency than in those without.

Diagnosis.—General paralysis in its onset is frequently overlooked; the moral perversions, though noticed, are not considered sufficient evidence of the presence of disease. A change of character in a man of middle life, especially if he has been an active, hard-working individual, should always excite the suspicion of general paralysis, but the diagnosis cannot positively be made till the onset of the characteristic symptoms.

From ordinary acute mania or other forms of insanity the diagnosis is difficult in the early stages, but is made certain by the occurrence of motor symptoms. In senile cases there is a resemblance in some respects to ordinary senile dementia, as in both there may be eroticism, extravagance, loss of memory, and fits; but in the latter there is but little tendency to generalized paresis. Localized paralyses or hemiplegia are of more common occurrence.

Acute mania from alcoholic excess may resemble general paralysis at the onset, especially if associated with exaltation and tremors.

Syphilitic disease of the brain or meninges may simulate the demented form of general paralysis. In the former the cranial nerves are more often affected, and optic neuritis or other signs of localized disease may be present, while the characteristic affection of the tongue and lips is wanting.

From monomania of grandeur, general paralysis is diagnosed by the affection of speech and other motor symptoms, by the more changeable nature of the exaltation, and by the course of the disease.

Intracranial tumors sometimes give rise to symptoms simulating the demented form of this disease.

Further, it may be mentioned that disseminated sclerosis, dementia associated with hemiplegia or other paralyses, and

paralysis agitans may possibly be confused with general paralysis.

True epilepsy is said to be never followed by general paralysis; but the onset of the latter disease is frequently marked by an epileptiform seizure, or there may be a series of these, so that for a time the diagnosis from epilepsy may be uncertain. The occurrence of the characteristic motor signs will decide the question. Epileptiform attacks occurring in the course of this disease are frequently associated with a rise of temperature.

Plumbism and the excessive use of the bromides may also give rise to conditions simulating general paralysis.

Prognosis.—General paralysis ends almost invariably in death, but some cases pass into a chronic weak-minded condition with arrest of the characteristic motor signs of the disease. Finally, a few cases have been recorded in which the patient recovered and remained well for years.

Pathology.—General paralysis may be regarded as the result of overactivity of the nervous system. This, in the first place, usually induces hyperæmia of the cerebral cortex, followed by exudation from the vessels, degeneration of the nervous elements, and their replacement by embryonic or connective tissue.

Morbid Anatomy.—The most common changes are: (1) thickening of the dura mater, with evidence of hemorrhagic pachymeningitis and opacities of the arachnoid. (2) The cerebral cortex is irregularly wasted, and presents areas of hyperæmia or anæmia. The atrophy is chiefly noticeable in the frontal and parietal regions, where in places the gray matter may be almost indistinguishable. (3) The interior of the brain may show alteration of consistence, either in the form of induration or softening. The ventricles are frequently much distended, and the ependyma covered with minute pearly granulations. The ganglia at the base are usually somewhat softened or wasted. The cerebellum also is generally somewhat soft. (4) In the spinal canal, meningeal changes may be found similar to those in the skull, and small calcareous plates are occasionally seen upon the arachnoid. The cord is often very soft or atrophied; but, on the other hand, definite sclerosis may be found in either the posterior or lateral columns, or in

both. The gray matter is frequently diminished in quantity and pale in color, or there may be local wastings. (5) The blood vessels may present atheromatous or syphilitic changes, and hemorrhage into the brain is occasionally met with.

Etiology.—One cause alone is rarely sufficient. (1) Sex. The disease is about four times as common in males as in females. (2) Age. It is most common between thirty and fifty-five years, the period of life most subjected to severe strain, although cases have been reported at the extremes of fifteen and seventy. (3) Heredity is a predisposing cause, but in a less proportion than in other forms of insanity, and a more frequent factor in females. (4) The majority of general paralytics are married. (5) Occupations or conditions of life involving great physical or mental strain and emotional disturbance with insufficient rest for repair. The lower classes are most frequently affected. Pecuniary difficulties and other adverse circumstances are potent factors. (6) Intemperance in drink. (7) Sexual excess. (8) In some cases general paralysis has followed directly upon an injury to the head; in others, an injury has appeared to act merely as a predisposing cause. (9) Syphilis. (10) Lead poisoning. (11) Excessive use of tobacco.

Treatment.—The disease is practically incurable when once the characteristic symptoms have developed. In the earliest stage, when the patient is conscious of an impending breakdown, a complete cessation from all causes of emotional or mental strain might act beneficially, but he is usually regarded as hypochondriacal by his friends, and, instead of rest, an attempt is made to stimulate him into cheerfulness. In most cases the patient is unconscious of his condition, and will not allow that he needs rest. Hence, almost invariably, removal to an asylum is sooner or later necessary. In syphilitic cases appropriate remedies should be tried, although the results are not encouraging. In some cases a remission or arrest of the symptoms has followed the occurrence of an injury or a local inflammation, or the application of iodine to the spine. General paralytics are very susceptible to powerful drugs, and such should be used with caution.

R. PERCY SMITH.

Symptomatic Indications.—*Cannabis Ind.* is valuable in this disease when there

is present great mental exaltation; *phosphorus* when it is dependent upon degenerative changes of the brain and spinal cord; *belladonna* is useful when the disease is associated with violent delirium, congestion in the head. *Pysostigma* is useful when motor disorder predominates over the mental.

GENU VALGUM.—See KNOCK-KNEE.

GESTATION, EXTRA-UTERINE.—See EXTRA-UTERINE GESTATION.

GLANDS, SCROFULOUS.—See SCROFULOUS.

GLANDERS (Farcy).—An infectious disease, of rare occurrence in man, and derived almost invariably by direct contagion from the horse, but capable of transference from one human being to another.

The virus of the disease may be received by inoculation through a cut or an open sore, or upon a mucous membrane. The period of incubation is short, lasting as a rule not more than four days.

Symptoms.—If there be a wound, it soon becomes inflamed, its edges puffy and surrounded by an erythematous blush, and there is a purulent discharge. The lymphatics in the neighborhood become red and tender, and the glands enlarged. When the lymphatics are cord-like and nodulated (farcy buds), the disease is called farcy, but the two diseases are really identical. Languor and headache, aching pains in the limbs, nausea and vomiting, high fever, a frequent pulse, a dry skin, constipation followed by diarrhea with fetid motions, are the chief symptoms in the early stage. Generally within a week of the onset of the disease bright red points or papules, surrounded by a yellowish or erysipelatous blush, appear on the face, nose, cheeks, or about the joints. These are soon converted into flat vesicles or bullæ, varying from $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter. They become depressed in the center, soften, and form abscesses, which burst, giving exit to a thick, sanious pus, and leaving unhealthy-looking ulcers with everted edges.

An important, though not an early or constant symptom is the presence of a viscid discharge from the nostrils, streaked with blood. The nose becomes

blocked with crusts, and is swollen externally; necrosis of the septum often results, the discharge being then purulent and offensive. The patient generally has cough, with blood-stained sputa. Rigors are not uncommon, and delirium and coma usher in a fatal termination.

The disease may occur in an acute or a chronic form. In the acute form it is very fatal, death usually occurring within two weeks, and often much sooner. In the chronic form the symptoms are similar, but are evolved more slowly. The patient becomes emaciated and cachectic, and may die in the course of three or four months, or he may ultimately recover after a protracted and tedious illness.

Ætiology and Pathology.—There are good grounds for the belief that glanders is due to the presence of a micro-organism. A bacillus, about the size of the tubercle bacillus, but thicker and mobile, has been discovered in the nodules of equine and human glanders, and it has also been proved that the inoculation of horses and guinea-pigs, with the cultivation products, is followed by the development of a disease presenting ulcers and nodules similar to those occurring in glanders, and that the bacillus is present in the blood, urine, and organs of the inoculated animals.

Morbid Anatomy.—After death, nodules, hard or purulent, according to the stage of the disease, may be found in the lungs, liver, spleen, and in the brain and its membranes. The joints often contain pus; the bones also may be affected. Hemorrhagic abscesses are often found in the muscles of the limbs, abdominal walls, and intercostals, a condition which has been regarded as characteristic of the disease.

Treatment.—If the patient be seen sufficiently early, it would be proper to cut out or to destroy with caustics the wound through which the inoculation took place. Abscesses should be freely drained as soon as possible, under antiseptic precautions. Antiseptic remedies, such as quinine or mercury, may be given internally, and a liberal supply of stimulants with a nourishing diet.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Kali bichrom*, will do good service in treatment of the respiratory and cutaneous symptoms; *mercurius* when the purulent tendency is pronounced and the lymphatics

are primarily affected. *Lachesis* is valuable in the malignant form of the disease, with black bullæ, tendency to gangrene.

GLANDULAR HYPERTROPHY.

—This term is used when a lymph gland is found to be enlarged and no direct cause for the enlargement can be assigned. When glands have been inflamed and remain enlarged for long periods without undergoing much alteration, they are sometimes spoken of as being in a condition of "simple hypertrophy." It is possible that lymph glands may undergo a true physiological hypertrophy from having an unusual amount of work to do, as the converse atrophy from disuse is known to occur both as a senile change and as the result of the removal of the tributary lymphatic area—for example, the amputation of an arm or a leg.

In lymphadenoma, the axillary or femoral glands undergo hypertrophy; in one form of leucocythæmia, and in some forms of lymphosarcoma, if a gland be excised and examined, sometimes only a simple increase in the normal constituents is found, and it is to the enlargement of the lymph glands found in these diseases that the term hypertrophy is most often applied. There can be little doubt, however, that in the subjects of these diseases there is some general constitutional change, the nature at present undetermined. See LYMPHADENOMA; LEUCOCYTHÆMIA.

FRANCIS G. PENROSE.

GLEET.—See GONORRHEA.

GLEOMA.—See TUMORS.

GLOBUS.—The sensation of a ball rising in the throat, a symptom commonly complained of by hysterical women.

GLOSSO-PHARYNGEAL NERVE, DISEASES OF THE.—This nerve supplies motor branches to the stylo-pharyngeus muscle and to the middle constrictor of the pharynx, but does not supply the levator palati, as that muscle receives its motor supply from the accessory nerve to the vagus. The glosso-pharyngeal is also the nerve of taste for the posterior part of the tongue and the soft palate, and it also supplies sensory nerves to those parts and to the upper portion of the pharynx.

Symptoms.—Paralysis due to disease

of the nerve itself is of very rare occurrence. It may result from syphilis, meningitis or diphtheria. The symptoms are loss of taste at the back part of the tongue, and some difficulty in swallowing, with anæsthesia about the fauces. See BULBAR PARALYSIS.

C. E. BEEVOR.

GLOSSITIS.—See TONGUE, DISEASES OF.

GLOTTIS, Œdema of.—See LARYNX, DISEASES OF.

GLOTTIS, Spasm of.—See LARYNGISMUS STRIDULUS.

GLYCOSURIA.—See DIABETES MELLITUS.

GOITER.—See BRONCHOCELE.

GONORRHEA.—The belief in the *specificity* of gonorrhea has been based upon the following conclusions: (1) The urethral discharge is said to contain a micrococcus which is capable of cultivation in foreign media. (2) That the cultivated organism is capable of exciting an attack of purulent inflammation in virgin soil. (3) That the constitutional symptoms, *e. g.*, rheumatism, are an indication of a general disease, consequent on inoculation of a specific virus.

Against these may be placed the facts that (1) The presence of micrococci in gonorrheal pus by no means proves that they are the essential agents of the morbid process. (2) Gonorrhea does not arise from an invariable cause, for purulent urethritis and vaginitis, the result of impure intercourse, does not obviously differ in nature from cases following mechanical and chemical irritation, or contact with leucorrhœal, lochial, and menstrual discharges. (3) Whatever the cause of the inflammation, the latter may develop the same local and constitutional complications. (4) The discharge, as it issues from the affected mucous membrane, is liable to be impregnated with indifferent organisms floating in the atmosphere. (5) The antiseptic treatment of acute purulent urethritis has not yielded the favorable results that might have been expected had the disease been derived from an indisputably infective source. (6) As stated by White, of Philadelphia, “(a) Gonorrhea has no period of incubation. (b) It predisposes to a second attack. (c) It is associated only with ordinary processes of inflammation. (d)

It may be awakened or reproduced at will and indefinitely.”

The *varieties* of gonorrhea have been named according to (1) the intensity of the inflammation, and (2) some special anatomical feature of the morbid process. When the inflammation develops rapidly with severe symptoms, it is called *acute*; when it is of a milder type, *subacute* or *catarrhal*; and when it is slight and transient, with little or no discharge, *abortive* or *irritative*. In some cases there is a tendency to fibrinous exudation with implication of the lymphatics; *membranous urethritis*. Again, the mucous membrane may be undermined by abscesses, excavated by ulcers, or thickened by granulations, conditions known respectively as *suppurative*, *ulcerative*, and *granular urethritis*.

Acute gonorrhea in the male is usually the result of pus coming in contact with the mucous membrane of the urethra during impure sexual intercourse. But patients frequently present themselves for treatment in whom there is a profuse discharge, which can be referred only to the irritation from leucorrhœal, lochial, or menstrual fluid. Instrumental irritation, the impaction of a calculus in the urethra, and strong stimulating injections are also capable of setting up purulent urethritis; but the inflammation in these cases is rarely so severe or lasting as when it arises from inoculation in the ordinary way. The surgeon should be on his guard against expressing too confident an opinion as to the causation of the urethritis in any given case.

The *symptoms* of acute gonorrhea are actively inflammatory in type, and usually manifest themselves within the first two or three days after connection. They may come on in a few hours, or be deferred for twelve days. The lips of the meatus are puffy and red, and sometimes they show superficial abrasions. The discharge is at first bluish-white, then distinctly yellow. It may be tinged with blood, or appear of a greenish hue. Micturition is painful, the sensation being as if the mucous membrane were scalded: This is due, in some degree, to mechanical distention of the inflamed tissue; but the chief causes of irritation are the salts of the urine, for the suffering is greatly relieved by the exhibition of alkalis. There is increased frequency of micturition with a certain amount of vesical

tenesmus. In the early stages it is probably reflex in its nature, for as yet the inflammation has not extended to the neck of the bladder. Chordee, or painful erection, is complained of, and mostly in the night time, so that the patient's rest is much disturbed. The penis is more or less curved in a downward direction, for the rigidity from the inflammatory effusion prevents the corpus spongiosum being distended to the same extent as the corpora cavernosa.

There are certain local complications during the progressive stage of acute gonorrhea which are partly due to spreading of the inflammation in the continuity, and partly to inoculation with the acrid discharge from the urethra. They are (1) balanitis, (2) posthitis, and (3) phimosis and paraphimosis. The glans penis is of a bright red color, and it is not rare for numerous excoriations to appear upon it, so that it looks as though it had been covered with a herpetic eruption the vesicles of which had burst. The prepuce is swollen so that it may be difficult or impossible to retract it. It may, however, be withdrawn and fixed behind the glans (paraphimosis), in which case it constricts the penis, causing partial strangulation, but never to such an extent as to induce serious sloughing. A furrow of ulceration sometimes makes its appearance at the seat of greatest tension, *i. e.*, on the dorsum of the prepuce a little behind the glans; the portion of the prepuce in front of the constriction is marked by a firm œdematous swelling.

In a case of average severity the ordinary symptoms reach their height in about a week. At the end of that period, under proper treatment, they remain stationary for some days, and then the third stage, that of subsidence, begins. With the extension of the urethritis backward and in depth, other symptoms develop with greater or less frequency. The mucous follicles may suppurate, forming small circumscribed abscesses; or pus may collect outside the urethra, and be discharged either into the passage or externally; the latter, which is not a common complication, is very exceptionally followed by extravasation of urine. By the implication of the lymphatic vessels, the foundation is laid for further troubles, for the submucous lymph paths are continuous with those of the skin of the penis, and so with the

inguinal glands. Gonorrheal bubo is generally situated just below Poupart's ligament at the inner end; and in the majority of cases it subsides without supuration, but abscesses may form in the affected gland or around it (perilymphatic). Lymphangitis is marked by induration and swelling along the course of the inflamed vessels.

Cowperitis, or inflammation of Cowper's glands, is marked by one or two rounded swellings (according as one or both bodies are involved) just in front of the membranous urethra. The ducts which open into the spongy portion of the urethra are invaded by the disease, and their orifices are obstructed by the tumefaction of the mucous membrane. Cowperitis may terminate in suppuration. The diagnosis has to be made between it and peri-urethral abscess, and painful swelling of the prostate. Like cystitis and prostatitis, it is a late complication of the second or so-called "stationary" period of gonorrhea.

Cystitis happens in about one case in four. Its presence is indicated by a frequent desire to micturate, by pain during and after the act, the last few drops of water being voided with much distress on account of the irritable state of the neck of the bladder. The urine contains a variable amount of muco-pus. The pain in the perineum is lancinating in character from spasmodic contraction of the urethro-vesical muscles. Reflex pains are often complained of in the hypogastric, inguinal, and lumbar regions. There is more or less tenderness on pressure above the pubes.

Prostatitis is a frequent sequel of gonorrhea. It is generally associated with some amount of cystitis. The special symptoms are dysuria, tenesmus, and a feeling of weight and distention in the rectum. Defecation is very distressing. On rectal examination the gland is found to be enlarged, puffy, and painful to the touch. The entire prostate may be involved in parenchymatous inflammation, but the glandular structure suffers most. The process may resolve completely; subside into a chronic state, or end in suppuration, in which event the abscess usually bursts into the urethra, but may open into the rectum. The pus should be let out as soon as detected. This is best done by puncture through the rectum, care being taken to avoid the

hemorrhoidal arteries. If the prostatitis passes into a chronic condition, the discharge, which was originally purulent, becomes clear and viscid like white of egg.

Epididymitis usually presents itself at the period of subsidence. The date of invasion is variable, but from four to six weeks after the incidence of the gonorrhea may be taken to include the majority of cases. The *symptoms* are swelling, pain, and exquisite tenderness to touch, with redness and œdema of the scrotal tissues, and frequently acute hydrocele of the tunica vaginalis and enlargement of the cord. Its constituent structures are welded together by inflammatory exudation. The patient's gait is very suggestive. The febrile symptoms vary in degree; the greater the pain, the greater the general disturbance.

Pelvic cellulitis and peritonitis are infinitely rare. The former may arise from extension of suppuration around the membranous urethra and through the prostate. Peritonitis *in the male*, as a sequel of gonorrhea, is all but unknown, only a few cases having been recorded.

Purulent conjunctivitis is the result of direct inoculation with pus from the urethra. The symptoms develop with alarming rapidity, the whole conjunctiva is enormously swollen, with engorgements of the vessels. The ocular layer overlaps the cornea (chemosis), and the latter soon shows signs of softening and ulceration, partly from the pressure upon it and partly from the cauterant and infective action of the pus with which it is bathed. The eyelids are red, swollen, and œdematous. Nothing short of early and active treatment offers a chance of saving the patient's sight. Fortunately, both eyes are seldom affected.

Gonorrheal scleritis is a disease of much milder type than the foregoing. It is analogous in its general pathology to the rheumatic affections of the joints, etc., and being a constitutional disorder, both eyes suffer. The conjunctiva is moderately congested. The circumcorneal zone of sclerotic vessels is injected. The iris may be involved. There is pain of an aching character, and some photophobia. The inflammation, though long enduring, tends to subside and resolve. It is peculiarly resistant to treatment, and it returns almost to a certainty with recurrence of the urethritis.

Gonorrheal rheumatism.—See DISEASES OF JOINTS.

Acute pyæmia resulting from gonorrhea is met with now and again; it may end fatally.

Subacute catarrhal urethritis is the form gonorrhea usually assumes in a second or later attack. The discharge is often profuse, and is readily excited, but the other local and general symptoms are relatively but little marked. The most likely complications are swelled testicle, scleritis, and rheumatism; the two latter being almost certainly invoked if they have previously occurred.

Irritative or abortive urethritis.—In this affection the contact with irritant matter causes a sense of heat about the meatus with slight redness and swelling. The discharge, if any, is mucous. The process comes to a natural termination in a few days.

Diagnosis.—It is known from urethral chancre by the greater diffusion of the swelling; by the discharge being more profuse and less frequently sanguinolent; and by the signs of irritation of a wide tract of mucous membrane. Urethral chancre is mostly found close to the meatus. The diagnosis may be difficult in the presence of phimosis and balanoposthitis. Bubo is not so common as in the case of chancre. Gonorrhea and chancre may coexist. Balanitis, with or without preputial chancre, may be mistaken for urethritis; but micturition is not nearly so painful, and there is absence of vesical, prostatic, and testicular trouble. Balanitis never causes scleritis or rheumatism. Its most common causes are chancre, and irritation from retained smegma, and tight phimosis.

Gonorrhea in the female is not so serious a disease as in the male, for the urethra in the female is less complicated in its anatomy, and, besides, it is not necessarily involved. It may affect primarily the vulva, the vagina, the os uteri, and more rarely the urethra; and by extension of the inflammation, the uterine canal, the fallopian tubes, the ovary, and the peritoneum. When the urethra is implicated its course is marked by an indurated cord-like swelling. Micturition is painful, and is accompanied by vesical tenesmus when the bladder is inflamed. The local complications are abscess of the vulva and of Bartholin's glands, bubo, excoria-

tion about the anus and buttocks, and inflammation of the pelvic cellular tissue and peritoneum, with, it may be, metritis and ovaritis. Gonorrheal sclerotitis and rheumatism occur less often than in the male; and yet it is not improbable that many cases of arthritis in the female, which are ascribed to ordinary rheumatism, are, in reality, gonorrheal; at any rate, patients complaining of joint troubles are not rarely the subjects of chronic vaginal catarrh. One explanation of the phenomenal sterility of prostitutes is that the fallopian tubes are obstructed or constricted as the result of gonorrhea having reached them through the uterus; at the same time, it must be remembered that the ovaries are liable to undergo fibrous induration and fixation from gonorrheal inflammation.

Treatment.—The principles of treatment in both sexes are: (1) to obtain rest as far as possible; (2) to withhold alcoholic and sexual stimuli; (3) to diminish the acidity of the urine: this is accomplished by the exhibition of alkalis shortly after meals; (4) to allay irritation by sedatives applied locally and given internally; (5) to insure strict cleanliness. In the acute stage, injections, except of the mildest description, are not advisable, and in the male they may be dispensed with. In the female hot water injections (unless the vulva is acutely inflamed, when the introduction of the nozzle of a syringe is too painful) may be used with advantage.

In the declining stage, cubebs, copaiba, or oil of sandal wood, should be given; but inasmuch as their action is not general, but only through the urine, they are useless in vaginitis; and mild astringent lotions should be injected. With proper care a first gonorrhea will get well of itself, and, in fact, many cases do quite as well without the use of injections, and it is by no means rare for a gleet to be traced to the persistent use of strong applications. It does not matter much what form of astringent is employed; tannic acid combined with sedative solution of opium, and sulphate of zinc with extract of belladonna, are admirable remedies. Strips of boracic-acid lint should be placed between the vulva or beneath the prepuce to absorb the discharge, and they should be frequently changed. The patient should be told of the danger of inoculating the eye with

the gonorrheal pus. In case of retention the urine should be drawn off by a No. 6 catheter, or the bladder evacuated by suprapubic puncture; preferably the former. To subdue local spasm, and to prevent or remove chordee, it is well to inject morphia into the perineum, or to give rectal suppositories of the same drug. Belladonna may be added with advantage. At the same time bromide of potassium should be administered in fifteen-grain doses twice or thrice a day, or in thirty-grain doses at bedtime. If an abscess forms about the urethra, or in the prostate, the matter must be let out without delay. Cystitis is best combated by rest, sedatives, and the fixed alkaline carbonates. In severe cases, as also in prostatitis, three or four leeches applied to the perineum will give immense relief. The bowels should be kept gently open.

In the event of purulent conjunctivitis, the sound eye must be closed and protected from inoculation, and the affected one treated with powerful astringents (*e. g.*, nitrate of silver, twenty to forty grains to the ounce) and constantly fomented. Splitting of the upper lid to relieve tension has been recommended, but it is of doubtful propriety.

Chronic urethral discharges, commonly known as gleet, owe their origin to a variety of conditions, *e. g.*, alcoholic and sexual excesses; chronic prostatitis; stricture of the urethra, and the long-continued use of strong injections.

The nature of the discharge will give some indication of the anatomical condition with which it is associated. When very slight and transparent, and merely the remains of an acute gonorrhea, it is owing to a relaxed or catarrhal condition of the mucous membrane. In such cases it tends to subside of itself, and weak astringent injections are the only remedies required. A profuse purulent discharge with but little scalding, etc., mostly arises from a local granular or superficially ulcerated state of the urethra, especially at the fossa navicularis and at the bulbo-membranous junction. The treatment consists in attention to diet, regular habits, and the internal administration of tonics and cubebs or copaiba. Much good may be expected from the careful passage of large bougies, and from the application of astringents to the affected spots, either in the form of injections, or a shielded point of silver nitrate, or the

red oxide of mercury ointment carried in the eye of a catheter.

In a typical gleet the discharge is serous or muco-purulent. There is dribbling at the end of micturition, which is prone to be abnormally frequent; and not seldom there are reflected pains in the belly and loins. The usual cause of these symptoms is stricture of the urethra, of wider or narrower caliber.

AUGUSTUS J. PEPPER.

Symptomatic Indications.—*Gelsemium* in the early inflammatory stage is often the only remedy required; discharge scanty. *Aconite* is also useful in inflammatory stage, when burning pains, difficult urination, and hemorrhage from the urethra are present. *Cannabis sat.* is useful after inflammatory symptoms subside; should be continued until cure is effected. *Mercurius sol.*, in the beginning followed by *calcium sulph.*, produces a more radical though a less speedy cure. *Cantharis* is valuable for inflammation extending to bladder, chordee, hemorrhage. *Pulsatilla*, for thick, yellow-green discharge, gonorrheal ophthalmia, orchitis.

GOUT (*Podagra*, affecting foot; *Cheiragra*, hand; *Gonagra*, knee).—A constitutional disease, hereditary or acquired, apparently dependent upon an excessive production and accumulation of uric acid within the system, attended by the deposition of urate of soda in the various fibrous and cartilaginous tissues of the body, but especially within and about the joints, and characterized, in the acuter forms of the malady, by recurrent attacks of articular inflammation, the smaller joints being primarily and chiefly affected.

Symptoms and Varieties.—Gout may be *regular*: *i. e.*, articular, affecting the joints; or *irregular*, comprising (*a*) visceral gout, in which symptoms referable to internal organs may develop independently of any joint affection, or appear rapidly upon the sudden subsidence of the joint inflammation: *retrocedent* gout; or seem, variously grouped, to take the place of what would otherwise have been a normal repetition of the usual gouty arthritis: *suppressed* gout; and (*b*) cutaneous gout, including the several forms of skin disease which are common, and have a special pathological significance, in gouty subjects.

I. **Acute articular gout** is commoner

in males, appears usually between thirty and forty years of age, is rarely experienced before twenty, and then only when the hereditary predisposition is strongly marked. First attacks are rare after fifty, and exceptional after sixty-five.

A first attack frequently, and subsequent attacks are almost invariably preceded by certain prodromata, as dyspeptic symptoms, flatulence, heartburn, constipation, or irregular diarrhea. There may be cardiac oppression or palpitation; attacks of asthma, bronchitis, or of sore throat, associated with a peculiar velvety appearance of the faucial mucous membrane. Drowsiness, vertigo, disturbed sleep, irritability of temper, neuralgic pains and cramps, are common prodromal symptoms. The urine often appears unduly concentrated, high-colored, and scanty, depositing lithates on cooling. Sometimes the attack is immediately preceded for a day or two by a feeling of unusual well-being; or occasional twinges of pain may be experienced in some of the smaller joints of the foot or hand.

A few hours after midnight the patient wakes with pain in the ball of one or other great toe. The local inflammation and pain rapidly increase until the latter becomes excruciating, intensely aggravated by the slightest movement. The joint appears swollen, with turgid superficial veins; the surface is hot, deep red in color, tense, and shining.

Chills or rigors occur, with more or less pyrexia; the pulse is frequent, the tongue furred, and there is loss of appetite, with thirst and constipation. The urine is scanty, abnormally acid, and throws down an abundance of amorphous urates, although the *absolute* amount of uric acid excreted during the twenty-four hours is below the normal. Sleep is prevented by pain and restlessness, and the temper becomes extremely irritable.

Toward morning—sometimes not until after the midnight following—the more acute symptoms subside. The exquisite tenderness of the inflamed joint gives place to a tolerable sense of aching tension, the skin begins to perspire, the temperature declines, and the patient, exhausted, falls asleep. The joint, though less painful, appears more swollen, and is still red and tender, but its surface is more moist and less shining. The ter-

mination of the painful paroxysm may be marked by a critical discharge from the bowels or skin, or by a very copious deposit of lithates.

This train of symptoms may be repeated with lessening severity for four days, or even for some weeks, and other joints may be similarly attacked, contemporaneously or in succession. Finally, the "fit of gout" comes to an end, leaving the affected joint still swollen, œdematous and tender for a time, and the patient temporarily weakened in proportion to the severity of the attack, but often expressing himself as feeling better than he did before his illness. The articular inflammation, though apparently intense, never runs on to suppuration, and the joint or joints which were affected during the attack appear, after a while, to have completely recovered their normal appearance and mobility.

Rarely does the first attack of acute articular (acquired) gout in the case of a male begin in any other than the metatarso-phalangeal joint of the great toe, and most commonly in the right foot. But other joints of the feet, and even of the hands, are sometimes the first to suffer; recent local injury—a sprain or blow—may determine the primary development of gout in a joint, such as the knee, which usually escapes during the earlier period of this disease. As the joint recovers its normal appearance, the superjacent skin undergoes free desquamation.

The first attack of acute gout is almost invariably followed by others, after intervals, the length of which depend mainly on the patient's habits and mode of life, but which tends inevitably to become shorter and shorter. With each successive attack other joints are apt to become implicated, and recurrent inflammations increase the stiffness and enlargement of articulations which have already suffered. The duration of the attacks increases in proportion with their greater frequency, and often the general symptoms grow *pari passu* in severity; while, as a rule, the more frequently any particular joint has suffered, the less acute are the local symptoms which it presents.

The second attack is rarely delayed more than a year; and though the rate at which the morbid process tends to successively affect the joints and the de-

gree in which they suffer vary greatly in different individuals, the permanent joint-mischief which is established sooner or later gradually and imperceptibly merges into that more or less crippled condition distinguished as :

2. **Chronic articular gout.**—As urate of soda is deposited in increasing quantity in and about the affected joints, the articulations appear permanently enlarged, and gradually lose their mobility, while the surrounding ligaments, tendons, and fasciæ become stiff, thickened, and inflexible; hence the joints appear irregularly bulged and nodulated. The skin covering the joints may appear pallid or livid. Concretions of sodic urate (*chalk-stones*) are deposited, and, ultimately destroying the overlying skin by pressure, produce unhealthy ulcers, which discharge masses or particles of the salt, sometimes mingled with pus, and exhibit but little tendency to heal. Similar concretions may develop in or upon any cartilage or expanse of fibrous tissue, and are thus commonly observed in the helix of the external ear, about the alæ nasi, and along the edges of the tarsal cartilages, where they may give rise to obstruction of the tear duct, and subsequently to lachrymal fistula.

After the smaller joints of the hands and feet, the ankles, wrists, elbows, knees, shoulders, and hips tend to suffer. In severe cases the disease may involve all the articulations of the body, finally producing, in conjunction with the infiltrated bursæ, ligaments, and tendons, an absolute crippling of all locomotive organs, with an appearance of extreme distortion and deformity. The recurrent attacks of localized gouty inflammation are less acute, but pain is never altogether absent, and is aggravated by comparatively trivial causes. At the same time, the general symptoms of the malady increase in severity and frequency; some of those mentioned as premonitory symptoms are nearly always present; the general health suffers in proportion, and the patient becomes flabby and enfeebled. Attacks of asthma or bronchitis are common, and may replace exacerbations of the joint-affection, and signs of cardiac degeneration and of circulatory failure are apt to develop.

The urine becomes abundant, pale, and watery, of low specific gravity, and deficient in solids, especially in uric acid,

which is now seldom deposited; at the same time albuminuria is apt to make its appearance in small quantity, and to be accompanied with hyaline or waxy casts. As the general health becomes enfeebled, crystals of oxalate of lime are frequently to be found in the renal secretion. Cystitis, prostatitis, and urethritis are not uncommon; and symptoms dependent on interference with the functions of the brain and nervous system may be developed. Hemorrhoids are frequently a source of trouble, and in women menorrhagia may be profuse and may persist long after the normal climateric age.

3. **Irregular gout.**—Individuals who possess a gouty heritage frequently exhibit peculiar symptoms without suffering from any definite affection of the joints. Symptoms of “irregular” gout are also observable in the acquired form of the disease, and occur either between or in place of the “regular” paroxysms of joint-inflammation. During infancy a proneness to night terrors, epileptoid attacks, enuresis, constipation or irregular diarrhea, laryngismus stridulus, bronchial catarrh, and various forms of eczematous eruption often indicate an inherited gouty tendency. The milk teeth may decay rapidly, and the child exhibit other indications of “delicacy.” Adenoid vegetations in the naso-pharynx, with their attendant complications, are frequent.

In adolescents and adults various symptoms indicative of functional derangement of the digestive and respiratory organs, of the circulatory system (repeated flushings, undue susceptibility to cold, phlebitis, and frequent “dying” of the fingers and toes) and of the brain and nervous system (headache and sciatica), together with the affections of the eye (attacks of “hot eye,” scleritis, retinitis, and even of glaucoma), may appear.

The *cutaneous* manifestations of irregular gout mainly take the form of *eczema* and *psoriasis*, or of a condition resembling a combination of the two, and prurigo. An eczematous irritation about the anal and the vulval orifices is far from uncommon in middle-aged and elderly gouty subjects, and is often most distressing. Eczema and psoriasis are very apt to reappear about spring and autumn, and while suffering from the skin affection patients are commonly relieved more or less completely from the arthritic and

visceral manifestations of gout. Erythema and urticaria are apt to be very readily provoked in some gouty persons.

Diagnosis, usually easy in acute cases. *Acute rheumatism* usually appears for the first time before the age of twenty, and exhibits a more gradual mode of invasion, and a different ætiological history. The size of the joints affected, their being less deeply reddened, the less excruciating pain, the profuse acid sweats, the shifting character of the arthritis, the usually high fever, the appearance of the tongue, the characters presented by the urine, and the liability to cardiac complications are usually obvious points in the differential diagnosis. *Pyæmia* beginning in the great toe-joint, would be distinguishable by its subsequent course and its peculiar pyrexial range. Sub-acute and chronic articular gout possess a history and causation quite different from *rheumatoid arthritis*, which chiefly affects poor and anæmic women, and usually begins between twenty and forty years of age; all the joints tend to be progressively implicated, but the symptoms are not acute or periodic in character. Urates are not deposited in the joints or elsewhere, and the urine presents no special peculiarity. Some cases of irregular gout may, however, present great difficulties in diagnosis, and require a careful consideration of possible heredity, with the previous and family histories and habits of the patient, and a minute investigation of the symptoms and progress of the case.

Ætiology and Pathology.—Gout depends upon a surcharging of the system with some substance resulting from the imperfect oxidation of albumen, and especially of albuminous food-stuffs; and *lithic* or *uric acid* is commonly regarded as the particular *materies peccans*.

In order that gout may develop, an amount of uric acid must be formed and retained within the system greatly in excess of that which can be eliminated or destroyed by the normal vital processes, which may be brought about by (1) an excessive ingestion of albuminous food; (2) by lessened oxidation of food-albumen not in itself abnormal in amount; and (3) by excessive ingestion, together with diminished oxidation, of albumen. In practical application, these may be broadly restated as (1) eating too much (of albuminous food); (2) eating enough, but

taking too little fresh air and exercise; and (3) eating too much *and* not taking sufficient exercise.

Two important conditions—hereditary transmission and impregnation of the system with lead—act as powerful *predisposing causes*. Sugary and sugar-forming or starchy foods are prejudicial to the gouty, because, being themselves easily oxidized, they rob the less readily oxidized albuminoids of the means required for their own complete digestion. Alcohol itself acts in a similar fashion as an inhibitor of tissue change; when combined with, or containing, saccharine matter, as in the heavier malt liquors and the sweeter wines, it is still more detrimental; and the imperfectly fermented wines, like ordinary port and sherry, appear to be specially harmful in this respect.

All causes which provoke dyspepsia in the individual tend to derange the digestive organs, and thus to aggravate the tendency to a production of lithic acid in excess; all these influences are aggravated by the ingestion of too little *water*—a dietetic error specially common among those who do not live by the sweat of their brow; for water, in addition to its value for cleansing the inside as effectively as the outside of the body, efficiently promotes tissue change and waste elimination, and can supply the system with oxygen both directly from its own volume of dissolved air and indirectly by chemical decomposition.

Uric acid, when produced in such an excess as to give rise to gout, is found in the blood as urate of soda; and is deposited in the cartilages of joints, both within and between the cells, and in the neighboring fibrous structures, leading in time to their erosion and destruction; as well as the articular nodulation and enlargement; the thickening and fixation of ligaments, tendons, and fasciæ; the enlargement of bursæ; and the formation of tophi and gouty abscesses and ulcers. The fibrous coats of arteries, from the aorta downward, the walls of veins, the periosteum of bones, the sheaths of nerves, the membranes of the brain and of the eye, may be similarly affected. The substance of the heart escapes, but that organ may suffer rapid degeneration owing to an implication of the coronary arteries in the gouty process. In the kidney, crystals of sodic urate appear

first within the tubules, forming whitish streaks on section: later, they are deposited in the intertubular tissue, and the irritation provoked by their presence may beget a cirrhotic process, which results in the small, contracted, "gouty" kidney, with a corresponding decadence of functional ability. The liver may undergo a fatty enlargement; and the various mucous membranes and the skin become irritated, congested, and diseased by the presence of a toxic agent, which they can but imperfectly eliminate.

During a paroxysm of acute gout, uric acid may be detected in the blood or in the fluid obtained from a blister (provided the latter be not raised in the immediate neighborhood of an inflamed joint). About m. vj of acetic acid are mixed with 3ij of serum, in a watch-glass; a single thread of linen is immersed in the fluid, and the watch-glass, protected from dust, is set aside in a warm place. In a few hours the serum gelatinizes by evaporation; and the thread, when withdrawn and examined under the microscope, is found to be incrustated with rhombic crystals of uric acid (Garrod).

Crystals of urate of soda have also been discovered in the sputa of gouty bronchitis, and as an efflorescence on the epidermis in cases of gouty eczema and psoriasis.

Treatment.—Persons who inherit the gouty diathesis, and sufferers from the declared disease, should correct all indolent and self-indulgent habits; they must avoid an excess of nitrogenous food, especially the coarser-fibered meats, smoked and salted provisions, rich and highly seasoned dishes, pastry, strong wines, and beers; and should take but little of sugary and starchy food, and of alcohol in any form.

Plenty of exercise, taken regularly in the open air, but always short of over-fatigue; warm clothing; careful attention to the hygiene of the teeth, skin, and bowels; early hours for rest and rising; thorough ventilation of bed and sitting rooms; and the avoidance of every kind of excess are of great importance.

Dyspeptic symptoms need prompt and careful treatment, and debility will call for tonics, of which iron, strychnine, and arsenic in small doses are especially useful, regard being always paid to the

presence of the lithæmic diathesis. Many gouty patients are intolerant of quinine.

During an *acute attack* the affected limb should be comfortably raised, and so supported as to be free from pressure, jars, and movement. The inflamed joint may be lightly incased in cotton-wool covered with oiled silk, or in a single thickness of lint saturated with a solution of chloral hydrate (grs. ij to $\bar{3}$ j), with or without an equal amount of morphine, or equal parts of the liniments of opium, belladonna, chloroform, and aconite, to which in the later stages potassium iodide (grs. v-x) or potassium chlorate may be added with advantage. Treating the joints to a local vapor bath is often specially grateful in the initial stage of inflammation. Gentle friction with a lanoline ointment containing chloral hydrate grs. ij and pot. iod. grs. x to the ounce relieves the troublesome itching which commonly attends desquamation, and promotes absorption. If the kidneys be sound, and especially if there be indications of hepatic congestion, three or four grains of calomel, followed by an aperient saline draught, is a useful commencement of medicinal treatment. An alkaline mixture containing grs. xv-xx of the citrate of potassium, and the same quantity of ammonium chloride, if there be symptoms of hepatic derangement, may be taken every four or six hours; and if the heart be sound and vigorous, a full dose of colchicum (m. xx-m. xxx of the wine) may be added to each dose, but this drug must not be given in routine fashion; its effects should be carefully watched, and the dose gradually diminished as the acute symptoms subside.

A regular and efficient action of the bowels must be maintained, preferably by the use of saline aperients, or with the aid of a pill containing rhubarb, podophyllin, colocynth, and hyoscyamus, together with small doses of calomel or of gray powder in certain cases.

Efficient perspiration should be encouraged by diaphoretics, such as the liq. ammon. acetatis, if necessary. Enfeebled cardiac action indicates strychnine or strophanthus, with ether and ammonium carbonate, together with lithia rather than potassium salts. Pain and sleeplessness may require the administra-

tion of hypnotics, as chloral, potassium, or ammonium bromide, and of anodynes, as pulv. ipecac. co. or of morphine *sub cute*. The abstraction of blood, whether generally or locally, is never admissible in acute gout. Diarrhea, if present, should not be hastily or completely checked.

The patient should drink freely of bland aqueous fluids, as toast and water, barley water, seltzer, potash, and Apollinaris waters (soda water and all soda salts are best avoided by the gouty. Milk usually agrees, and may be sipped freely especially if diluted with barley water or mineral water. Should there be a tendency to vomiting, half the volume of plain or of carbonated lime water may be added to the milk. Patients enfeebled and exhausted will need a more generous dietary, but it must be light, and easily assimilable: beef-tea, mutton and chicken broth, and plain soups, in which, as in milk, an egg may be beaten up. In some cases of extreme debility small and repeated doses of sound whisky, brandy, or old rum may be given, well diluted. The indication for stimulants may usually be satisfactorily met by the administration of the sp. æth. sulph. in medicinal doses.

As convalescence advances, white fish, fowl, game, and mutton may be gradually added to the dietary; with perhaps a little spirit, well diluted, or small quantities of sound light wine, such as hock, or still Moselle; until, with the more or less complete re-establishment of his health, the patient is able safely to resume some appropriate form of the regimen.

Stiffness or effusion persisting in a joint after the subsidence of other symptoms is best treated locally by gentle friction with some stimulating liniment containing potassium iodide, and by hot salt water douches, with passive motion, massage, and gentle, regular, elastic pressure. It is usually an additional indication for the administration of tonics, especially iron, strychnine, arsenic, and phosphorus, together with gentle hepatic stimulants and aperients—*e. g.*, ammoniac chloride, podophyllin, elonymin, rhubarb, and the like.

Chronic gout is to be treated on the same lines, but the potassium salts are particularly valuable. Small doses of colchicum, taken for some time together, are useful. Guaiacum is sometimes of

service, and tonic medicines, such as preparations of bark and iron, almost always so, especially if there be oxaluria. Local treatment, including friction and shampooing, may greatly improve the condition of joints not hopelessly disorganized. The continued use of certain mineral waters, Vichy, Wiesbaden, etc., is often productive of good results, especially when combined with the valuable hygienic measures to which patients are commonly subjected, and to which they more willingly submit, during a visit to such health resorts. Gouty ulcers and abscesses should not be too actively treated; a simple dressing of lint saturated with a lithium or potassium salt, continuously applied beneath oiled silk, answers best.

The various manifestations of *irregular gout* must be treated as affections of the organs specially implicated, due regard being always paid to the underlying gouty diathesis. Acute symptoms referable to the heart or stomach, acute gouty colic and collapse may require a liberal administration of stimulants and anodynes, with warmth to the surface, and sinapisms over the heart and epigastrium. Gouty bronchitis is much benefited by the inhalation of fumes of nascent chloride of ammonium. Arsenic is not always well borne in the cutaneous affections of the gouty, and such patients appear to be sometimes rendered worse by a too rapid mending of their skin troubles. When flannel is not tolerated in these cases, silk articles of underclothing are useful substitutes.

Sufferers from gout derive benefit from residence in a warm, dry, and equable climate. Excessive acidity of the urine, and the deposit of urates from the secretion, are at all times strong indications for the administration of alkaline medicines, with moderate doses of aperients.

C. E. SHELLEY.

Symptomatic Indications.—In the onset of the disease, with chills, restlessness, inflammatory symptoms, *aconite* is often useful. *Belladonna* for erysipelatous redness.

The hot air bath, of a temperature of 200° to 300° F., may be used to advantage in gout, in connection with the appropriate remedy, *aconitine*, *colchicine*, *atropia*, or *arseniate of strychnine* (see HOT AIR TREATMENT, p. 1558).

GRANULOMA FUNGOIDES (*Mycosis Fungoides*; *Fibroma Fungoides*).

—A chronic inflammatory disorder, probably of specific origin, affecting the superficial and deep layers of the skin, and occasionally the mucous membranes.

Symptoms.—In the early stages, urticarial, erythematous, or eczematous patches, of irregular shape and size, with well-defined margins, appear on various parts of the body, the scalp and skin of the trunk being perhaps their commonest seats; they are attended by much itching, and are not controlled by ordinary treatment. Exudation may take place from minute fissures, and crusts form over the patches. Resolution and restoration of the skin may occur at this stage, and serve to clearly distinguish this disease from malignant infiltrations. More frequently, the patches become hypertrophic and firm, hard nodules, varying in size from that of a pea to an apple, either sessile or pedunculated, develop on them; frequently, large subcutaneous lumps like boils appear and disappear with marvelous rapidity.

Usually the nodular tumors break down and form deep, unsightly ulcers, which contain sensitive, fungating granulation tissue, and discharge thin pus and serum. Considerable pain attends the process, and the patient becomes sleepless and depressed.

Finally, the lymphatic system is affected, and a progressive cachexia is established, which terminates in death, often from pneumonia or pleurisy.

Treatment.—In the earlier stages, arsenic, pushed to the most extreme limits, is certainly sometimes beneficial if not absolutely curative. Pyrogallal acid ointments are the best local application, but their action must be carefully watched. Iodoform is useful for the fungating masses. One case completely recovered after an attack of erysipelas.

J. J. PRINGLE.

GUMS.—They are affected by abscess (gum-boil), by ulceration, and hypertrophy. Abscess arises from irritation of carious tooth.

Treatment.—Foment; then open when abscess has fairly formed; give attention to the teeth. Ulceration is caused by mercury, scurvy, syphilis, and, indeed, any other cause of stomatitis. First. Remove cause. Wash with pot. chlorat.; paint

with sol. argent. nit. gr. $x-\frac{2}{3}$ j, or touch with solid argent. nit. Give pot. chlorat. and tonics internally. Hypertrophy may require that the outgrowth be snipped off.

GUNSHOT WOUNDS.—*Causes.*—

1, Mere explosions of powder; 2, wadding; 3, small shot; 4, bullets and slugs; 5, cannon-balls; 6, splinters of shells.

Characters.—Four chief forms: 1. Simple contusions. Caused by spent-shot, or by "oblique impact." Formerly attributed to "windage." May produce most severe internal injuries with no visible damage to the skin. 2. Superficial wounds, grooving, not tunnelling, the flesh. 3. When bullet lodges. Particles of clothing, etc., may enter with it. 4. Where the bullet pierces and escapes. Though bullet escape, foreign bodies carried in with it may remain. Rifle-bullets are distinguished from musket bullets, make cleaner and less contused wounds, but smash and splinter bones, and pierce the body with a more straight and undeviating course. They also cause greater shock.

Shock.—Depends much upon individual constitution. Is usually great. Pain usually slight, often unnoticed.

Hemorrhage.—Primary is rarely serious, except when the largest vessels are wounded. Secondary is very common, perhaps in war because of bad sanitary conditions. Burns from powder may occur at close quarters.

Examination.—First see how many wounds there are. Then, examine patient's clothes. Apertures in them may indicate the direction of the wound; the absence of a piece of cloth may suggest its presence in the wound; or the exit of the bullet may, in rare cases, be proved by its being found in the clothes. Then explore the wound with the finger carbolized. But in gunshot wounds of the chest or abdomen, the surgeon should insert neither probe nor finger, unless he is prepared to follow up his search, if necessary, by operative measures. Place the patient in the attitude in which he received his wound; its direction can thus be better judged. Examine carefully once for all. Make counter manipulation with the fingers of the other hand to assist the finger in the wound. There are instruments for detection of bullets. Nelaton's probe (porcelain head). De

Wilde's electric bell indicator. Krohne and Sesemann's electric indicator.

Apertures of exit are cleaner and smaller than even the ball which made it. Entrance is everted larger and lacerated. The quicker the passage of the ball the less are these differences; and they are sometimes *nil* if a bone has been struck. Only part of a bullet may have escaped by the aperture of exit. A spent bullet may make its exit in two places. Bullet may rebound from a bone and fall out of aperture at entrance. Course of slow bullets is often very peculiar. In the process of healing, small ring-shaped slough and gangrenous shreds are first thrown off. Granulation and suppuration follows. Opening of exit usually closes before that of entrance.

Prognosis.—Depends on amount and position of injury. "The extensive tearing and crushing caused by large missiles do not differ from other large crushed wounds caused by accident."

Treatment.—Principles same as those of other contused wounds; differences of detail chiefly depend on peculiarity of surrounding circumstances, and upon the parts involved.

Head.—Very dangerous, from the diffused injury done to the brain and its membranes. Inner table fractured more than outer. Frequent complication with meningitis, abscess, etc. Gunshot wound of brain almost always fatal. Fracture with depression usually fatal. Perfect rest is required, darkness and low diet. Cold locally. Venesection may be useful. Trephining contra-indicated. Do not mistake a wound in which part of outer table of skull has been plowed off, for fracture with depression.

Thorax.—Diagnosis, complications, etc., are much the same as other wounds of chest. Non-penetrating wounds of any violence almost sure to bruise lung. Penetrating wounds fatal nine times out of ten. Treat like other wounds of chest. Allay first hemorrhage, secondly inflammation. To check bleeding from an intercostal artery lay a large piece of linen over wound, the middle portion of the linen is pressed into the wound by the finger, so as to form a kind of pouch, which is then distended by sponge or lint pushed into it until the pressure arrests the bleeding; by stretching out the corners of the cloth the pressure of the plug will be increased.

Abdomen.—In penetrating wounds the ball may pierce more than one viscus. The chief sign, sometimes the only one of penetration is the extreme collapse. Recovery may take place; then often a fecal fistula. Gunshot wounds of bladder have often recovered.

Extremities.—Injuries to soft parts only, usually do well, unless some large artery or nerve be struck. Injuries to bones are remarkable for comminution and frequency of longitudinal fissure into joints. Consequent great liability to osteomyelitis and blood-poisoning. Impossible to be so conservative in treatment in battle as in civil practice. The rule is to amputate for fractures in middle and lower third of femur. Put up most other fractures in immovable plaster case. In gunshot injuries of extremities, as of other parts, ordinary rules of surgery apply, only bearing in mind the smashing and splintering and the special difficulties in after-treatment. Hence, excision of knee and hip are condemned by experience. Shoulder, elbow, and ankle are suitable for excision. Put up excisions in immovable plaster cases. In some cases of wounded knee-joint, an attempt may be made to save the limb; here again a plaster case is necessary. Fractured thighs should not be transported far to hospital.

C. B. KEETLEY.

HÆMACYTOMETER (*αἷμα*, blood; *κύτος*, a cell; and *μέτρον*, a measure).—By means of this instrument it has become possible to estimate approximately the number of corpuscles in a given quantity of blood.

The apparatus consists of—(1) A capillary pipette, graduated to 5 c.mm., for receiving the blood when drawn; (2) another pipette graduated to 995 c.mm. for receiving that quantity of the diluting fluid; (3) a small glass vessel in which the two fluids can be thoroughly mixed; and (4) a cell the depth of which is exactly $\frac{1}{5}$ millimeter, and on the floor of which there is graven a micrometer scale in squares of $\frac{1}{10}$ millimeter each. The diluent fluid, as recommended by Dr. Gowers, consists of sulphate of soda 104 grains, acetic acid 1 dram, and distilled water 4 ounces.

The procedure is simple. The blood is obtained by puncturing the finger, previously cleansed, and it is important not

to squeeze the finger forcibly. The drop of blood is drawn into the tube (1) until the requisite amount is collected (5 c.mm.). This is then ejected into the vessel (3), which has been previously filled with the measured quantity (995 c.mm.) of the saline solution by means of the graduated pipette (2). Here the blood and saline are thoroughly mixed by means of a small glass spatula. The mixture thus consists of 995 parts of saline and 5 parts of blood or as 200:1. A drop of this mixture is then placed in the cell, which is completed by adjusting the cover-glass, and, after a few minutes' interval to allow of the corpuscles being deposited at the bottom of the cell, the numeration is made by counting the corpuscles visible in each square. It is well to count the numbers in at least ten squares, and then to strike the average contents of a single square.

The calculation of the number of corpuscles per cubic millimeter of blood is then easily made by multiplying the number per square by 100,000.

Such a calculation is only approximate, since the normal average of contents of the blood in red corpuscles varies, according to sex, age, and other circumstances, both above and below the limit named. The number of white corpuscles may be counted by the same means, but it is necessary to count them in a large number of squares before striking the average, owing to their relatively small numbers. In health, there would be about one white corpuscle to seven or eight squares.

The white corpuscles are readily distinguished by their glistening aspect. They are best numerated by using a low power (fifty diameters) and noting how many of the squares are visible in the field, as well as the number of corpuscles.

SIDNEY COUPLAND.

HÆMATEMESIS (Vomiting of Blood) is a symptom rather than a disease, and occurs in a variety of pathological conditions. These may be divided broadly into two classes—the *general*, or constitutional, and the *local*. The former includes various febrile diseases, as yellow fever, smallpox, scurvy, anæmia, leucocythæmia, and purpura hemorrhagica. Hematemesis takes place in case of irritant poisoning, and is sometimes vicarious of menstruation.

In the latter class a subdivision must be made according as the stomach is or is not the seat of organic disease. Simple ulcer and cancer of the stomach on the one hand, and venous obstruction from hepatic or cardiac disease on the other, form the chief varieties. Fatal hemorrhage occasionally occurs from rupture of one of the circle of veins which surrounds the lower end of the esophagus. In a few fatal cases, no lesion has been found in the stomach. Blood coming from the posterior nares, or from the lungs during an attack of hemoptysis, may be swallowed unconsciously and brought up by vomiting, and an aortic aneurism may perforate esophagus or stomach, and give rise to profuse hematemeses.

Hematemeses is preceded by pallor, giddiness, and a feeling of nausea and faintness. Sometimes actual fainting occurs. Vomiting then ensues, and upon the quantity and quality of the blood brought up the diagnosis largely depends. It is remarkable on account of its profuseness in two classes of cases: in simple gastric ulcer, and in portal congestion due to cirrhosis of the liver. In cancer, the bleeding is usually comparatively small in quantity. The blood oozes slowly into the stomach, and is acted on by the gastric juice before being vomited, so that it presents a "coffee-ground" appearance. It is difficult to tell sometimes whether such an appearance is due to blood or not; if so, a small quantity of the vomit should be placed in a test-tube and treated with a tincture of guaiacum and ozonic ether, when, if blood be present, the characteristic reaction will be observed.

Diagnosis.—Sometimes difficult between hematemeses and hemoptysis, especially when the vomited blood is not seen. The history of the case will help to a certain extent, but the points chiefly to be relied on are: In hematemeses, giddiness and nausea are more likely to be felt, as a considerable quantity of blood may escape into the stomach before vomiting occurs. Vomited blood is darker in color, and may be mixed with particles of food. It consists partly of clots, and has an acid reaction. In hemoptysis, the blood is generally brought up after a sensation of tickling in the throat; it is usually in smaller quantities and is ejected with each act of coughing. It is brighter in color, alkaline in reaction, and frothy from admixture with air.

It must not be forgotten, however, that when a large quantity of blood is vomited some may find its way into the air passages and excite coughing; and, conversely, if coughed up in the first instance, a portion may be swallowed, and may be brought up by vomiting. In such cases, unless the attack is actually seen, the previous history and the present state of the patient must be the guide. *Malæna* (blackness of the motions) is almost certain to occur after hemorrhage into the stomach; some of the blood passing down the intestinal tract, and being so acted on by the digestive fluids as to produce the so-called "tarry" ejections. But here again a source of fallacy arises from the fact that, after a profuse hemoptysis, it is by no means uncommon for blood swallowed during the attack to be subsequently passed in the motions.

Pathology and morbid anatomy.—In cases of the general class, the hemorrhage has its origin in the altered state of the blood, and probably to some extent in weakening of the walls of the vessels. In cancer there is an oozing, generally moderate in amount, from the surface of the new growth. In the case of portal obstruction and obstruction from cardiac disease, the blood-pressure becomes too great for the capillaries to withstand, and transudation of blood takes place. Hemorrhagic erosions of the mucous membrane may also be found, and are especially frequent in cases of valvular disease. When profuse hematemeses occurs in cases of portal obstruction, the bleeding seems to take place from the whole mucous surface as from a sponge, and no distinctive morbid appearance may be found in the stomach. The bleeding here may be in greater amount than in any other form of hematemeses.

In gastric ulcer the bleeding is caused in most cases by the erosion of the wall of an artery.

Prognosis.—Depends mainly on the cause underlying the hematemeses. So far as the immediate result is concerned, the larger the hemorrhage the greater the danger. The prognosis is not unfavorable in gastric ulcer, even where the hemorrhage is considerable and repeated. In cancer the ultimate prognosis is absolutely hopeless. In cases where the hematemeses is due to hepatic cirrhosis the bleeding may be so profuse as to destroy life very quickly; this is the variety

in which the immediate danger may be greatest. If, however, the bleeding be moderate in quantity, it may, by relieving the portal congestion, be beneficial rather than otherwise.

Treatment.—The patient must be placed in the recumbent position, kept perfectly quiet and cool, and given ice to suck. Nothing else should be taken by the mouth in the first instance. The external application of ice to the epigastrium is also to be recommended. If there be reason to suppose that portal obstruction is the cause of the hemorrhage, the bowels should be opened by laxatives. But if the diagnosis of gastric ulcer or cancer be made, and the bleeding be not arrested by ice, astringents, such as liquid extract of ergot in $\frac{1}{2}$ -drain doses, with 10 grains of gallic acid, should be given every four hours. Opium, also, will be found invaluable; 3 to 4 grains of the pil. plumbi composita (acetate of lead and opium) may be given every four hours. If the stomach be too irritable to retain these, the subcutaneous injection of ergotine (2 to 5 grains) with morphine ($\frac{1}{8}$ to $\frac{1}{3}$ grain) should be employed.

If the case be one of gastric ulcer, absolute rest to the stomach is the most important element of treatment. This is secured by feeding the patient by means of nutrient enemata or suppositories only, for a week or ten days, after which milk, beef-tea, and soups, and a very gradual return to solid diet.

DAVID W. FINLAY.

Symptomatic Indications.—*Ipecacuanha* is usually the remedy required, especially when the blood is bright red. *Hamamelis* is excellent when the blood is venous, or from the liver or spleen. *Arnica* is valuable when the hematemeses is the result of injury. *Aconite* is sometimes valuable when hematemeses occurs in plethoric persons, with febrile symptoms.

HÆMATOCELE, PELVIC.—An effusion of the blood into the pelvis. *Hæmatocele*, blood effusions into the peritoneal cavity; *hematoma*, bleeding into the cellular tissue. An intra-peritoneal effusion of blood usually gravitates into Douglas's pouch, and the condition is therefore spoken of as *retro-uterine hæmatocele*.

Hemorrhage into the peritoneum may come from many different causes, and is

only a symptom or event in the course of different diseases.

1. Hematocele may arise from *rupture of a vein in the broad ligament*. The hemorrhage may take place into the cellular tissue of the broad ligament or into the peritoneum. Either form is rare.

2. *Hemorrhagic perimetritis*.—Inflammation of any serous membrane may be accompanied with hemorrhage, and the peritoneum is no exception to this rule.

3. Hematocele may be the result of the *rupture of an ovary*. At every ovulation, rupture of a Graafian vesicle takes place, and is accompanied by an effusion of blood, probably not in health exceeding 3 j. Occasionally, when the ovary is enlarged and very vascular, more profuse hemorrhage occurs. It is probable that when signs and symptoms of slight hæmatocele follow fatigue, over-exertion, or sexual excitement, they may be due to increase of the hemorrhage accompanying the rupture of a Graafian follicle. In other rare cases, the ovary has been found enlarged, soft, and sponge-like, and infiltrated with blood (resembling the spleen of a subject who had died from purpura or scurvy); nothing is known of their pathology, and the few recorded have been rapidly fatal, either from the amount of the bleeding or from subsequent peritonitis.

4. Hematocele may be due to *rupture of a fallopian tube*. The most common cause of this is extra-uterine gestation, which may terminate in early rupture, followed by absorption of the effused blood and of the products of gestation. The experience of operators goes to show that extra-uterine gestation is probably the most common cause of hæmatocele. In some cases the tube is found enlarged, thickened, and containing blood, but neither fetus nor membranes can be found. Such cases may be results of inflammation of the tube (usually bilateral), or they may be pregnancies in which the fetus has been overlooked, or perhaps has been absorbed.

5. There may be *bleeding from the tubes* into the peritoneum as a result of fevers, phosphorus poisoning, purpura, scurvy, atrophy of the liver, and yellow fever.

6. Hematocele may follow *delivery or abortion*, more often the latter. It has been supposed that the blood from the

uterus regurgitates through the fallopian tubes into the peritoneum. It may also, in these circumstances, be secondary to perimetritis.

7. Hematocele may be a result of *menstrual retention* from atresia of the canal. This is the more likely to cause hematocele the higher up in the genital canal the obstruction lies. (See AMENORRHŒA.)

8. Retention of menses, leading to regurgitation of blood along the tubes, has been attributed to causes other than atresia, some of which are very doubtful—*e. g.*, congenital stenosis of the cervix, hypertrophy or thickening of the cervix, flexions of the uterus, and spasmodic contraction of the uterus. That tumors or cancer of the uterus may block the canal, there is no doubt.

9. *Closure of the tubes* at the uterine end, preventing blood exuded by them from escaping *per vias naturales*, may lead to the formation of pelvic hematocele.

Symptoms and Signs.—The history of a case of hematocele depends upon the condition to which the hemorrhage is due. The symptoms at the time of the effusion are those of internal hemorrhage—sudden pain, faintness, pallor. If examined soon after the blood has been poured out, while it is still fluid, no physical signs will be found (beyond those that may have been present before the effusion), or perhaps there may be some slight fulness around and behind the uterus. When the blood has coagulated, and the outer layers of coagulum organized and connected with surrounding parts, the physical signs become those of an effusion into the peritoneum. The signs are the same whether the effusion be of inflammatory lymph, of serum, of pus, or of blood. The outline of the swelling felt per vaginam is that of the peritoneum, which forms the lower boundary. A tumor is present which is fixed, dips down lowest behind the uterus, cannot be felt in front of it, and at the sides joins the uterus a little above the level of the internal os, and laterally retreats beyond the reach of the finger in the vagina. If the tumor be large, and the space within which the blood is effused limited by adhesions, the uterus will be displaced forward. We infer that the effusion is a hematocele when its formation is accompanied by symptoms of internal hemorrhage (pallor, faintness, etc.) rather than by those of inflammation, febrile disturbance). A large

effusion may by its pressure cause disturbance of the surrounding parts; hence irritability of bladder, or retention of urine, rectal tenesmus, and some degree of proctitis are frequently present.

Course and Treatment.—If the patient survive the immediate shock of the hemorrhage, the usual course of pelvic hematocele is to complete recovery by absorption of the effused blood, which will be evidenced by the gradual improvement in the patient's condition, and progressive diminution in the retro-uterine swelling. In such case no treatment will be called for other than expectant—rest in bed while there is any pain or fever, tonics if appetite fail, laxatives to prevent disturbance by the passage of hard scybala. But the case may be seen when it does not seem to be tending toward recovery, (1) A case is very seldom seen while hemorrhage is going on, but if seen in this condition, and it be possible, before she is moribund, to open the abdomen, it is proper to do so. (2) If a slight hematocele be followed by signs of increase, a course which points to the persistence of the condition causing the hemorrhage, the abdomen should be opened. (3) If the effusion be so great as to cause serious trouble by its size, such as retention of urine, or obstruction of the bowel, or if febrile symptoms come on and lead to the inference that suppuration has occurred, laparotomy should be performed in preference to tapping by the vagina. By tapping, fluid is drawn off, but nothing curative is effected; and, if the diagnosis be erroneous, tapping may be injurious. If the abdomen be opened, any morbid condition present can be effectively dealt with; and if the operator be competent, the danger is scarcely, if at all, greater than that of tapping by the vagina.

G. E. HERMAN.

Symptomatic Indications.—*Hamelis* is frequently useful for the primary hemorrhage. *Aconite* for resulting inflammation. *Arnica* aids absorption.

HÆMATOCOLPOS.—Retention of blood in the vagina from atresia of that canal (see AMENORRHŒA). Besides the usual form, we may have blood retained in one-half of a double vagina, when we find a fluctuating swelling extending down one side of the vagina, and usually on its anterior aspect. As the point of closure may be anywhere in the length of the

vagina, the swelling does not always extend down to the vaginal orifice. If the atresia be high up, the blood may be contained in a cavity formed by the vagina and cervix uteri, but it is impossible to say how much of it is formed by the uterus and how much by the vagina.

Treatment.—Let out the blood by incision, and then cut out a large piece of the septum to prevent closing again.

G. E. HERMAN.

HÆMATOMA, PELVIC.—An effusion of blood into the cellular tissue of the pelvis.

In the unimpregnated condition it is rare except as a result of direct violence, or diseases accompanied by a tendency to hemorrhage, such as hemophilia, purpura, and scurvy. With these exceptions, it is almost exclusively a disease of pregnancy and the puerperal state. In pregnancy, the veins which return the blood from the genital organs become very large, often varicose, and are liable to rupture either from slight direct violence or as a result of pressure. If this happen, bleeding takes place into the cellular tissue.

If the effusion be slight, so that it does not extend beyond the cellular tissue of the pelvis, it will be distinguished from an intraperitoneal effusion of blood by being situated at the side of the uterus instead of behind it, and, as a rule, on one side only. The mass which it forms will be in apparent continuity with the uterus as low down as the vaginal insertion, and instead of retreating beyond the reach of the finger, like an intraperitoneal effusion, it slopes off toward the bony wall of the pelvic outlet. Like an intraperitoneal swelling, it is fixed, and like it, as time goes on, gets smaller and harder, and finally disappears. Effusions so small as to be limited to the cellular tissue within the pelvis produce only slight symptoms, which, as to their kind, resemble those of intraperitoneal hemothecoele, and the case only requires expectant treatment.

In pregnancy or the puerperal state the effusion is seldom limited to the cellular tissue within the pelvis. It usually extends down by the side of the vagina into the labium, where it forms a swelling which may reach the size of a fetal head. The symptoms are mainly those

produced by the size and tension of the swelling. The patient will call attention to the swelling, complain of pain in it, and state that both pain and swelling began suddenly. The local troubles are usually more urgent than the general condition. The swelling is tense, at first fluctuating, then of a boggy consistence. It is dark blue or purple in color, and this, together with its sudden formation, will distinguish it from an abscess. It is not reducible, by which it is known not to be a hernia. Tumors of the labium will be of still more gradual formation than either of these conditions.

Treatment.—Keep the patient recumbent, in order to prevent further bleeding, relieve pain and prevent inflammation by an evaporating lotion (liq. plumbi subacet. $\frac{3}{4}$ ss, spt. vin. rect. $\frac{3}{4}$ ss, aq. rosæ O. j). Under this treatment absorption will gradually take place, and as the swelling diminishes, pain will also lessen. Should labor come on, and the swollen labium obstruct the passage of the child, it may be necessary to incise it, or it may burst spontaneously. If either of these events happen, the cavity should be emptied of clot as thoroughly as possible, well washed out with an antiseptic solution (corrosive sublimate 1-2000), and a drainage-tube, reaching to its deepest part, inserted. The cavity should afterward be washed out daily with an unirritating antiseptic, such as a saturated solution of boracic acid. The patient should be kept recumbent until the cavity is nearly filled up.

G. E. HERMAN.

HÆMATOMA AURIS (Bloody Tumor of the Ear.—Insane Ear.)—An effusion of blood between the cartilage of the ear and the perichondrium.

It occurs in two forms, acute and chronic. It begins most commonly in the upper angle of the hollow of the concha, sometimes in the fossa of the helix, and very rarely in the fossa of the antihelix, or in the external auditory meatus. In the acute form a bright red, or bluish-red swelling occurs, and reaches the size of a pigeon's egg in from twelve to forty-eight hours. The tumor is elastic or firm upon palpation, is slightly tender, and generally painless.

In the chronic form the swelling, heat, and injection are much less; the tumor in a few weeks attains the size of a bean

and slowly shrivels. In the acute form the tumor, if left to itself, will sometimes suppurate and burst, if blistered it generally shrivels slowly, if incised the same result is more rapidly attained. In any case the result almost invariably is considerable deformity; a hard compact puckered mass, of a dull, dead-white color, with tough adherent skin, being left. The pinna loses its form, becoming much distorted and contracted, its graceful curves and hollows disappear, and it remains hard, rigid, and resistant.

Pathology and Ætiology.—Hematoma is commoner among men than women, is always associated with long-continued excitement and restlessness. In men it occurs most frequently among general paralytics, sometimes in chronic maniacal excitement, rarely in acute mania, active melancholia, chronic epilepsy or terminal dementia. It is usually unilateral, if both ears are attacked there is generally an interval, extending from a few days to months or even years. Hematoma auris occurs occasionally among the sane, and is then always the result of injury. (See GENERAL PARALYSIS OF THE INSANE.)

Treatment.—In the chronic form a natural cure generally occurs. This may be hastened by the application of acetum cantharides, or liquor epispasticus. In the acute form the early use of strong lead lotion, or some blistering fluid, often gives a satisfactory result. Early blistering is the best treatment. The blistering agent may be applied to the cranial aspect of the pinna. If incision be preferred, it should be done early, and the ear should be strapped to the head. Considerable deformity is the usual result of this affection.

GEORGE REVINGTON.

HÆMATIDROSIS (or “**Bloody Sweat**”), an affection of rare occurrence. It is a hemorrhage on the surface of the skin in parts where the cuticle is thin and delicate, and it is produced by rupture of capillaries in the plexus round the mouths of the sweat ducts.

HÆMATOMETRA.—Retention of blood in the uterine cavity from occlusion of the cervical canal. It is rare as a congenital condition; usual causes are cicatrization after injuries in parturition, sloughing, ulceration, or cauterization.

Treatment.—Let out the retained blood by an incision through the occluded part, and keep the canal patent by a stem until the incision has healed (see AMENORRHŒA).

Unilateral hæmatometra presents greater difficulty in diagnosis. This term implies that there is retention of blood in one-half of a double uterus. The patient may menstruate regularly from the other half, and therefore the guidance given by the symptoms of amenorrhœa is wanting, but dysmenorrhea is usually present. The tumor is formed during menstrual life. It is tense, may fluctuate, and is situated at the side of and close to the uterine canal, which is permeable, and which it displaces to the opposite side. It is distinguished from an ovarian tumor by its close adherence to the uterus and its situation low down in the pelvis. The natural cure of unilateral hæmatometra by spontaneous opening and discharge of the retained blood is more common than the same occurrence in the ordinary form of hæmatometra. It may also rupture into the peritoneum, or the retained blood may distend the whole tube and escape from it into the peritoneal cavity either by rupture of the tube or through its natural opening. In either case peritonitis is the result.

Treatment.—Make an opening with the knife, antiseptic precautions being observed, and keep it open with a glass stem until the margins of the opening have healed. The presence of unilateral hæmatometra does not prevent pregnancy in the naturally developed half of the uterus. It is often associated with absence of the kidney on the malformed side. In rare cases there may be *retention of blood in an imperfectly developed uterine cornu*, the cavity containing blood being only connected with the cervix uteri by a band of fibro-muscular tissue. It would be scarcely possible to distinguish such a tumor from an enlarged ovary or a dilated tube. The best treatment would be to remove it by abdominal section.

G. E. HERMAN.

HÆMATOTHORAX.—Hemorrhage may take place into the pleural cavity: (1) In simple and tubercular pleurisy the fluid occasionally contains blood which has escaped from the newly formed

capillary vessels. Bloodstained effusions may also occur in cases of serous effusion in the subjects of scurvy or purpura. (2) Active hemorrhage may be produced mechanically by direct injury, involving any of the vessels of the lung or chest wall, or of the diaphragm. The rough end of a fractured rib, or a direct stab, or an incautious incision in the operation of thoracentesis may all produce bleeding of this kind. (3) The rupture of an aneurism of the aorta may fill the pleura with blood. (4) Bleeding may take place from the surface of cancerous or other growths affecting the pleura, or from disintegrating tubercular deposit leading to ulceration.

Treatment.—In cases of acute pleurisy the diagnosis will be made when the fluid is being withdrawn, and the treatment of the case will be determined by other considerations. If there be reason to suspect the presence of a malignant growth, it is generally best to leave the case alone. For the treatment of hæmatothorax the result of injury or incised wound, see CHEST.

HÆMATURIA.—A condition in which blood is mixed with the urine. The discovery of red corpuscles is considered a sufficient proof of its existence. When only the coloring matter of the blood is found in the urine, the term hemoglobinuria (*q. v.*) or hematinuria is used to designate the condition.

Characters.—The color varies within wide limits. It depends upon the relative proportions of the blood and urine, on the completeness of the admixture, and on the chemical changes effected thereby. When the blood is derived from the kidney, the intermixing is complete, and the color of the resulting fluid is sometimes that of pure blood, but more often a dingy smoky tint prevails, and a red, brownish, or beef-tea colored sediment is deposited. Every gradation between these types may be found. Blood casts are often present.

When the bladder or the urethra is the source of the blood, it is less intimately mixed with the urine, and retains more of its characteristic appearances. In the former case, the proportion of blood distinctly increases toward the end of micturition. In the latter, it is expelled at the outset and often at the end, as well as—in some cases—in the

intervals between the successive repetitions of the act. In both it is frequently clotted. Flat clots come from the bladder; long cylindrical clots in most cases from the ureter. Profuse hemorrhage is generally due either to tumors or to calculi.

Tests.—The most satisfactory and easily applied test is the *microscope*. The red blood disks are easily recognized, though they but rarely retain their normal bi-concave shape. In urine of low specific gravity they become globular, but crescentic or crenated when the specific gravity is high. They are so pale that their color fails to characterize them. The only objects likely to be mistaken for them are pus corpuscles, which are larger, granular, and easily clarified by acetic acid (*see* PYURIA); vegetable sporules (*e. g.*, *torulæ*), which, if not oval and nucleated, have a more highly refracting margin; broken dumb-bell crystals of oxalate of lime, which may generally be identified by the presence of neighboring uninjured crystals, or the remains of a piece of the connecting bar still adherent to the fragment; and finally the nuclei of renal epithelium. These are recognized, as in the previous case, by fragments of the cell adhering to the nucleus, by the presence in the same specimen of properly formed cells, and by the readiness with which they absorb logwood or methyl aniline staining fluids.

The remaining tests only show the presence of blood-coloring matter, and are therefore equally characteristic of hemoglobinuria.

(1) Almen's, or the *guaiacum test*. The reagents needed are the freshly prepared pharmacopœial tincture of guaiacum, and a 15 per cent. solution of peroxide of hydrogen in ether. The solution is known as "ozonic ether," and, kept in a properly stoppered bottle, will last some years. Two or three drops of the tincture of guaiacum are added to about a dram of urine, and the fluid shaken; about twenty drops of ether are then poured upon the top of the mixture. If blood be present, a blue color appears at the junction of the fluids. This reaction is given by saliva, iodide of potassium, and some other substances when treated in a similar manner, and is, therefore, taken by itself, untrustworthy.

(2) *Heller's test* is obtained by boiling urine previously rendered alkaline by liquor potassæ. It consists in the production of a reddish-brown precipitate made up of phosphates and blood-coloring matter.

Causation.—The varieties of hematuria are classified according to the part of the urinary tract whence the blood is derived.

1. **Renal**.—(1) In *congestion* due to a chill or one of the acute fevers the amount is small, the urine slightly smoky, while blood casts and other microscopic evidences of the condition are present, Cantharides, turpentine, cubebs, copaiba, potassic nitrate, quinine, and carbolic and hydrochloric acids, in toxic doses, may give rise to hematuria. Their irritating effect is transitory, and is chiefly exerted upon the upper part of the urinary tract. A small amount of blood may also occur in the albuminuria of pregnancy. (2) *Inflammation*.—In acute Bright's disease the amount is variable. Blood casts are generally numerous. In suppurative nephritis and acute pyelitis the amount is small. (3) *Tumor*.—Here the hemorrhage may be profuse; it frequently depends on some slight injury, and is irregular, both in the duration of the attacks and in the length of the intervening periods. Sometimes clots are formed, in which case renal colic may result. In other cases, especially when the cortex is involved, blood casts may be found. (4) *Tubercle*.—When the disease is primary there may be sufficient blood to tinge the urine, but its presence is often first ascertained during the microscopic examination of the deposit, when thready blood clots and pelvic epithelium may be discovered. (5) *Renal embolism*.—The quantity is small, the onset and disappearance are sudden, and the duration of the attack is brief. (6) *Calculi*.—Large amounts appear at intervals, especially after trivial injuries, while much smaller quantities, with pus cells, epithelium, and various crystals, are often almost constant. (7) *Parasites*.—In hydatid disease the urine may be tinged with blood. (8) *Cystic disease*.—Blood is but rarely found. According to Ebstein, however, its appearance is frequent and intermittent. (9) In hematuria of *traumatic* origin suppression of urine often accompanies the condition.

2. **Bladder and Prostate**.—Hematuria may be due to (1) *congestion*, (2) *inflammation*, or (3) the presence of a *simple or malignant tumor*. In the latter case the bleeding is generally profuse, and its occurrence intermittent. (4) *Tubercular disease* only occasions hemorrhage when ulceration is present. (5) *Calculus*. (6) *Parasites*. Hematuria due to the bilharzia hematopium is mainly of vesical origin. The spiked ova may be found in the blood and mucus passed at the end of micturition. (7) *Ruptured varicose veins*, sometimes known as vesical hemorrhoids.

3. **Urethra**.—The chief causes of urethral hemorrhage are—(1) *inflammation* and *ulceration* as in gonorrhea; (2) *injury*; and (3) the lodgment of a calculus.

4. **General Diseases**.—(1) *Hemorrhagic diseases*—*e.g.*, purpura, scurvy, hemophilia, leucocythæmia, and pernicious anæmia. In these cases, excepting the last, the blood is generally derived from the pelvis of the kidney or the bladder. Hematuria is of rare occurrence in pernicious anæmia, and its cause is doubtful. (2) *Acute specific diseases*, *e.g.*, cholera, yellow fever, remittent and intermittent fevers, and the malignant forms of the exanthemata. (3) A few cases have been described in which asthma, extreme mental emotion, and vicarious menstruation, have been the *assigned* causes.

(5) The possible admixture of blood with the urine after it has left the urethra may occur during menstruation, or in the presence of any vaginal or uterine discharge containing blood. In these cases there is rarely intimate mixing, and normal urine can be withdrawn by the catheter. Suspected malingerers should be made to pass water under observation.

Occasionally, no cause for the hematuria can be made out.

Diagnosis.—The principal facts to be determined in any given case are: (1) the color and the microscopic appearances of the urine; (2) the constancy of the morbid condition; and (3) the degree of admixture.

Prognosis.—Depends upon cause. Good in those rare cases in which no cause can be made out.

Treatment.—Varies with the cause. Where no diagnosis can be made, the

therapeutic measures common to all conditions producing it are—first, absolute rest in bed, and, secondly, relief of the bowels. Cold and astringents are generally recommended, but only when acute inflammatory conditions can be excluded. The cold should be continuous, and should be applied as closely as possible to the supposed source of hemorrhage. Astringents may be given by the mouth, or may be injected into the bladder. In the first case, gallic acid, ergot, acetate of lead, perchloride of iron, and turpentine have been administered; for the purpose of injection, alum ($\frac{1}{2}$ dram to a pint of cold water) is employed.

H. MONTAGUE MURRAY.

Symptomatic Indications.—*Hamamelis* is often useful, especially when the hemorrhage is apparently venous. *Gallic acid*, one-tenth grain dose, is useful for hemorrhage from the kidneys, after scarlet fever, in Bright's disease and after injuries. *Bel-ladonna* may be useful in congestion of the kidneys after cold, scarlet fever. Turpentine, in one-tenth minim doses, is valuable in passive hemorrhages, with debility. *Chimaphilla*, in severe hematuria, does good service.

HÆMOGLOBINOMETER.—It is important in many blood diseases to know, not merely the amount of red corpuscles, but the quantity of coloring matter they contain. For anæmia depends primarily on a deficiency in this constituent, and there are conditions—*e. g.*, chlorosis—where the corpuscular richness may not be much, if at all, below the average, while the richness in hemoglobin may be considerably less than normal.

The simplest instrument for clinical use is the one invented by Dr. Gowers. It is intended to give an approximate estimate of the percentage of hemoglobin in the blood, based on the comparison of a specimen of diluted blood with a standard mixture of the tint of the same amount of blood diluted with 100 times its volume of distilled water. It consists of two small tubes of the same caliber—one contains the standard (a mixture of glycerin jelly and picro-carmin in such proportion as to give the tint of 20 c.mm. of blood diluted 100 times—*i. e.*, in 2 c.c. of water), the other is graduated in equal parts of 100 divisions in 2 centimeters (100 times 20 c.mm.). Blood to the amount of 20 c.mm. drawn from the

finger is received into a fine tube. It is then transferred to the graduated tube, and distilled water is dropped in and thoroughly mixed with the blood by shaking the tube. The color of the mixture is from time to time compared with the tint of the standard in the other tube, and, when the two approximate, no more water is added. Supposing the standard tint be attained after water has been added to the level of 65 on the graduated tube, then the percentage of hemoglobin would be 65.

SIDNEY COUPLAND.

HÆMOGLOBINURIA (*Hæmatinuria*).—Urine containing blood-coloring matter in a form apart from red blood disks.

Characters.—The urine may be clear or turbid, and may vary in color from a pale pink to a reddish black. Usually it is dark red, and is stated by the patient to resemble porter or the sediment of beef-tea. On standing, it deposits a still darker sediment, which, under the microscope, is found to consist of dark amorphous granules, with renal casts, apparently composed of similar material. A few red corpuscles may be recognizable. Crystals of hemin and of oxalate of lime, as well as hyaline casts, are occasionally present. In rare instances the coloring matter takes the form of disks of various sizes. The coagulated albumin is dark, and often not in larger quantity than may be due to the proteid contained in the red blood disks. Occasionally it is more plentiful, and occasionally, also, it seems, when coagulated, to show a peculiar tendency to float on the surface of the urine. The specific gravity is generally high, the reaction acid, and the urea liable to considerable variation above or below the normal standard.

Tests.—With the exception of the different microscopic appearances, these correspond to those given under HÆMATURIA.

Classification.—(a) Characterized by recurring periodic attacks, is known as "paroxysmal" or "intermittent" hemoglobinuria. (b) Certain toxic conditions and certain febrile states in which hemoglobinuria forms an occasional but prominent symptom.

(1) **Paroxysmal Hemoglobinuria.**—The immediate antecedent to an attack is usually exposure to cold in a severe, or it

may be, a mild form. In some cases it occurs only in the morning; in others, only in the winter. Exhaustion and malaria are also causes.

Symptoms.—The onset is marked by a sensation of cold, shivering, and lumbar pain, which is sometimes intense, extending down the thighs, and accompanied by retraction of the testicles. The extremities become blue and cold, and the temperature rises from two to five degrees. About this time, or during the heat and sweating that follow, the urine is found to be discolored, and the proportion of corpuscles in the blood to have fallen from 2 to 15 per cent. The hemoglobinuria may persist some hours after the other symptoms have disappeared. Its onset and cessation are quite sudden, and the attack is over in less than twenty-four hours after the first symptom. The destroyed corpuscles are replaced in a few days. Fever of a malarial type is sometimes present, and a yellowish discoloration of the skin, with or without purpuric spots, has been observed.

Pathology.—In some cases it has been found that the disintegration of corpuscles observed in the urine exists simultaneously in the blood removed by cupping or by puncture, and that the change can be artificially produced in those liable to the condition either by cold or by local interference with the circulation. It would therefore appear that the disease is one of unduly rapid and incomplete blood-metabolism, the breaking up of the blood disks occurring in the cyanosed parts. It is uncertain whether the kidneys merely fulfill their ordinary excretory function, or whether, in addition, their vessels are liable to a vasomotor spasm similar to that affecting the extremities. The association between this condition and Raynaud's disease is so close that many regard them as complementary manifestations of a common process (*see* RAYNAUD'S DISEASE). Closely allied is pernicious anæmia, in which the hemolytic action is also increased, and and therefore also the urea and urinary pigment.

(2) **Toxic Hemoglobinuria.** — This condition occurs as an occasional symptom of poisoning by any of the following substances: Chlorate of potassium (the most frequent); carbolic, hydrochloric, sulphuric, and pyrogallic acids; carbon dioxide; arseniuretted and phosphuretted hydrogen; nitro-benzine; naphthol;

mushrooms; also in the following febrile states: Typhoid fever, scarlatina, septicæmia, and pyæmia. It has been recorded as occurring in an epidemic form among infants; and may appear in cases of burns, fat embolism, purpura, scurvy, and after transfusion of blood from animals of a different species.

Rigors, vomiting, and diarrhea; these are often followed by cyanosis and fatal collapse.

Diagnosis.—If the urine be examined, no mistake is possible. The pain may simulate renal colic, but is bilateral.

Prognosis.—In the first group there is no immediate danger. The occurrence of attacks can generally be prevented by a careful avoidance of the ascertained cause. The cases falling under "toxic" are almost invariably fatal.

Pathology.—The kidneys in many cases are of a deep chocolate color, with radiating striæ of a still deeper tint. The tubules contain hemoglobin. The assumed explanation is a destructive metabolism of the blood.

Treatment.—In the paroxysmal form the diet should consist of hot soups, the clothing should be woolen, and quinine should be administered in large doses. The drug is most efficacious in the cases which most closely resemble ague. During the attack warmth is practically the only remedy. During the intervals protection from all forms of exposure is essential, but especial attention should be paid to the particular cause in each case, as, if this can be avoided, the attacks may often be altogether averted. The patient should, if possible, reside in a warm climate. H. MONTAGUE MURRAY.

See HÆMATURIA.

HÆMOPHILIA, or the "hemorrhagic diathesis," is applied to that condition of the body in which there is a great tendency to hemorrhage, traumatic or spontaneous, and often great difficulty in its arrest.

In the subjects of this remarkable tendency comparatively slight injuries may be followed by serious and even fatal consequences. A slight blow on the surface of the body may produce a large hematoma, or the extraction of a tooth be followed by uncontrollable hemorrhage. There is a marked tendency to articular affections, which may take the form of a simple serous effusion resembling rheu-

matic synovitis, or a hemorrhagic effusion, which may be spontaneous, or follow some trifling injury. The effusion, when serous in character, is sometimes excessive in amount. The knee is the joint most commonly affected. Many cases prove fatal from traumatic hemorrhage, but in others spontaneous bleeding occurs from the bowels or stomach, or into the brain, and causes death.

The subjects of hemophilia seldom attain adult life. The fatal tendency usually cuts them off in childhood. But it is said that the tendency to bleed is less marked as age advances.

Pathology according to Sir W. Jenner: "(1) The tissues are all soft so that they bruise easily. (2) The blood is slow in coagulating, but its coagulum, when formed, is as firm as in health. (3) Blood is formed rapidly; there is a tendency to plethora of the smaller vessels, and injuries have the worst effect, and spontaneous hemorrhages are most likely to arise when the patient is looking his best."

Kidd has found changes in the smaller vessels, especially the veins (endothelial proliferation and defective formation of the adventitia), and it is probable that the cause of the bleeding depends upon such changes in the vessel walls together with the plethoric state.

Ætiology.—The tendency first shows in early childhood, particularly at the period of the second dentition. Although preponderating among males, females are not exempt, and beyond puberty are exposed to the additional risk of menorrhagia, and of flooding after delivery. It is also notable for the manner in which it is transmitted by heredity. Rarely met with in females, it is conveyed through the female line. Thus in a family the sons, or some of them, may be affected and if any survive and marry, their children may wholly escape; but the male children of the daughters are very likely to be bleeders.

Treatment.—The prophylactic treatment of hemophilia rests in the pursuit of a regular life, avoidance of excitement and of excess. "Every month or oftener a mercurial, followed by sulphate of soda, should be administered, in order to control the tendency to plethora. The saline should also be given once every week, and both should be repeated at any time when the patient appears to be fuller of

blood than normal. The diet rather dry, with a considerable proportion of white meat, and plenty of open-air exercise be taken. The greatest care should be observed in order to avoid mechanical injuries." For the arrest of external hemorrhage, strong styptics must be used, the perchloride of iron being the best. The same drug may also be employed in enemata to control rectal bleeding. Ice-bags may be applied to the joints when there is effusion into the synovial cavity. Pressure must be used to arrest the bleeding from cuts; often, however, in spite of every care, the hemorrhage cannot be checked.

SIDNEY COUPLAND.

Symptomatic Indications.—*Phosphorus* is the principal remedy in the hemorrhagic diathesis.

HÆMOPTYSIS.—Expectoration of blood may be the result of many different causes, but the term is usually confined to cases in which the hemorrhage takes place from some part of the respiratory tract. Aneurisms of the aorta perforating the lung or large air tubes, and bleeding from the cavity of the mouth or nasopharynx, may give rise to the same symptom, and may thus simulate true hemoptysis.

Pathology.—If we exclude the slight hemorrhage which is occasionally seen in connection with hemophilia, scurvy, purpura, and certain infectious diseases, in which diapedesis of red corpuscles occurs without gross vascular lesion, it may be said that hemoptysis is invariably a consequence of the rupture of blood vessels, and in most cases this depends on morbid conditions of the lungs.

Pulmonary hemorrhage may be the result of simple congestion, or structural lesions of the blood vessels of the lung.

Hyperæmia and rupture of capillaries will account for slight hemoptysis, and is probably the explanation of many of the minor hemorrhages met with in phthisis, as well as in bronchitis, emphysema, certain cases of pneumonia, pulmonary embolism, hydatid of the lung, mediastinal tumors of various kinds, cardiac disease, cases of high arterial (aortic) tension, alcoholism, and perhaps in vicarious menstruation.

The more profuse attacks of hemoptysis are usually the result of perforation of some large vessel. This may be

brought about in three different ways. In the first, branches of the pulmonary artery and veins become weakened in consequence of the development of a tuberculous growth in their walls. This leads to thrombosis and occlusion of the vessel; but softening and rupture of the vascular wall may also ensue.

The same result may occur in non-tuberculous cases, where the pulmonary artery has undergone atheromatous degeneration.

In a second and commoner form, ulcerative softening of tubercular masses extends to large vessels, and gives rise to extensive hemorrhage. Progressive excavation and gangrenous processes may occasion hemoptysis in a similar manner in non-tuberculous affections.

A third and far more important vascular lesion consists in the development of aneurisms of branches of the pulmonary artery situated in the walls of cavities. The pathology is as follows: The formation of a vomica in the lung, involving a loss of the support of the vessels lying on the floor of the cavity, leads to a weakening of their walls on the exposed side. As the result of this change, aided, probably, by the development of a secondary arteritis, an artery gradually dilates to form a lateral expansion or aneurism. In the ordinary form, the bulging affects only one side of the vessel; but, occasionally, an artery crossing a cavity becomes uniformly expanded, constituting a fusiform aneurism. In size, these aneurisms may vary from a pin's head to a plum, though, as a rule, they are not larger than a cherry.

Usually, a single aneurism is found, but it is common to meet with three, and as many as twenty-two have been found in one lung. Aneurisms are rarely found except in chronic cavities, the vessels becoming more rapidly obliterated when excavation is acute, though exceptions to this rule are not wanting. In a few instances aneurisms of the pulmonary artery have been seen bulging into dilated or ulcerated bronchial tubes. With these exceptions excavation of the lung is an indispensable condition for the development of pulmonary aneurisms, the nature of the disease on which the cavity depends being immaterial.

Aneurisms may undergo thrombosis and become occluded, or they may rupture and give rise to hemorrhage. It is not unusual to find aneurisms completely

thrombosed, or still patent without any evidence of rupture having occurred. In such cases there is generally considerable thickening of the dilated vascular wall, but where rupture has occurred, thickening, as a rule, is only slight.

Evidence of rupture and subsequent repair is by no means rarely obtained in cases where hemoptysis has ceased some time before death.

On examining the bodies of persons who have died of hemoptysis, we find blood in the air passages and pulmonary cavities, and frequently in the stomach also. The lungs are studded with numerous dark-red patches, consisting of blood inhaled into the terminal bronchi and pulmonary lobules. In eighty fatal cases, ruptured aneurism of the pulmonary artery was found in seventy.

It is probable that profuse hemoptysis, which does not prove fatal, is, in most cases, the result of pulmonary aneurism, and in a smaller number of instances is due to erosion of a large vessel. The pyrexia which sometimes appears a few days after an attack of hemoptysis is accounted for by the insufflation of infective cavity secretions, together with the effused blood, into distant parts of the lung, giving rise to the development of specific bronchopneumonic lesions.

Death may, in rare cases, be due to syncope; but, as a rule, the amount of blood lost is insufficient to account for the fatal termination, which is really suffocative, and depends on the wide-spread obstruction of the smaller bronchi and air vesicles, caused by the inhaled blood.

Capillary hemorrhages from the bronchi, trachea, and larynx are not uncommon, but profuse hemoptysis, depending on affections of these parts, is one of the rarest occurrences, and is more likely to result from cancerous or syphilitic ulceration than from tuberculous disease. Direct injury to the lung may be mentioned as an occasional cause.

Symptomatology.—Occasionally it is preceded by signs of excitement of the circulation, but, as a rule, the attack is quite sudden, and frequently at night. Exertion and mental agitation appear to precipitate the hemorrhage in a few instances; but often no exciting cause is found. The quantity of blood expectorated may be small, or as much as two pints may be lost within a short time. The blood is generally bright red, and

frothy, and often mixed with sputum. Occasionally it is dark and venous in appearance in cases of profuse hemorrhage from the pulmonary artery. When bleeding has been going on slowly for some time, the blood collects in pulmonary cavities, and acquires a blackish red or chocolate color. Clots are often expectorated, especially as the attack is passing off. The sputum usually remains blood-stained for some days after active bleeding has ceased. A recurrence of hemorrhage after apparent cure is by no means uncommon. During an attack of hemoptysis the patient almost always exhibits great apprehension, and feels weak and faint. The face is pale, the extremities cold, the pulse small and feeble, and blood is brought up at intervals, with a frequent short cough. At times, blood coming from the lung is swallowed and subsequently vomited. The temperature is lowered while the hemorrhage lasts, but soon regains its former level, and in some cases a marked rise occurs within the next two to five days. Patients are usually much debilitated and depressed after a fit of hemoptysis, a result which is attributable to the mental shock produced by the attack, rather than to the amount of blood lost.

Diagnosis.—During the attack presents little difficulty. The expectoration of bright frothy blood, and the short frequent cough point to the respiratory organs. In hematemesis the blood is dark and grumous, and often mixed with the contents of the stomach, which give it an acid reaction. It is vomited, not coughed up, and, as a rule, a large quantity is voided at a time, and successive attacks do not occur. In both forms of hemorrhage blood may be vomited and passed by the bowel, that in hemoptysis the blood having been swallowed during the attack. As long as hemoptysis continues, and for some little time afterward, it is better to abstain from physical examination of the chest altogether.

Excluding cases where the disease is advanced, not much information is obtained from superficial examination of the lungs, owing to the presence of blood in the bronchial tubes, and we not unfrequently fail to discover any definite signs of pulmonary disease on making the most careful examination of persons who have recently had profuse hemoptysis. This is especially the case where hemoptysis is

the first tangible symptom, the so-called "phthisis ab hæmoptoe." The explanation is probably to be found in the existence of circumscribed deeply seated tubercular masses, or even small cavities, surrounded by spongy lung tissue, which masks their presence altogether.

The diagnosis, so obvious when the attack is witnessed, is not always easy when the patient is seen for the first time, a week or more after the hemorrhage has occurred. Careful inquiries should then be directed to the following points: the nature of the attack, character of the blood, subsequent staining of the sputum, presence or absence of pulmonary symptoms. In most instances the information thus obtained, when combined with a careful examination of the chest, will suffice to settle the question. But in cases with a doubtful history, in which physical exploration gives a negative result, and pulmonary symptoms are absent or slight, it may be impossible to determine the origin of the hemorrhage, especially when the amount of blood lost is small (*see* HEMATEMESIS).

If the patient be liable to epistaxis, or bleeding from the gums, the difficulty is greater. In cases of this description the general condition of the patient, the presence or absence of pyrexia and wasting, the family history, and the examination of the sputum for tubercle bacilli may supply useful information.

When there is reason to suspect that hemoptysis is false or spurious, the nasopharynx and cavity of the mouth must be carefully inspected, as blood escaping from these parts, especially during sleep, is liable to trickle into the larynx and trachea. Anæmic girls often complain of their mouths being "full of blood" in the morning; others say that they find blood on their pillow on waking. This sometimes appears to be due to oozing from spongy gums, but in other cases the "blood" found on the mouth proves to be simply a brownish deposit on the teeth and gums, representing secretions that have become dried in consequence of the habit such patients often have of sleeping with the mouth open.

In persons with a history of syphilis in whom the absence of morbid physical signs and of constitutional symptoms seem to preclude the idea of pulmonary disease, the possibility of syphilitic ulceration of the larynx, trachea, or bronchi

should be kept in mind, and careful examination made with the laryngoscope.

Prognosis depends upon the severity of the hemorrhage, also upon the extent of the pulmonary lesion. If the hemoptysis appears to be due to early phthisis, the patient may be expected to recover from the attack, as death in such circumstances is uncommon. But where confirmed pulmonary disease is present, the possible existence of an aneurism renders an accurate prognosis impossible, and a guarded opinion should be expressed. Profuse hemoptysis is practically the result of some disease of the lung, and, with rare exceptions, that disease is tuberculous.

Treatment.—It is important to remember that pulmonary hemorrhage is the result of two main conditions—hyperæmia and perforation of vessels. In the first, the bleeding is seldom profuse, and tends to relieve the morbid state on which it depends. In the second and more important class, in which life may be directly endangered, the blood comes from vessels, often of considerable size, which have invariably undergone structural changes. The natural method of cure in these cases consists in the formation of a thrombus, sealing up the rent in the artery, or obliterating its lumen. It is evident, therefore, that reduction of blood-pressure and slowing of the circulation in the pulmonary artery—conditions which favor the establishment of thrombosis—are the principal objects to be aimed at.

The faintness produced by copious hemorrhage in itself contributes to this end, owing to the depression of the heart's action which accompanies it, and is consequently to be encouraged.

In every case, whether profuse or slight, complete rest is of the first importance. The patient must be kept in bed in a cool, airy room, and should avoid talking and movement of any kind. Iced milk may be given in small quantities, but no other form of food, and stimulants should be expressly forbidden. Cough may often be relieved by the continuous sucking of small pieces of ice. When case is slight, no further treatment is required. In serious hemorrhage, these measures must be supplemented by the administration of suitable drugs. In the selection of these we are met by many difficulties, owing to the fact that remedies like digitalis,

which slow the circulation, at the same time raise the blood-pressure. On the other hand, some of the most powerful depressors of arterial tension, *e. g.*, nitrite of amyl and nitroglycerin, cause excitement of the heart's action.

Saline purgatives, which cause determination of blood to the intestine, and thereby lower the blood-pressure, are free from the above objections, and are often of service, though their action is slow.

The cough which is excited by the presence of blood in the bronchi is a great source of danger, in consequence of its disturbing effect on the lung. If the sucking of ice fail to give relief, opium is called for. This drug not only gives local rest to the ruptured pulmonary vessels, but it also quiets the restlessness of the patient, and also possesses hemostatic properties. At the same time, death from hemoptysis being more often due to asphyxia than to loss of blood, the sedative influence of opium on the respiration may sometimes be injurious.

The hemostatic action of oil of turpentine and tartar emetic are probably to be attributed to their depressing action on the heart.

Ipecacuanha in nauseating doses induces faintness, and seems to act in a similar manner to turpentine; but its tendency to occasion vomiting constitutes an objection to its use.

Styptic medicines, such as gallic acid, lead, and ergot, which are supposed to arrest hemorrhage by causing vascular contraction, are more generally used than any other remedies at present.

It is difficult to believe that vaso-constrictive drugs can be of service in profuse hemoptysis depending on perforation of vessels, seeing that in these cases the contractility of the muscular coat must be either abolished or seriously impaired. On the other hand, the rise of blood-pressure entailed by arterial contraction, and the constipation which is produced by astringents, must be regarded as undesirable results.

The action of ergot is as uncertain and unsatisfactory as that of other styptics. Inasmuch as tangible objections exist to the use of styptics, it seems preferable to lower the blood-pressure by rest, low diet, and saline purgatives, combined, if necessary, with opium. A mixture containing sulphate of magnesia 60 grains, with sulphate of soda 20 grains, may be given

every four hours till looseness of the bowels is produced, the same remedy being continued for a few days in less frequent doses, so as to maintain a watery flow from the intestine.

If cough or restlessness be troublesome, morphine in small repeated doses should be administered by the mouth; or, better still, $\frac{1}{2}$ grain of the drug may be injected under the skin. Turpentine is sometimes useful, $\frac{1}{2}$ dram of the oil being followed by a few doses of 20 minims at intervals of two or three hours. Tartar emetic in doses of about $\frac{1}{6}$ grain is recommended.

If styptics be preferred, the following are commonly used: Ergot, in the form of the liquid extract, 1 to 3 drams, followed by 20 minims every half-hour or hour for a few doses; or ergotin, 1 to 2 grains hypodermically; gallic acid, 20 grains every hour or two; acetate of lead, 3 grains every three hours; sulphuric acid, 30 minims, in combination with alum, 20 grains, every three or four hours.

The constipation commonly produced by astringents must be obviated by the use of purgatives. Counter-irritation to the chest wall may be employed as an adjunct to other measures.

Great care is needed in the resumption of exercise, ordinary diet, and stimulants, owing to the tendency of hemorrhage to return. The patient should be confined to bed, on a spare diet, as long as blood is expectorated.

In cases of false hemoptysis dependent upon oozing from the gums or upon nasopharyngeal hemorrhage, local astringent applications should be combined with the treatment of anæmia or other disorder of the general health.

PERCY KIDD.

Symptomatic Indications.—*Hamamelis* is a reliable remedy, almost specific when the flow is passive, from venous hemorrhage; blood black. *Ipecacuanha* holds first place for active hemorrhage, with sensation of bubbling in the chest; tickling cough. *Ferrum acetate* is a valuable remedy when the hemorrhage is of laryngeal or tracheal origin, with frequent tickling cough. *Digitalis* is useful when the hemorrhage is due to mechanical embarrassment of the circulation. *Arnica* is valuable when the hemorrhage results from injury or from heart difficulties, particularly when the blood is abundant,

blackish with clots, with sadness. *Aconite* is useful in sthenic cases, with discharge of red, frothy blood, incessant cough, anxiety, red face. *Phosphorus* is the principal reliance when hemoptysis occurs in connection with fevers, or with the hemorrhagic diathesis.

HÆMORRHAGE.—Is classified: *a.* According to source, into 1, arterial; 2, venous; 3, capillary; and 4, parenchymatous. The latter is a term applied to hemorrhage from the tissues full of small arteries and veins, *e. g.*, the penis and the tongue. *b.* According to the time of occurrence into 1, primary (at time of wound); 2, intermediate or recurrent (within a few hours); 3, secondary (a few days after wound). *c.* Into 1, traumatic; 2, spontaneous (*see* HEMOPHILIA). Arterial hemorrhage contrasted with venous hemorrhage: Arterial is florid, and spurts in jets; venous is dark, and either does not spurt rhythmically at all, or does so only in relation with the acts of respiration. Arterial, however, is dark when respiration is interfered with, and venous is florid sometimes, when it wells up from a deep wound, and is thus exposed to the air before becoming visible.

Natural Checks to Hemorrhage.—Arterial hemorrhage is stopped naturally by 1, active contraction of vessel; 2, passive contraction, consequent on decrease of total quantity of blood in system; 3, weakening of heart caused by loss of blood; 4, obstruction of vessel by clot. The first three are, one or other, more or less accessory to the operation of the fourth cause. Venous hemorrhage is stopped partly by causes similar to those which check arterial hemorrhage, and partly by the action of the valves in the veins. Capillary hemorrhage is stopped by the contraction of the connective or other tissues in which the vessels are embedded, and by coagulation. Hence, when these tissues are diseased, capillary and also parenchymatous hemorrhage may be very troublesome.

Pathology.—Natural changes in and around a wounded vessel. *a.* If a wound be partial and transverse, the wound gapes; bleeding is considerable, and has to be checked ultimately by clotting, which may not occur till syncope comes on and predisposes to it. *b.* Wound longitudinal. Wound does not tend to gape. Hemorrhage is, therefore, more

easily checked by coagulation and contraction. *c.* Wound completely divides artery. 1, The ends of the artery retract into the sheath, sometimes curling or twisting up; 2, the ends contract; 3, coagulation takes place within the artery; 4, coagulation occurs outside the artery, within and sometimes without the sheath; 5, organization of the clot or part of it; finally, cicatricial contraction occurs in the newly-organized tissue. Recurrent hemorrhages are caused by the returning force of the circulation, which, when a patient becomes warm in bed, may be enough to open a vessel not firmly closed.

General Symptoms.—1, Face first pale, then blue; 2, pulse sinks; 3, temperature sinks; 4, dizziness; 5, nausea or vomiting; 6, eyes dazzled; 7, noises in ears; 8, fainting and unconsciousness; 9, either the patient recovers or gets worse. In the latter event the following set of symptoms are noticed: 1, face waxy; 2, lips blue; 3, eyes dull; 4, body cold; 5, pulse thready, frequent; 6, breathing incomplete; 7, repeated swooning; 8, permanent unconsciousness; 9, twitching of arms and legs; then death.

Treatment.—Many cases require great decision, sound anatomical knowledge, and sanguine courage for their proper treatment. Classification of local remedies, seven chief classes, viz.: 1, ligature; 2, torsion; 3, acupressure; 4, compression; 5, flexion; 6, styptics; 7, position.

Ligature.—Divided into—1, ligature at the bleeding point, and 2, ligature of the artery above the wound, *i. e.*, ligature “in the continuity.” In case of a vessel being wounded, cut down to the wounded point, tie the vessel, immediately above and below the wound. But in some cases, such an operation would involve a deep and large incision, *e. g.*, in hemorrhage from upper part of posterior tibial artery; and in other cases the artery is diseased at the spot bleeding. In such cases the artery is often tied in the continuity. Materials used: silk, hemp, catgut.

Operation.—Instruments required are scalpel, forceps, retractors, director, artery forceps (occasionally, also, aneurism needle), tenaculum. In tying an artery at the spot wounded, a sufficiently free incision should be made (usually by enlarging the wound which leads down to the artery), and then each end of the

bleeding artery should be seized and ligatured, if the vessel has been divided completely. But if the vessel has been only punctured, two ligatures must be applied with the aneurism needle, one above and the other below the wound. Secure the ligature with a reef-knot, pulling each end of the knot tight with the tips of the forefingers pressed against it; unless catgut be used, one end of the ligature is left hanging out of the wound. To tie the artery in the continuity, see directions under ANEURISM.

Torsion.—Bryant's directions are: “The vessel should be drawn out, as in the application of the ligature, and three or more sharp rotations of the forceps made. In large arteries, such as the femoral, the rotation should be repeated till the sense of resistance has ceased; the ends should not be twisted off. In small arteries the number of rotations is of no importance, and their ends may be twisted off or not, as the surgeon prefers. When the vessels are atheromatous, or diseased, fewer rotations of the forceps are required, the inner tunics of the vessels being so brittle as to break up at once and incurve.” The effects of torsion practically resemble those of ligature, but the inner coats curl up more in the former case, sometimes forming a regular valve. Though torsion leaves no dead foreign body in the wound like a piece of ligature, yet the bruised end of a twisted artery is less likely to live and form adhesions than the less damaged end of a ligatured artery.

See ACUPRESSURE.

Compression.—There are several forms: 1, Tourniquet; 2, digital; 3, ordinary bandages, with or without graduated compress; 4, elastic bandaging. Chief kinds of tourniquet are Petit's and Signorini's; Petit's is most used for operations, and consists of a webbing band, with a pad, and a screw for tightening. It is usual to place a small compress, made of a small soft roll of bandage or of lint, over the artery to be compressed. Signorini's is used chiefly in the treatment of aneurism; it consists of two curved metal arms, with a screw hinge between the two, and a pad for the artery at the extremity of one. Lister's, for the abdominal aorta, is on the principle of Signorini's. In applying any tourniquet it is necessary to adjust it with great deliberation and care, otherwise the pad is liable

to slip off the artery. Digital compression is preferable in almost any case: 1, because of the liability of all instruments to slip out of place; 2, because the human finger is so delicate, tender, and elastic when compared with a rigid tourniquet or bandage. But it is difficult to obtain for this purpose, and expensive of time and labor. In some cases, *e. g.*, hemorrhage from internal carotid into pharynx, no other form of compression might be applicable. Digital is often supplemented by the compression of a small sand-bag, placed upon the finger, which sand-bag supplies the place of muscular force.

Bandaging.—In arterial hemorrhage from a limb, if an attempt be made to check it by the bandage and compress, the joints should be flexed and the whole limb bandaged. There is a form of compression called “plugging”; for instance, if a gluteal aneurism were opened freely in mistake for abscess, the proximal end of the artery would very likely be in the pelvis, and inaccessible; then the aneurism would have to be stuffed with lint and the pelvis bandaged, *pro tem.*, while further measures were considered or undertaken.

Flexion is closely allied to compression, and should almost always be combined with it. One objection to flexion is the disagreeably constrained position often unavoidable.

Styptics.—1, heat; 2, cold; 3, drugs, *e. g.*, iron, tannic acid, gallic acid, catechu, alum, matico, and many others.

Heat.—In hemorrhages from mucous membranes, for example, those called “parenchymatous,” hot water is more effectual than cold; so, also, in oozing from wounds. In major amputations it should be preferable because it is less depressing than cold. The actual cautery should be used at a black heat, and held close to, but not touching the bleeding part. It causes an eschar with a suppurating surface beneath. Cold is applied chiefly in the form of ice or iced water. The most powerful styptic drug is perchloride of iron. The strongest tincture is usually employed, and it is often made to saturate a compress. Thus styptics, pressure, and flexion can all be combined if desirable. Turpentine is a most effective but painful and heroic styptic. Remedies should be supplemented by elevation of the part, general rest, and avoidance of anything likely to excite the patient's cir-

culatation. For the faintness and weakness caused by hemorrhage, horizontal pressure, ammonia ether, and wine are recommended. The application of Esmarch's bandage to limb has been suggested, to drive more blood into the vital centers. See TRANSFUSION.

Secondary Hemorrhage.—Its causes are: 1, defect in the ligature itself; 2, defect in the manner of tying it; 3, the ligature's having been applied too near an offset of the artery, so that collateral circulation has prevented the formation of the usual fibrinous plug; 4, atheroma; 5, suppuration or sloughing of the wall of the artery, which suppuration or sloughing is sometimes the result of a contusion and sometimes of erysipelas; 6, vascular excitement. The approach of secondary hemorrhage is usually insidious, but it is frequently very sudden, and may be fatal even in a few minutes if the artery be large.

Treatment.—Never delay or temporize in these cases. Try first pressure, and if properly applied it will rarely fail. The mode of application must necessarily vary, only it should always be firm and uniform; the bandages, unless elastic, should be starched; the compresses over the bleeding point carefully graduated, and, if the bleeding artery be in a limb, the bandage should cover the whole of the limb. With pressure should be combined perfect rest, elevation, and flexion. To secure rest, splints are sometimes useful. For vascular excitement, give vascular sedatives, *e. g.*, tinct. digitalis. (See Treatment of Hemorrhage in general.) When these means fail, the choice lies between ligature of the bleeding vessel and the bleeding point, ligature of the artery in the continuity, digital pressure, and amputation of the limb. Some cases are adapted for the use of the actual cautery, of styptics, or of acupressure. Ligature of the artery in the continuity is to be deprecated, because it is liable to be followed by gangrene, and is, moreover, far from a certain remedy. Ligature at the bleeding point is often useless, because the tissues are there so diseased, or it is objectional because it would involve opening up a large stump nearly healed. Digital pressure is not always readily obtainable. Certain cases are suitable for amputation. The cases are secondary hemorrhage from the main arteries from the lower extremity, when pressure, rest,

elevation, flexion, and re-tying at the bleeding point have failed. In such cases, tying the main artery in the continuity is very liable to be followed by gangrene, and re-tying at the bleeding point is often impossible from the depth of the wound and the state of the tissues.

C. B. KEETLEY.

HÆMORRHAGE, POST-PARTUM. See POST-PARTUM HÆMORRHAGE, under LABOR.

HÆMORRHAGE, ACCIDENTAL, IN LABOR.—The result of partial detachment of the placenta from its normal situation, the source of bleeding being from the uterine sinuses. Arising from violent emotion, blows, jerks, straining, or accidental dislodgement during the progress of labor.

Symptoms.—Fainting, collapse, dull pain over the fundus uteri, partial cessation of pains, hemorrhage especially between the pains. A doughy feel of that portion of the uterus where the placenta is detached is noticeable, and is specially marked if the hemorrhage is concealed; pulse small and feeble.

Diagnosis.—From inertia uteri by the pain and the bleeding, and by the pains, if present, being still effectual.

Prognosis.—Unfavorable if concealed, if it have existed for some time before the hemorrhage becomes manifest, leading to the formation of a clot on the walls of the uterus which becomes adherent and difficult to remove, eventually becoming a source of septic mischief; favorable if discovered and treated early.

Treatment.—Rupture the membrane and hasten delivery; wash out the uterus daily with Cond's fluid and water, or iodine and water.

Symptomatic Indications.—*Ipecacuanha* is the most frequently required remedy, particularly when the hemorrhage is profuse, of bright red blood, with nausea, faintness. *Hamamelis*, when flow is passive, steady, slow, dark blood. *Belladonna*, profuse flow, bright red, hot blood, full bounding pulse. *Chamomilla*, dark blood, with intermittent gushes of bright red blood; cold extremities. *Cinnamon*, bright red flow; after exertion or strain. *Sabina*, dark red hemorrhage, with dark clots in thin watery blood—next in value to ipecacu-

anha. *Secale*, passive hemorrhages of dark, thin, fetid blood.

HÆMORRHAGE, UNAVOIDABLE IN LABOR.—See PLACENTA PRÆVIA.

HÆMORRHOIDS (Piles).—Enlargement and varicosity of the hemorrhoidal veins. When formed by dilatation of the veins which underlie the mucous membrane within the external sphincter ani muscle, they are termed *internal piles*; when formed external to that muscle, and therefore covered with integument, *external piles*. Hemorrhoids from which blood is discharged are spoken of as *bleeding*; and those which do not bleed as *blind*; when existing in a painless condition as *indolent*.

External Hemorrhoids, when in an active state, appear as softish, rounded tumors of the integument at the verge of the anus, livid in hue, and tender to the touch. When the congestion is increased, as by the passage of a costive motion, the pile becomes more swollen, tense, and tender. This congestion may subside, and the contained blood-clot—which is formed at an early stage of the process—may be gradually absorbed, so that the site of the pile becomes occupied by a flattened, more or less plicated, and almost insensitive, fold of hypertrophied integument. Or the congestion may run on into inflammation, with a corresponding increase in the size, redness, tension, and tenderness of the tumor; and this inflammatory condition may undergo remission, with subsequent recurrence from time to time, or may completely subside. Or an inflamed pile may suppurate, the little abscess bursting with a discharge of mingled blood and pus, and eventually healing with obliteration of the enlarged vessel and consequent cure of the local mischief.

Bleeding is quite exceptional in the case of external piles.

Internal Hemorrhoids often fail to attract attention until they have grown sufficiently long to protrude at the anus during defecation; appearing as one or more tumid swellings of the mucous membrane, which, if the piles be inactive and the sphincter relaxed, present as softish tumors with a granular surface. If congested, inflamed, or strangulated by the sphincter, they appear as dark

red, tense, smooth-surfaced protuberances, painful, and bleeding readily. Large internal piles of old standing often induce more or less eversion of the anal margin, and in such cases it is important not to mistake the encircling ring of everted skin for external piles, as its excision is apt to be followed by troublesome contraction of the anus.

Large internal piles which have protruded beyond the sphincter muscle are liable to become constricted and *strangled*; painful congestion and inflammation follow, which may result in gangrene and sloughing off of the external portion of the tumors thus affected. Sometimes internal piles are more sessile in character, existing mainly as flattened nævoid swellings of the mucous membrane, and rarely protruding beyond the anus.

Internal piles are prone to bleed, especially when to their congestion is added the local irritation caused by the passage of bulky and constipated motions. The amount of blood lost at stool may vary from a few drops to as much as several ounces; it may occur only at the time of defecation—and in this respect may be quite irregular, or may exhibit a marked tendency to periodical recurrence or to periodical increase. Sometimes the hemorrhage takes place within the bowel, independently of defecation. The blood lost is often dark and venous in character. The longer a pile exists in an active state, the more dilated do all the blood vessels within it and its immediate neighborhood become; and in such cases arterial hemorrhage, even to the forcible spouting of bright red blood, is both common and severe.

Both internal and external hemorrhoids may coexist in the same individual.

Symptoms.—*External Piles* are accompanied by a sensation of tenderness, heat and irritation at the anal margin. When congested or inflamed, the heat and pain proportionately increase, and render sitting uneasy or intolerable. At the same time there is more or less of the malaise and general irritability of temper or despondency usually experienced in connection with a congested state of the portal system.

Internal Piles, during the earlier stage, may be productive of no appreciable symptoms, or, at most, of some sense of fullness and uneasiness within the rectum, and occasional or persistent pain in the back.

The next stage is marked by the occasional loss of small quantities of blood during or after the passage of a constipated motion, and increased heat and irritation within the orifice of the bowel. Then the piles begin to protrude during defecation, but return within the sphincter on completion of the act. Later, they protrude at stool—and to a greater extent—and their return within the bowel needs to be assisted with the fingers; they also bleed more readily and to a larger amount.

Finally, the mucous membrane becomes more hypertrophied, the sphincter muscle more relaxed, the anus everted, sore, and inflamed, and the piles protrude whenever the patient assumes the erect, or even the sitting, posture: while abrasion and irritation of the everted tissues induce a constant muco-purulent and sanguinolent discharge which stains the patient's linen. Defecation becomes exceedingly painful, and there is often more or less irritation about the neck of the bladder, or of the uterine system.

All these symptoms are aggravated (as, at first, they are only experienced) after any excess at table, or in alcohol, or by some imprudence which induces local congestion and spasmodic contraction of the sphincter.

If hemorrhage occur to a marked extent, or be frequent or continuous, the patient's complexion becomes pallid or sallow, and he may exhibit all the symptoms of profound anæmia (*q. v.*).

Ætiology.—Some persons exhibit a constitutional, and others an hereditary predisposition to the development of piles. This is favored by all conditions that impede the portal circulation and determine a flow of blood to the intrapelvic organs—sedentary habits, overfeeding and overdrinking, sexual excess, urinary disorders, flexions of the uterus, pregnancy; cardiac, respiratory, and hepatic disease; local chill, constipation, violent purging, and the abuse of aloetic aperients.

The malady is exceptional before puberty, but is rarely altogether escaped in later years, and is common in middle and advanced life. Men suffer more than women; but women who have borne children are liable to the development of piles.

Treatment.—If the portal system be congested, it should be unloaded by a

mild mercurial cathartic, and the action of the bowels so regulated that they are every day *sufficiently* relieved by the easy passage of a softish motion, but without any intestinal irritation or excessive purging. The confections of senna and of sulphur, the compound liquorice powder, or a dose of aperient mineral water taken every morning on rising, are suitable to this end.

The patient should take abundant exercise in the open air, and must use cane or wood-seated chairs, avoiding all softly cushioned seats. Rich and highly seasoned dishes as well as alcohol must be abstained from; and the abdomen, legs, and feet should be warmly clothed.

Eight or ten ounces of cold water, injected into the rectum every morning, is a very useful measure; and some astringent—such as ice, tannic acid, rhatany, hazeline, or alum may be added to the water, if advisable, in order to control venous bleeding; or an astringent suppository may be used. The orifice of the bowel should be cleansed with cold water after each defecation, and any protruding piles should be at once pressed back within the sphincter by the fingers smeared with simple oil, or anointed with the unguentum gallæ cum opio, or with an ointment containing cocaine and acetate of lead.

A few 2-dram doses of the liquid extract of coca leaves will often check the venous bleeding and other symptoms of congested internal piles; and a mixture containing sodium or magnesium sulphate, sulphate of iron, glycerine, and dilute sulphuric acid is useful in such cases.

In persons suffering from general plethora, lack of sufficient exercise, excess at table, or from any form of congestion of the liver or kidneys, it is unwise to check completely or too suddenly the venous hemorrhoidal bleeding, which may serve as a useful safety-valve; and under these conditions a course of alkalies, with a little colchicum and careful hygienic management, are often all that is needed for gouty subjects. But arterial bleeding from piles is never beneficial to health; nor is it so amenable as the venous variety to merely medicinal treatment.

Excision of external piles.—Seize with volsellum forceps, clamp, snip off with scissors curved on the flat, pass a cautery lightly over stump, unclamp; snip off

any pendulous little fold of skin; pad of oiled lint: T-bandage.

Ligature of internal piles.—Let the nurse empty patient's rectum with an enema shortly before operation. Patient should sit over warm water, to relax the parts and make it easier to protrude the piles. He then lies on one side and draws up his knees. Seize each tumor with pile forceps, cut through that side of it next the skin with scissors, surround base of tumor with a hempen thread, tie the pile very tightly. Cut ends of ligature short, oil well, and push back the ligatured mass within the anus again. Ligature separates in about a week. An anodyne is to be given after the operation and a laxative on the second day. Anæsthesia often dispensed with. Dress with dry cotton-wool.

Cauterization of internal piles.—Preparation same as for ligature. Smith's clamp, ivory side downward, snip off piles with scissors, sear bases with actual or with galvanic cautery. Latter said to cause least after-pain. Unclamp gradually, and cauterize any bleeding point. Suppository or morphia. Usual to anæsthetize during this operation. After-treatment same as for ligature. Recovery quicker. Danger about the same, but in either very little.

Nitric acid.—Suitable for sessile hemorrhoids. Apply with a piece of wood through speculum. Concave clamp to protect healthy mucous membrane. Galvanic cautery applied lightly answers admirably for sessile hemorrhoids.

NOTE.—When operating for hemorrhoids, avoid as much as possible damaging the line where the mucous membrane joins the skin. When there is a fissure, operate on it first.

C. B. KEETLEY.

Symptomatic Indications.—*Nux vomica* is the principal remedy for full, blind piles, especially from abdominal plethora and in persons of sedentary habits. *Hamamelis* does good service in the idiopathic form, especially bleeding piles, main reliance when hemorrhage is excessive. *Sulphur* is useful in chronic form, with constipation, itching tenesmus, rush of blood to the head. *Podophyllin* is useful when due to portal congestion, clay-colored stools, chronic hepatic affections. *Ferrum* may be useful in anæmic person; slight frequent hemorrhages. *Æsculus hip.* is regarded as almost a

specific when attended with obstinate constipation, sharp pains, and slight hemorrhages. *Belladonna* for piles with much inflammation, throbbing pains, hemorrhage. *Arsenicum*, in chronic, in emaciated subjects; tumors burn like fire, worse at night.

HÆMOSTATICS (Styptics).—Remedies used to arrest hemorrhage. They act either (*a*), by promoting coagulation of the blood in the vessel (see **ASTRINGENTS**), or (*b*), by causing contraction of the bleeding vessel, as nitrate of silver, acetate of lead, and ergot; the latter, or its active principle, sclerotinic acid, being especially useful when given hypodermically; cold and heat are also powerful agents belonging to this class.

HAIR, DISEASES OF THE.—**Hirsuties (Hypertrichosis)** hypertrophy or superabundance of hair. Normal hairs may increase in size and length, *e. g.*, on the eyebrows, nostrils, ears; or coarse pigmented hairs may grow upon regions normally provided with lanugo.

The development of hair is closely correlated with maturation and disease of the genitalia. In both sexes sexual precocity is accompanied by premature development of pubic and axillary hairs; at the menopause, or in consequence of menstrual disorders, women are often disfigured by growth of hair about the chin and lips, and a similar condition occasionally occurs during pregnancy. Long coarse hairs on congenital or acquired mole are very frequent. More rarely a temporary *hirsuties* results from spinal disease or nerve injuries, or from local irritants employed therapeutically.

Treatment ought to be directed to the cause. Caustic pastes are sometimes used, but they are apt to produce excessive irritation, and the hair which subsequently appears is generally more abundant and more deeply pigmented than before. Destruction of superfluous hairs by electrolysis is a satisfactory operation where the hair is dark and strong, the growth localized and not progressive. See **ELECTRICITY**.

Trichiasis denotes an abnormality in direction of the growth of the hair, most commonly observed in the eyebrows and eyelashes. In the latter situation, the hairs often turn inward, and cause con-

junctivitis. They are best extirpated by electrolysis.

Fragilitas crinium, brittleness of the hair-shaft, is a symptom of many diseases, especially those which induce morbid dryness of the skin—*e. g.*, diabetes, seborrhœa, tinea tonsurans. On traction, the hair-shafts are easily fractured. Occasionally, the distal end of the shaft splits, or the hair splits within the follicle and appears on the surface like a minute wisp.

Treatment consists in the use of pomades or simple oils.

Trichorexis nodosa is a disease characterized by brittleness of the hair-shaft and by the development upon it of fusiform, bulbous, nodular swellings of a whitish color, easily mistaken for "nits." It affects the beard and mustache more frequently than the hair of the scalp, and causes considerable disfigurement. The nodal expansions are distributed irregularly along the shaft, the internodal portions of which are quite healthy; at the nodes, the medullary substance is absent, and the cortex is distended and stretched by an accumulation of air. Fracture takes place at the nodes, and the brushlike ends may interlock, maintaining the continuity of the hair, but often at an acute angle. Nothing is known of its ætiology, and even removal of the beard is seldom of avail, the succeeding hair having the same peculiarity.

Piedra is a parasitic disease somewhat similar to trichorexis, affecting the hair of the scalp in women. Small, hard nodules surround, or are attached to one side of the hair-shafts, which on microscopic examination prove to be masses of spores budding forth from one cell. Constant washing cures the condition.

Plica polonica is a matted, entangled condition of the hair, the result of personal uncleanness and the desiccation of accumulated purulent discharges accompanying pediculosis and eczema capitis.

J. J. PRINGLE.

HALLUCINATION.—Hallucinations are sensory impressions which occur without the action of external stimuli, and must be carefully distinguished from illusions, which are false perceptions of actual objects. Any of the special senses may be affected, including disorders of the sense of touch, tactile hallucinations,

which are comparable to the paræsthesia of such nervous diseases as locomotor ataxy; and visceral hallucinations, which closely resemble the visceral paræsthesiæ of various spinal diseases; also organic sensations, such as nausea or faintness. Of hearing is the most common, and occurs chiefly in delusional insanity and melancholia, also in acute mania, more especially in the alcoholic variety; of sight, is chiefly observed in mania and delirium, and is generally acute and temporary, whereas those of hearing may last for years. Hallucinations of these two senses may be unilateral or bilateral, and may be simple, as visions of lines or spots, or sounds as of buzzing, or complex, apparently as heavenly scenes or the sound of human voices. Hallucinations of taste and smell are generally associated; they are of rare occurrence, and of serious import.

GEORGE REVINGTON.

HAMMER TOE.—See TOES.

HAND, DEFORMITIES OF (includes fingers). Four classes, viz.: 1, Deficiency; 2, excess; 3, webbed fingers; 4, contractions. It is rare to find a finger or any part of the hand congenitally deficient.

Supernumerary fingers are frequent; one is the common number, and it lies usually on ulnar side of little finger. Thumb may be bifid, or there may be supernumerary thumb. A finger may be too long or too short. A very rare deformity is a double hand on the same wrist.

Contractions.—Congenital contraction assumes the form called “clubbed hand,” which is analogous to clubbed foot, but very rare. Rheumatic contraction bends the fingers upon the palm and is practically the most important deformity of the hand.

Causes.—Either chronic rheumatic diathesis, or the habit of pressing on some round-headed instrument, like a chisel or a walking-stick.

Signs.—One or more fingers, especially the little one, is flexed, a tense subcutaneous fibrous band bridging across from it to the palm. There is chronic inflammatory thickening and contraction of fibrous tissue between palmar fascia and sheaths of flexor tendons.

Treatment.—Supernumerary fingers

should be amputated. As their proximal joint sometimes communicates with one of the normal metacarpo-phalangeal articulations, in such a case the base of the supernumerary finger may be left. If the operation is done at an early age this stump will not grow.

Clubbed hands can only be treated on the same principles as clubbed foot, but with not nearly the same hope of success.

To treat rheumatic contractions: Divide subcutaneously, if possible, or else antiseptically, the contracted fibrous bands, carefully avoiding any injury to sheaths or tendons. Then extend fingers on a splint. Look also to the cause.

Webbed fingers, unless ingeniously treated, reunite after being cut apart. To obviate this, pass a metal ring through the base of the web, and keep it there till the aperture cicatrizes. Then complete the separation, or wrap a flap of skin taken from the back of one finger over the raw surface of the other finger, and another flap of skin taken from the palmar surface of the latter finger over the raw surface of the former, utilizing, of course, the skin of the web itself. In this skin is taken from the buttock. Gradual strangulation of the web by a clamp.

C. B. KEETLEY.

HANGING, DEATH BY.—Since the adoption of the “long drop,” death is now generally due to pressure upon the medulla oblongata or spinal cord, from fracture or dislocation of one or more of the cervical vertebræ; but in other forms of hanging it usually results from asphyxia.

The proof that a person has met his death by hanging will depend upon the position of the body when found, the presence of certain external marks on the neck, and of the signs of asphyxia in the internal organs, and the absence of any other cause of death. The external signs about the neck will depend upon the length of time the body has been allowed to hang after death, and the nature of the suspending cord. The mark on the neck is generally an oblique, hard, dry, yellowish, horny furrow, sometimes marked with superficial ecchymoses. A small ligature will, of course, produce a thin and deep line; when there are two marks, these usually cross, instead of being parallel. Similar appearances re-

sult if the body be suspended immediately after death; to prove that this had been done would be almost tantamount to proving that a murder had been committed.

The face is usually turgid, with blood-stained froth about the mouth and nostrils; the tongue is swollen and semi-protruding. In men, the penis is often semi-erect, an escape of prostatic fluid having taken place; in women, the genital organs may be turgid or blood-stained. Internally, the right side of the heart and the lungs will be found engorged with venous blood; the left side may be empty; there may also be fracture or dislocation of the cartilages of the larynx, or fracture of the hyoid bone; sometimes the middle and inner coats of the carotid artery are found to have been divided.

It is rare that an opportunity for treatment presents itself; when it does, a free supply of air and artificial respiration affords the best prospect of restoring suspended animation; bleeding is sometimes useful.

HARELIP.—There are many degrees of this congenital deformity, both of single harelip and double harelip. The fissure is not central, but corresponds in single harelip to one side and in double harelip to both sides of the intermaxillary bones. The intermaxillary are the bones which form the front of the hard palate and alveoli carrying upper incisor teeth. Harelips vary in depth from a mere notch in the edge of the upper lip to a total separation of the intermaxillary bones. It often coexists with cleft palate. Male sex predisposes. Double harelip almost always affect boys, and is ten times less common than the single variety. The intermaxillary bones in double harelip often project forward from the end of the nose, and are frequently only half developed in size.

Treatment.—Operative only. Best time is the third to fifth month of infancy. Contra-indicated during dentition or ill-health. Plastic operations fail in syphilitic (Verneuil.) Chloroform unnecessary and difficult to administer. If desired anæsthetic vapor may be pumped through a catheter. Child should lie or sit on a table, or on nurse's or surgeon's lap. Secure his limbs by rolling him up lightly but firmly in a towel. Assistant to check

hemorrhage by holding each side of the upper lip between his finger and thumb. Surgeon sponges for himself, or lip may be secured in T. Smith's forceps. Begin by separating with the knife the two sides of the lip from the jaw subjacent, unless the former structures be already very free. Then pare the edges of the cleft. Remove enough, especially from the apex of the cleft and from the junction of the cleft with the edge of the lip. Then suture, strap, and put on Bainsby's truss. The incisions are best made with a view to utilizing the "parings" of the fissures. In double harelip the whole margin of the intermaxillary nodule is pared. When this nodule projects, it must, unless it is rudimentary, be broken at the base and bent back to the level of the lip. If rudimentary, it may be removed altogether except the skin which covers it anteriorly. This must be stitched back, either to complete the nasal septum if that is deficient, or otherwise fill the gap in the lip. Modes of suture: 1. The "harelip" suture proper. Two pins. Enter and exit $\frac{1}{4}$ inch from fissure; pass deeply, nearly reaching mucous membrane. Lower one secures coronary artery. Twisted suture. Interrupted wire suture at red border of lip. Sharp ends of pins nipped off. Pieces of lint placed beneath ends of pins. Strapping, broad at ends and narrow in middle, brought across the lip. 2. The common interrupted wire suture. This answers well for ordinary cases, and is less likely to leave scars. All pins should be removed on third day very gently, the lip being well supported at the time and strapped immediately afterward. Act of suckling rather beneficial than otherwise, as it tends to close the fissure. In order to bend back the intermaxillary bone when it projects, instead of breaking its base, it is a better plan to cut a V-shaped piece out of the septum nasi.

C. B. KEETLEY.

HAY FEVER (Hay Asthma).—A catarrhal affection of the mucous membrane of the eyes, nose, and air passages, frequently combined with asthmatic paroxysms, and due to the action of certain irritants on an abnormally sensitive mucous surface.

Symptoms.—Attack may commence with irritation of the conjunctivæ, lachry-

mation, and an increased secretion from the Meibomian glands; some chemosis is frequently present. There is a feeling of fullness and oppression in the head, pain across the frontal sinuses, and intolerance of light. After an interval varying from a few hours to some days, the nasal mucous membrane becomes affected; or it may be primarily attacked, the affection of the eyes being secondary; the patient sooner or later complains of intense irritation and stuffiness in the nose, and the mucous membrane may swell to such an extent as to render breathing through the nose difficult, even impossible. There is also a profuse discharge from the nose (at first watery, afterward becoming muco-purulent), with incessant sneezing. The catarrhal condition may also extend up the eustachian tubes, giving rise to deafness. In some cases the disease extends down the throat, causing a feeling of dryness and itching in the fauces; and if the bronchial mucous membrane be attacked, there will be cough and a sense of constriction across the chest. Well-marked asthma may accompany an attack or may constitute its chief feature, the coryza being less marked.

There may be slight pyrexia, but it is frequently absent; the pulse is usually somewhat accelerated. The attacks have a depressing influence, and there may be evidences of gastric disturbance. Urticaria is sometimes associated with hay fever.

Diagnosis.—The catarrhal symptoms which mark the onset of the attack, and the occurrence of violent sneezing after exposure to a source of irritation—in typical cases the pollen of various grasses—usually render the diagnosis easy. The only cases which present any difficulty are those in which symptoms of asthma appear without a previous catarrhal stage; but these may usually be distinguished from ordinary asthma by the fact that the attack occurs by day, and that it can be traced to the inhalation of some irritant or odor.

Prognosis.—In the majority of cases a cure may reasonably be expected; and even where this cannot be obtained, great relief can be afforded.

The changes in the nose are usually of a hypertrophic character, and constitute the condition known as “hypertrophic rhinitis.” The whole nasal

cavity may be affected, or there may be only a puffy swelling of the inferior or middle turbinated bodies, or a patch of erosion on the mucous membrane. Polypi, and a deflection of the septum nasi, are present in some cases. In a case of prolonged duration, all symptoms ceased as soon as a perforation in the septum had taken place, apparently proving that the irritable zone from which the reflex stimulus started was situated on the septum. On touching the interior of the nose with a probe, parts of the mucous membrane will often be found to be hyperæsthetic, and it may be possible to start an attack of sneezing in this way. Whatever the local changes, a paroxysm of hay fever is invariably accompanied by swelling and engorgement of the erectile tissue, which forms so important an element of the inferior turbinated body, but which is also present in other parts of the nasal mucous membrane. This is followed by an increased secretion, at first purely serous in character, but which later may become muco-purulent.

Ætiology.—At least three factors are concerned in the production of an attack: (1) a general nervous constitution of the individual; (2) a local irritability of the conjunctival or nasal mucous membrane; (3) some direct exciting cause. As regards the first, it is to be noted that the greatest sufferers from hay fever are the English-speaking peoples. As a rule, the victims are persons belonging to the educated classes, laborers almost entirely escaping. Inhabitants of towns are more prone to be attacked than country folk. Men are more subject than women, and heredity exercises a powerful influence. The second factor has been considered under pathology. The remaining factor is the direct exciting cause. Careful and prolonged investigation has shown that the pollen of certain grasses is the most powerful exciting cause of hay fever; but other sources of irritation, as dust, or the perfume from some plants, or the odor of certain animals, are capable of starting an attack in those predisposed to it, or a bright light, heat, or touching the irritable zone may start an attack.

True hay fever usually begins at the middle or last of August, and lasts about five or six weeks, or even longer in severe cases.

Treatment.—Bearing in mind the three factors concerned in the production

of the affection, it will be desirable, in the first place, to improve the general health of the individual. Severity of many cases is aggravated by the injudicious use of stimulants. The depression produced by the disease would seem to suggest the administration of alcohol, but when its action in dilating the arterioles is considered, it will be seen that locally its effect is far from beneficial. Mackenzie recommends 1 grain of valerianate of zinc with 2 grains of the compound asafetida pill, given two or three times a day. Tincture of opium in 5 to 10 minim doses, either alone or in combination with the same quantity of the tincture of belladonna, has been highly praised. One physician reports that $\frac{1}{10}$ of a grain of morphine with $\frac{1}{200}$ of a grain of atropine, administered subcutaneously three times a day, robbed the hay season of its misery so far as he was concerned, but the objections to recommending injections of morphine in chronic illness are so weighty that the drug should only be employed as a last resource. Another speaks favorably of his personal experience of succus belladonnæ, $\frac{1}{2}$ dram being added to 3 ounces of water, and a teaspoonful taken every hour until the symptoms are relieved: the same solution may be used as a lotion for the eyes. Bromide of potassium (10-20 grs.) with 3 minims of liquor arsenicalis, is useful for allaying the nervous erethism met with in hay fever, while at the same time the arsenic has a tonic effect. Antipyrin in 10 to 30 grain doses twice a day has an excellent effect; it seems to have an anæsthetic action on the sensory and secreting nerves of the nasal fossæ.

The second point to be considered is the removal of the patient from the exciting cause of the paroxysm. Many who suffer severely in the country are almost free at the seaside. A sea voyage generally proves beneficial. But if the individual cannot escape from the country, he should be instructed to wear out-of-doors "goggles" with pale-blue glasses, and, if he will submit to it, a blue silk veil of double thickness over the face. He should take life as quietly as possible, and especially avoid exertion in the sun. On the least suspicion of the complaint commencing he should bathe the conjunctivæ with a solution of corrosive sublimate 1-3000, and the same solution may be cautiously sprayed up the nostrils.

Plugging the nostrils with tampons of cotton-wool soaked in glycerin is very useful in some cases. Lastly, the greatest care should be taken to examine the nasal passages with the view to discover the presence of any departure from the normal condition. If a puffy swelling of the turbinated bodies exist, or the mucous membrane be hypertrophied, the use of the galvano-cautery can be recommended. The surface is first rendered anæsthetic by dabbing it with a 20 per cent. solution of cocaine. After an interval of five minutes the cocaine may, if necessary, be applied a second time. The galvano-caustic blade should then be drawn along the mucous membrane so as to score it freely, or the fine point may be passed into the tissue in several places. Whichever plan be adopted, as healing occurs contraction takes place, and the undue sensitiveness of the surface is thereby destroyed. More prominent hypertrophied tissue or polypi may be removed by the galvano-caustic loop. Similar procedures will be found of great service in cases of paroxysmal sneezing and other neuroses starting from the nasal mucous membrane. Though the immediate effect of the application of a weak solution of cocaine to the nasal mucous membrane is to produce an alleviation of the most distressing symptoms of the disease, the effect soon passes off and the application has to be renewed. As a result of the dilatation of the blood vessels which is the secondary effect of cocaine, the mucous membrane increases in thickness, so that eventually cocaine aggravates the evil it was meant to cure. Moreover, the seductive effect of the drug should not be forgotten, nor the risk of starting the cocaine habit. A 10 or 20 per cent. solution of menthol dissolved in almond or olive oil and applied to the nasal mucous membrane has yielded good results, and has none of the drawbacks of cocaine. Sir Andrew Clark has proposed a plan of treatment by which the irritability of the nasal mucous membrane is exhausted. An ounce of glycerin of carbolic acid, 1 dram of hydrochlorate of quinine, and a two-thousandth part of perchloride of mercury are made into a solution by the aid of heat, and the interior of the nostrils is freely swabbed out with the mixture. He claims that about half of those whose cases he was able to follow were cured for the season, and four persons were cured "for good." Anointing

the interior of the nose with an ointment consisting of one ounce of vaseline and a dram of oil of eucalyptus, with or without a dram of the solution of atropine, B. P., will be found useful. Among minor remedies which have been found of use in alleviating some of the symptoms of hay fever may be mentioned carbolized smelling salts, the formula for which is pulv. carbonis ligni; ammon. carb., aa 3 ij; tr. benzoini co., 3 j; acidi carbolici, ol. lavandulæ, aa mx; liq. ammonii fort., q. s.; misce bene; also the inhalation of benzoin, a dram of the tincture in a pint of hot water, and the use of a spray of a 25 per cent. solution of rectified spirit.

F. DE HAVILAND HALL.

Symptomatic Indications.—*Arsenicum* is useful, particularly for the catarrhal symptoms, thin, acrid discharge, frequent sneezing, chilliness, restlessness. *Sabadilla* is recommended when sneezing is excessive. *Gelsemium* when eyes are much affected, with profuse lachrymation. *Ipecacuanha* is of service when asthmatic symptoms are prominent.

HEAD, DISEASES OF THE.—

Abscess of the scalp may be met: 1. In the scalp proper, above the aponeurosis. 2. In the lax tissue beneath the aponeurosis. 3. Beneath the pericranium. Abscesses in the first and third situations are circumscribed, but those beneath the aponeurosis are generally diffuse. Scalp abscesses may follow contusions, ecchymoses, wounds, fractures, the breaking down of scrofulous or syphilitic deposits, and bone affections. They all demand an early incision, but, apart from this, call for no special treatment.

Tumors of the Scalp.—**Hematoma.**—Collections of blood (like abscesses) may be met with: 1. In the substance of the scalp (these are small and circumscribed). 2. In the lax tissue beneath the aponeurosis (the hematomata may be very extensive, and may involve nearly the whole of the vault, being limited only by the attachments of the aponeurosis). 3. Beneath the pericranium. The first two named follow simple contusions, and demand no special consideration. The last named are usually spoken of as cephal-hematomata, and present some points of interest. They are met with in the newly born, depend upon some injury received during birth, are most common in males, and are usually situated on the parietal

bone, especially that of the right side. They usually appear within forty-eight hours of birth, and form soft, elastic, fluctuating, and painless tumors of variable size. They are always precisely limited by the pericranium, and therefore never extend beyond a suture. In a few days the center of the swelling feels soft, and around its margin is noticed a tolerably hard ring. The latter is probably due to partial coagulation, and in old cases may be replaced by a harder ring of ill-formed bone. The prognosis is favorable, the swelling disappearing in from fifteen days to two months. The condition calls for no treatment.

Sebaceous cysts are peculiarly common on the scalp. They are apt to be multiple, and may attain great size. They form roundish tumors with very distinct walls. They are movable, possessed of faint fluctuation, and cannot be separated from the skin. When of large size the hair that covers them atrophies, and the tumor becomes bare. They are of very slow growth, may remain stationary for an indefinite time, are painless, and contain altered sebaceous matter and epidermal *débris*. Many present a black point upon their summits. They are apt to suppurate if injured. When suppuration occurs the skin in time gives way, the sebaceous matter protrudes, and granulations spring up from the exposed sac wall. In this way a fungating vascular mass (the follicular or fungating ulcer of the scalp) may be produced, which closely resembles epithelioma. From this disease, however, it may be separated by the history of the case, by the previous existence of a sebaceous cyst, by the absence of any infiltration at the margins of the sore, and of any enlargement of lymphatic glands. The only mode of treating sebaceous cysts is by incision.

Congenital dermoid cysts resemble the sebaceous cyst in most points. They are, however, small, seldom exceeding a diameter of two-thirds of an inch, of very slow growth, congenital, and contain in addition to sebaceous matter, as a rule, a number of fine hairs. They are most common at the outer angle of the orbit, and always have deep connections with the pericranium. They may lie in actual depressions in the cranial bones. They should be excised when possible, but those about the orbit have often such

deep connections as to render complete excision inadvisable.

Horns.—These strange excrescences are developed from the interior of a sebaceous cyst that has been opened up by rupture or inflammation. They are formed of sebaceous matter that has become dry and horny from exposure. As fresh matter is constantly being produced by the cyst wall at its base the horn grows. Some have attained the length of six or eight inches. They can be best treated by carefully excising their bases, including the whole of the remains of the sebaceous cyst.

Pachydermatocele.—This remarkable affection is also known as elephantiasis, and as hypertrophy of the scalp. It consists of an immense overgrowth of the scalp tissues. The tumor formed consists mainly of connective tissue, and hangs down as a huge pendulous tumor, that is often lobulated, is flabby to the touch, is painless, and covered by normal skin. The tumor may cover the eyes and even drag upon the mouth. It causes distress only by its bulk. In some cases it is congenital, in others it appears at puberty or in young adults. It is most common about the temporal or parietal regions. Some benefit may attend the use of long continued pressure, but if this fails excision offers the only alternative treatment.

Pneumatocele.—A tumor containing air; the collection is beneath the pericranium. Pneumatocele is usually met with over the mastoid process. The mastoid cells or frontal sinus have become perforated, and air finds its way under the pericranium from the middle ear in the one case, and from the nose in the other. The perforation may be due from accident, to caries sicca, or to atrophy of the bony walls of the cells or sinus. The tumor is small, round, painless, and tympanitic. By pressure it may be made to disappear. Its progress is exceedingly slow, and it usually produces no trouble. It should be treated simply by the pressure of a carefully applied pad. The following are also to be met with in the scalp: Nævi, cirroid, racemose, and arterio-venous aneurisms; arterial varix; sarcomata; fatty, fibrous, and papillomatous growths. These, differing in no essential respect from like growths found elsewhere, demand no especial notice. Nævi and arterial angiomas are more

common on the head than in any other part of the body. The first named are most often met with about the anterior fontanelle, the orbit, and the temple, and the latter in connection with the temporal, posterior auricular, and occipital arteries.

Affections of the Skull.—**Meningocele; encephalocele, hydrencephalocele.**

—Terms are applied to certain tumors that consist essentially of a protrusion of some part of the cranial contents through an aperture in the skull, all congenital. When the tumor contains a protrusion of the meninges only, the term meningocele is used; when a protrusion of brain, encephalocele; and when the mass is formed by a portion of brain, greatly distended with fluid from a dropsical ventricle, hydrencephalocele; the last named is the most common, while the pure meningocele is the most rare. These protrusions depend upon congenital defects in the development of the skull, whereby gaps are left in the cranial bones.

The most common site is the occipital region, where the gap is found about the middle line of the occipital bone, and whence it may extend to the foramen magnum or the posterior fontanelle.

The site next in frequency is the root of the nose, the protrusion leaving the skull between the cribriform plate and the frontal bone, and appearing externally between the frontal and nasal bones. These tumors are usually much smaller than those on the occiput, and being very often covered by red and vascular skin, have been mistaken for nævi. The rarest situation is at some point (usually at a suture line) about the sides or base of the skull. Tumors developed in the latter situation have projected into the orbit, the mouth, and the pharynx.

Symptoms.—These protrusions appear as roundish elastic tumors, covered by normal skin, which may, however, be greatly thinned and also excoriated. They usually have a pulsation synchronous with the heart, and may be reduced more or less by pressure, such reduction being often followed by brain symptoms (headache, vomiting, convulsions, stupor, etc.).

They are often pedunculated and pendulous. The hole in the skull can usually be made out. On forcible expiration the tumor, as a rule, becomes more tense or increases in size. If the mass be small

the skull will be normal in outline; if large, the child will be microcephalic.

The separate symptoms and the features in the differential diagnosis are exhibited in the following table:

	Size and Surface.	Pedicle.	Fluctuation.		Translucency.	Pulsation.	Reducibility.
MENINGOCELE.	Small. Surface smooth.	As a rule pedunculated.	Most distinct.	MENINGOCELE.	Perfect.	Rarely present.	Always reducible.
ENCEPHALOCELE.	Small. Surface smooth.	Wide base. Rarely pedunculated.	Absent.	ENCEPHALOCELE.	Opaque.	Distinct.	Reducible, but not completely.
HYDRENCEPHALOCELE.	Often large and pendulous. Surface often irregular or lobed.	As a rule pedunculated.	Distinct.	HYDRENCEPHALOCELE.	Translucent only at most dependent or most prominent parts.	Rarely present.	Irreducible.

Prognosis.—The majority of the subjects of these deformities die within a short period of birth. In hydrencephalocoele the prognosis is absolutely bad; in meningocele it is the least hopeless. In most cases the tumor increases, and in time bursts, causing death from collapse, convulsions, or acute meningitis. It may, however, remain stationary, and the patient attain adult life. In meningocele, the bony gap may become so narrow that the cavity of the tumor is cut off from the cranial cavity, and a spontaneous cure follows.

Treatment.—The mass should be simply protected. Operative interference is only justifiable under *one* condition, viz., when rupture of the tumor is threatening. 1. Meningocele. Empty the sac with a capillary trocar, and repeat the tapplings as the sac refills. This has resulted in a cure. If, however, the sac refill in a shorter time after each tapping, and the fluid becomes dull, injections of iodine may be used (tr. iodi. one part, water two parts); this measure has met with little success. As an alternative the excision of the sac under antiseptic precautions may be entertained. 2. Encephalocoele. Repeated tapplings (if there be fluid in the sac), followed by pressure by means of an elastic bandage, may be employed. 3. Hydrencephalocoele is not adapted for any operative interference.

Caries and necrosis.—Caries of the

skull is less common than necrosis, and may be due to injury, to syphilis, or to scrofula. It is most often met with on the external table, but may commence in the inner table or the diplœe. The bones usually involved, in order of frequency, are frontal, mastoid, occipital. The disease may be very extensive, and in any form the cranial vault may be perforated. This perforation may occur at many spots, especially in the syphilitic form, and through the holes so formed the pulsations of the brain may be recognized. In such cases the dura mater is thickened by inflammatory deposit.

The pathology and general symptoms of the affection do not differ from those of caries elsewhere. The gravity of the disease depends to a great extent upon certain *special complications*. These are pyæmia from suppurative phlebitis of the diploic veins, thrombosis of the cerebral sinuses, collections of pus between the dura mater and the bone, meningitis of the convexity, and, in rare cases, abscess of the brain.

Treatment.—Treat the constitutional condition. Evacuate all collections of pus; keep the parts clean. If the caries be spreading, a cautious use of the gouge may be advised. If pus be pent up either in the substance of the bone or beneath the dura mater, the application of the trephine is called for. In many cases, also, of early spreading caries, the trephine,

not necessarily applied through the whole thickness of the skull, may arrest the disease.

Necrosis may follow contusions, lacerations of the scalp, fractures, burns, and extravasations of blood beneath the pericranium or the dura mater; or it may follow eruptive fevers, or depend upon scrofula or tertiary syphilis.

In the idiopathic forms the frontal and parietal bones are most often involved. The whole thickness of the bone may necrose, but more usually the disease involves only the outer table. In rare cases it has involved only the inner.

The necrosis is usually limited, but it may be very extensive, and in some recorded cases nearly the whole of the vault of the skull has been lost by necrosis in the process of years.

The mode of separation of the sequestrum is the same as that observed in necrosis elsewhere, and the only pathological feature special to skull necrosis is the absence of any new bone formation. The sequestrum is not retained or invaginated by a new bone, and the gaps left in the cranium after the separation of the sequestra are filled up by fibrous tissue only. The special complications that may attend caries may attend necrosis.

Treatment.—Give free exit to all discharges. Superficial necrosis may be practically left to itself, or the process of exfoliation may be aided by the use of strong sulphuric acid. Remove all loose sequestra. If the dead piece be too large for convenient removal, it may be trephined and removed in segments. The trephine may also be used when pus collects between the dura mater and the bone.

Tumors of the Skull.—Osteomata.—Bony tumors that grow from the outer table of the skull are called exostoses, those springing from the diploë or inner table enostoses. Some are spongy or cancellous in structure, but the majority have the structure of ivory exostoses. These tumors are often multiple, sometimes symmetrical, and are most commonly found in connection with the frontal bone, less frequently with the mastoid and occipital bones. They are usually irregular and bossy; they are of slow growth, and only cause trouble when they compress the brain (enostoses) or grow into the orbit or nose. Exostoses

in the latter sites may necrose *en masse*.

In the great majority of cases these tumors call for no operative interference, indeed are affected by none. Carcinoma of the skull is met with, but always as a secondary affection.

Fungus of the dura mater.—A sarcomatous tumor growing from the dura mater (and in very rare instances from the pia mater or arachnoid), penetrating the cranium, and appearing under the scalp. The growths may be primary or secondary. The former are rarer and are single, the latter are due to metastasis and often multiple. This form of sarcoma is rare, since the majority of the sarcomata of the dura mater do not perforate.

Symptoms.—In some cases there are cerebral symptoms (headache, neuralgia, vertigo, vomiting, convulsions, etc.). As the tumor makes its way through the bone, a soft spot of thinned bone may perhaps be felt at the vertex, which crackles on pressure. This thin bone gives way, and the sarcoma protrudes as a small, flat, firm tumor that pulsates and can be reduced on pressure; on reduction the hole in the skull may be made out. The mass soon grows, and, spreading beyond the hole, becomes prominent, softer, and at the same time irreducible and no longer pulsating. If the patient lives long enough the mass may fungate through the scalp tissues. Sarcomata growing from the bone are harder, are never reducible, and never pulsate. The affection is rapidly fatal, and is beyond the reach of any but palliative treatment.

Hypertrophy of the skull.—1. Some few cases of *simple hypertrophy* have been noted. The subjects have usually been advanced in life. The hypertrophy may involve the entire skull evenly, or be limited to some portion of it. The cause is unknown.

2. *Osteo-porosis.*—This term is applied to certain large thick skulls with obliterated sutures, the bones of which, on section, appear uniform and finely porous, like white brick. The general shape of the skull is, as a rule, not altered, but the component bones may be four or five times their normal thickness. This change is more or less entirely limited to the vault of the skull. In some cases this peculiar hypertrophy has been associated with osteo-malacia, and in other

instances with osteitis deformans. In the latter affection, however, the bones are usually quite dense on section, and the dimensions of the skull are greatly increased in all its diameters.

3. In *leontiasis ossium* the skull is thickened and deformed by the growth of irregular bossy masses of rough and porous bone. These masses may be very large, are often symmetrical, and produce great deformity. The frontal, parietal, and malar bones are most often affected, the orbits and nasal fossæ may be encroached upon, and certain of the cranial foramina closed. It appears usually at or before puberty, and is of unknown origin. Pressure symptoms of various kinds arise. No form is amenable to any but palliative treatment.

FREDERICK TREVES.

HEAD, INJURIES OF THE.—Important because almost all varieties are liable to be complicated with cerebral mischief. Classification is primarily anatomical. 1. Scalp injuries; 2, fractures of skull; 3, injuries of brain and its membranes; 4, injuries of cranial nerves.

I. Scalp may be contused or wounded, or both.

Contusions of scalp.—Extravasation may be diffused or circumscribed. Latter occurs either, 1, above cranial aponeurosis, 2, just beneath it, or, 3, between epicranium and bone.

Signs.—Fluctuation, hard and thickened margin, soft center, rarely any discoloration. Cephalhematoma, a special kind of scalp extravasation which lies mostly just beneath epicranial aponeurosis, is the result of pressure during birth, and is usually situated over the parietal bone.

Fluid contents.—Blood with its corpuscles more or less disintegrated, its coloring matter more or less diffused, and perhaps partly crystallized, while its plasma is often partly coagulated. The coagulation may entangle the coloring matter and leave the fluid contents pale and yellow.

Diagnosis.—From fracture. The hardened margin of an extravasation can usually be deeply pitted by steady and continued pressure. See Fracture.

Treatment.—Cold and pressure. Afterward discutient lotions (lotio ammonii chloridi, etc.). Only the most obstinate cases should be aspirated or punctured by a small knife. After puncture

apply antiseptic dressings. When supuration occurs, open freely and poultice.

Scalp, wounds of.—Often contused and lacerated.

Prognosis.—Very good even in the most severe cases, because the vessels of the scalp lie chiefly superficial to the aponeurosis. But for the same reason, the blood supply of the cranium is sufficiently interrupted in extensive lacerations to cause danger of necrosis with its consequences. Other dangers in scalp-wounds are erysipelas, and accumulation of pus, causing puffy swelling.

Treatment.—Clean carefully, and replace flaps accurately. Use sutures if necessary, but do not pass them through the aponeurosis. Dressing should be just enough to support and protect from draughts of cold air, without heating. Bleeding vessels can sometimes be conveniently secured between a needle and twisted suture. Treat complications on general principles, giving free exit for pus, etc.

II. **Fractures of skull.**—May be classified in three ways: (a) into simple and compound, (b) into fractures of the vault and fractures of the base, and (c) according to the physical characters of the fracture, into fissures, starred, depressed, punctured, elevated, and comminuted fractures. It should also be noted, when possible, what is the relative amount of damage done to the inner and outer tables of the skull.

Causes.—Blows and falls on the head, and, though very rarely, indirect violence, viz., falls on the feet or blows on the lower jaw. The nature of the fracture naturally depends greatly on the cause.

Anatomy and pathology.—Position of fracture depends chiefly on point where the causative force has been applied, and on nature of force. Sharp instruments cause depressed fractures at the point of contact. Sometimes they only crack the outer table, while they depress the inner. Heavy, softish bodies, *e. g.*, a bale of cotton, are likely to cause fractures of the base. The skull has been divided into three "zones," and evidence given to show that a blow on the vault of one zone is likely to cause a fracture of the base of the same zone. The middle zone consists of "the parietals, the squamous, and the anterior surface of the petrous portions of the temporals, with the greater part of the basisphenoid." The posterior and anterior zones include the rest of the skull.

The middle zone is the commonest seat of fracture. Shape of fracture; see classification. A very common shape is a depression with three triangular sides sloping downward till their apices meet in the center of the depression. In fractures of the base, sutures—*e. g.*, the petroso-occipital—are sometimes torn open. Most fractures of the base are continuations of fissures of some part of the vault. But a few appear to be genuine cases of contre-coup. This is what is meant by contre-coup. Suppose a watch lying with its face toward the table, and a weight to fall upon the back of the watch. If the glass cracked, that would be a fracture by contre-coup. In some of these cases, the base of the skull is said to be broken by contusion with the atlas. One table is usually more damaged than the other, and the least damaged lies toward the surface where the violence has been applied, therefore the most damaged is almost always the inner table. Extravasations within the cranium, damage to internal and middle ears, and to cerebral centers and nerves, as well as membranes of brain, very common.

Signs and diagnosis.—Obvious in compound fractures with depression. In compound fractures without depression, fissure looks like a red line. One of the sutures must not be mistaken for a fissure. Simple fractures without depression can only be recognized or suspected indirectly through their complications. Simple fractures with depression have to be distinguished from contusion with thick, hard margins. The depression in fracture is generally more abrupt at one part of its margin than another, while the hard margin of a contusion is usually tolerably circular and uniform, as well as impressionable by steady pressure with the finger. Fractures of frontal sinuses, or of mastoid cells, often cause emphysema.

Signs of the fracture of the base of the skull.—Bleeding from ear, nose, or mouth, escape of cerebro-spinal fluid from the ear, subconjunctival ecchymosis, paralysis of cranial nerves, especially of seventh pair. Tenderness of mastoid process and ecchymosis in suboccipital region indicate fracture of posterior fossa, unless direct violence has been applied to the tender and bruised parts. The anatomical explanation of the above symptoms is obvious. Hemorrhage from the ear is the common-

est of them. A somewhat rare symptom of fractured skull is escape of brain-matter. Cerebro-spinal fluid is very watery, saline, and contains only a trace of albumen, and the faintest trace of sugar. When such a fluid escapes from the ear, directly after an injury, it is pathognomonic of the fracture of the base. Amount of fluid may be considerable. In diagnosing fracture of the skull, always consider the brain-symptoms, if such are present, and consider also the nature of the force which caused the accident. Serious and long-continued cerebral symptoms, following a heavy blow on the head, are usually caused by fracture and its complications.

Prognosis.—Depends usually altogether upon the amount of injury done to the brain. In estimating this, consider the cause, the situation, and the shape of the fracture, the age, habits, and health of the patient. The injury done by sharp instruments is generally local and pretty manifest to the surgeon's senses. Heavy, blunt, soft bodies are apt to severely concuss and contuse the brain and fracture the base of the skull, while causing very little superficial damage. Fractures of the base are usually, but not always, fatal. Fractures with escape of brain-matter have been recovered from. Fracture at root of nose may only affect anterior wall of frontal sinus. Young children have no frontal sinus. Depressed, and especially punctured fractures, very liable to wound dura mater and brain. Kidney-disease makes wounds in this, as in other regions, very serious.

Treatment.—In all cases, rest, coolness, low diet, high, hard pillows beneath head. Ice locally, a purgative at commencement. Vigorous antiphlogistic treatment the moment signs of inflammation appear. Leeches. Cold douche. Continue observations of simple cases at least a month. Remove loose, depressed pieces in comminuted fracture.

Symptomatic Indications.—*Arnica*, with *aconite* or *belladonna* should signs of inflammation appear.

Indications for trephining.—The occurrence and persistence, in spite of treatment, of symptoms of local intracranial suppuration, or hemorrhage, or of cerebral irritation, after a blow on the skull. Trephining is contra-indicated in cases of diffused injury to the brain, and even in cases of depressed fracture unattended

by cerebral symptoms. Depressed bone by itself never gives rise to marked symptoms of compression, and when these are present hemorrhage exists with it. When there is a depressed fracture, it is right to trephine as soon as cerebral symptoms appear. Otherwise, icebags, etc., should have a fair trial first. When there is comminution, depressed pieces can sometimes be raised by the elevator or forceps only. See Trephining.

III. Injuries of the brain and its membranes.—These include extravasations of blood within the cranium, contusion and laceration, inflammation and suppuration of traumatic origin, hernia cerebri; and here also must be noticed the conditions styled “concussion” and “compression.”

Extravasations of blood within the cranium.—1. Between the dura mater and bone; 2, in cavity of arachnoid; 3, on the surface of the brain between it and the arachnoid; 4, in the substance of the brain or in its ventricles.

1. Extravasation between the dura mater and bone.

Causes.—Wounded blood vessel, usually a branch of middle meningeal artery, sometimes a wounded sinus, especially the lateral sinus.

Pathology.—The effused blood forms a clot, often of enormous size, and having very little tendency either to be absorbed or to become encysted. This clot, when large, causes a corresponding depression on the surface of the brain.

Signs.—May be *nil* if clot be small, or even in the case of a large hemorrhage, if it be poured out so gradually that “the brain has time to accommodate itself to the pressure.” When symptoms are present they are those of compression or of irritation. The most valuable evidence of extravasation exists when symptoms of compression come on, not immediately after the injury, but after an interval of consciousness. For prognosis, treatment, etc., see Compression. It is to be noted that irritation of the nerves of the dura mater causes reflex convulsions and contractures of the same side of the body as the injury to the head.

2. Extravasation in cavity of arachnoid. Very common.

Pathology.—When not absorbed has a tendency to form blood-cysts contained in a new fibro-serous membrane which is attached to the parietal layer of the

arachnoid, and makes a depression on the surface of the brain.

Signs and diagnosis.—Cannot be distinguished from other intracranial hemorrhages. Long after the original injury, it is liable to cause headaches and mental irritability.

Treatment.—See Compression and Cerebral Irritation.

3. Extravasation on surface of brain, beneath visceral arachnoid. Accompanies general cerebral injuries. Never encysted. May spread very widely. No special signs. No special treatment.

4. Extravasations into substance of brain or into its ventricles. Not to be distinguished from apoplexy except by the history. *Treatment, etc.*—As in apoplexy.

Contusion and laceration of brain.—

Pathological anatomy.—Minute extravasations, sometimes few, sometimes numerous, sometimes occupying only a limited portion of gray matter, sometimes diffused through greater part of brain; sometimes attended with very little injury to cerebral substance, sometimes followed by complete softening and disintegration, or, after a longer interval of time, by atrophy of brain-substance. Situation often opposite the part of cranium struck (contre-coup). Usually middle or anterior fossa of base. Lacerations are often complicated with large extravasations.

Symptoms.—Partial spasms and paralysis, occasionally coma. Frequently concussion. None of these symptoms belong specially to cerebral contusion and laceration, which are so difficult to diagnose satisfactorily that their treatment, etc., will best be considered under the heads of Concussion, Compression, Cerebral Inflammation, Irritation, etc.

Encephalitis, traumatic.—This includes meningitis, for, during life, inflammation of the membranes cannot be diagnosed from that of the brain-substance; though a shrewd guess may sometimes be formed by considering the exciting cause. Classified into: 1, acute, and 2, subacute or chronic.

Causes.—All injuries of the head. For even a scalp wound may excite, firstly, osteitis, and secondarily, meningitis and cerebritis. Neglect of rest and of temperance after head-injuries is very likely to excite inflammation.

Pathology.—Congestion of the parts inflamed. Firstly, yellowish lymph and then pus appears on the inflamed mem-

branes. Cerebral substance may soften and break down. Serous effusion into ventricles. When the exciting injury is not very deep, *e. g.*, most punctured fractures, the membranes are chiefly affected; but when it is general or deep, *e. g.*, concussion of brain, the cerebral substance may be the chief seat of inflammation. Although the appearances are most marked at the actual seat of injury, yet traumatic encephalitis generally spreads to a great part of the brain and its membranes. In chronic cases, parietal and visceral layers of arachnoid cohere. The amount of cerebral congestion is estimated post mortem by the number and size of the red points visible on section of the hemispheres. This test is not satisfactory, for it is influenced by the relative fluidity of the blood and the pressure of serous effusion in the ventricles.

Signs.—1. Acute. Severe pain in head, oversensitiveness to light and sound, noises in ears, one or both pupils contracted, partial spasms and paralyses, epileptiform convulsions, usually, or, at all events at first, unilateral; fever, pulse frequent or variable, temperature raised slightly at first, and raised more if suppuration come on. Vomiting. Delirium. Lastly coma, and death by exhaustion and compression. The relative prominence of the symptoms catalogued above varies greatly in different cases. In comatose stage pupils eventually dilate. 2. Chronic. When it comes on long after receipt of injury, there may be premonitory signs, *e. g.*, irritable temper, headaches, etc. The symptoms differ only from those of acute inflammation in being less concentrated and severe.

Diagnosis.—Traumatic intracranial inflammation can scarcely be confounded with any other disease, if its causes and signs are carefully considered.

Prognosis.—Very serious, especially if not treated promptly and boldly.

Treatment.—Cold locally, purging, calomel, venesection, leeching, morphia. Venesection rarely used now. Leeching over temples and mastoid processes very beneficial. But local cold is the most powerful remedy. The cold douche is the most effective form, and it should be used courageously and perseveringly. Icebags. Purging is highly praised. Calomel and butter placed on tongue. Small doses of calomel and morphia sometimes given, especially when furious

delirium comes on in a few days after a head-injury. Dark room, head raised on high hard pillows, hair cut short. Probably many cerebral inflammations which have resulted from wounds would have been prevented by antiseptic dressings.

Symptomatic Indications.—See BRAIN, INFLAMMATION OF.

Intracranial suppuration.—Within the skull, as elsewhere, suppuration is one of the “terminations” of inflammation; it is practically very important whether the pus be between the skull and dura mater, just beneath the dura mater, or within the brain substance.

Signs.—Not decisive. Symptoms of compression gradually coming on during encephalitis and accompanied by further rise of temperature and rigors. At the same time a coexistent scalp wound may become pale and dry, or Pott’s puffy swelling may form. If the wound be deep enough, the bone may perhaps be seen exposed by separation of pericranium. When these local signs are present, it is not unlikely that the pus is lying just beneath that part of the skull.

Prognosis.—Very bad; to make it worse, pyæmia is a not unfrequent complication.

Treatment.—The main question is that of trephining. Difficulty of treatment consequent on difficulty of diagnosis. When above symptoms are well marked, trephining is clearly indicated. Then, if brain is not found pulsating beneath exposed dura mater, the membrane may be punctured. The knife has been plunged boldly into the brain itself, not without success. Operate antiseptically.

Hernia cerebri.—*Causes.*—Wounds of skull and dura mater, followed by inflammation of part of brain immediately beneath it. More common in children, and when aperture in skull is small, than when it is large.

Pathology.—Inflammatory proliferation of connective tissue of brain, leading to a hernia of a substance whose structure is sometimes entirely like that of granulation-tissue, brain-substance, and clotted blood, and sometimes a blood-clot only.

Signs.—Hernia usually appears a few days after injury, but may appear much later. Brown, or reddish-brown mass, pulsating synchronously with respiration, and increasing in size. Brain symptoms, sometimes very slight at first, are those of cerebral irritation and inflammation.

In fatal cases death ensues from the encephalitis.

Prognosis.—Bad.

Diagnosis.—From fungus of dura mater and fungus of cranium. Former appears gradually, and is preceded by no fracture from external violence; latter does not pulsate.

Treatment.—Protective and slightly compressive. Shaving off is contra-indicated. A hollow metal cap fitting accurately. An ordinary dressing, combined by a soft pad and bandage.

Concussion and compression of brain.—“Concussion” and “Compression,” two terms which represent each a peculiar and important assemblage of symptoms, rather than a definite pathological state. Persons suffering from concussion are, in common parlance, said to be stunned. Compression means a more alarming condition, in which the patient cannot be aroused from stupor, and lies wholly or partially paralyzed. The presence or absence of paralysis has been given as the distinguishing mark between the two states. The origin of the term should always be borne in mind: “Concussion,” of course, means “shaking” or “striking,” and “compression” implies the pressure of something, *e. g.*, blood, or pus, or bone, or serum, on the brain.

Concussion.—*Pathology.*—No thoroughly satisfactory evidence of concussions occurring without some bruising or laceration of the brain.

Terminations.—Recovery may be and usually is perfect, or there remain headaches, mental irritability, affections of the senses, weakness, impaired virility, epilepsy. Concussion frequently passes into compression.

Treatment.—At first warmth, hot blankets, hot bottles, friction, and other gentle remedies for shock. Alcohol contra-indicated. And it should always be borne in mind that concussion is not usually in itself dangerous, but that it is quite possible by too vigorous and too stimulating a treatment to bring on hemorrhage or inflammation. When reaction has taken place, if not before, precautionary measures against hemorrhage, inflammation, etc., should at once be adopted. See Fractures of Skull.

Compression.—*Pathology.*—Depressed fracture of skull, extravasated blood within the cranium, inflammatory thickening or

œdema of the brain, or pus within the cranium are found, besides in each case various conditions such as are sketched in the above notices of contusion, intracranial hemorrhage, inflammation, etc. Symptoms :

CONCUSSION.

1. Insensibility, from which patient can usually be partially aroused.
2. Respiration feeble, like that of a patient in a faint condition.
3. Pulse weak, irregular, and often frequent.
4. Special senses dulled.
5. Pupils variable, but usually sensitive to light.
6. Nausea as recovery is taking place.
7. Bowels relaxed, but sphincters not paralyzed.
8. Bladder can expel water.
9. Comes on instantaneously and passes off gradually.

COMPRESSION.

1. Total insensibility.
2. Respiration stertorous, slow, and puffing.
3. Pulse full, slow, labored.
4. Special senses paralyzed.
5. Pupils widely dilated, or sometimes one dilated and the other normal or contracted.
6. Stomach insensitive.
7. Sphincters may be paralyzed, but bowels are torpid.
8. Bladder paralyzed; consequent retention of urine.
9. Does not usually appear at moment of injury, but afterward, and tends to get worse.

Treatment of compression varies with the suspected or known cause, whether extravasated blood, or depressed fracture, or inflammation, or suppuration, or foreign body. But always attend to these points; 1, dark room; 2, head high; 3, head shaved; 4, head cool; 5, low diet; 6, see that the bowels act freely, if necessary, placing a drop of croton oil in a little sugar on the tongue. The treatments of inflammation and suppuration are given above. The question of trephining for compression has been answered in the affirmative or the negative, according as the intracranial mischief is believed to be local and accessible, or to be general. But I am inclined to hold that the introduction of the antiseptic treatment reopens this question, and that antiseptic trephining may be justifiable to relieve general intracranial tension. I must again also call attention to the power of the cold douche long continued, *e. g.*, for hours, over intracranial inflammation.

Symptomatic Indications.—*Arnica* in first stage. If injury be severe, with extreme restlessness and jactitation of the muscles, quick pulse, rigors, and delirium, resort may be had to *belladonna*. For jerking of the tendons of the extremities, or clenched hands, foam at the mouth, *stramonium*. Rolling of the head from side to side, depression, stertorous breathing, etc., *hyoscyamus*.

Cerebral irritation. — Pathology. — Probably laceration of brain.

Symptomatic Indications.—*Ignatia* or *cicuta virosa*. For weakness of mental faculties after injury, impaired memory, nausea, vomiting, vertigo, *aconite* is serviceable. Blackish or brownish vomiting, with much prostration, *arsenicum*.

Symptoms—1, bodily; 2, mental. Bodily: attitude of general flexion—knees drawn up, elbows bent, etc.; restlessness; eyelids firmly closed; no heat of head; pulse weak and not frequent; rarely retention. Mental: irritable temper; desire to be let alone; muttering, frowning, grinding of teeth if disturbed. When these symptoms subside, the mind is left for a long time weak and fatuous.

Treatment.—On general principles: darkness, rest, quiet, coolness, icebag, patience. Chloral and even morphia may be given in some cases; but their effects should be keenly and cautiously watched.

IV. Injuries of the cranial nerves.—*Causes.*—Fractures of bones of the skull, extravasated blood, inflammatory effusion.

Signs.—May be deduced from consideration of functions of these nerves. Paralysis in most cases, spasms in some. Disturbed nutrition of cornea and conjunctiva when fifth nerve is injured.

Prognosis.—Usually unfavorable; but when the paralysis or spasms come on during attacks of intracranial inflammation, recovery may take place on absorption of inflammatory effusion.

Treatment.—If possible remove the cause. Nerves most frequently affected are seventh and second pairs.

Among notes on injuries of the head, we must notice traumatic osteitis of the cranial bones, which, when acute, is usually called "inflammation of the diplœ." Chronic osteitis of cranium follows any injury (of course it is sometimes syphilitic); it may result in hypertrophy, caries, or necrosis. Acute inflammation of cranium is very dangerous, from its liability to spread to membranes of the brain.

C. B. KEETLEY.

HEADACHE (Cephalalgia) is a symptom in a great variety of diseases. It may be due to organic cerebral disease, congestion and anæmia of the brain, functional nervous disorders, toxæmic conditions, and derangements of the stomach and liver. The character of the pain

varies considerably; it may be superficial or deep, constant or paroxysmal, general or local, dull and heavy or throbbing and stabbing.

Headache is frequently the first symptom, and occurs in nearly every case of meningitis, and of tumor or abscess of the brain. The pain is rarely paroxysmal, but usually constant and liable to exacerbations, which may be of the most excruciating description. It is frequently circumscribed, but is of little or no localizing value unless the lesion be superficial. In some cases of syphilis of the meninges or cortex, and of superficial abscess, pain is referred to a spot which is extremely sensitive to pressure; or the seat of the pain may be distant from the lesion—so far, indeed, that frontal headache has been known to occur in disease of the occipital lobes. On the whole, pain referred to the occiput is of far more diagnostic importance than if it be frontal.

Headache also occurs in many functional nervous disorders. One of the commonest of these is migraine, *q. v.* It need only be said here that there are many imperfectly developed forms of that affection, and that headache unaccompanied with vomiting, or any sensory disturbance, is one. Among hysterical women and sensitive, emotional people, and especially girls, who are perhaps also precocious, headache is a common symptom, and may resist every treatment. In these cases there is often a neuralgic element, which gives it a distinct coloring, and justifies its name of neuralgic headache. The pain may be general or local, is not paroxysmal, and may persist for days. Hysterical women sometimes experience a vertical headache, which is usually described as boring, like that which might result from the driving of a nail into the top of the head ("clavus hystericus").

Headache is common in cases of nerve exhaustion from almost any cause, and particularly from prolonged mental effort or worry. It may result from anæmia, and is then commonly frontal, or may be due to congestive states of the brain resulting from heart disease, asthma, and other forms of dyspnœa. In these cases it is throbbing in character, and increased by stooping, coughing, or any condition which tends to increase the congestion.

Frontal headache is frequently the result of errors of refraction, especially hypermetropia and astigmatism. In many of

these cases there is occipital pain of a neuralgic nature, and sometimes a painful area on the scalp, the hair of which feels as if it had been "slept on the wrong way."

Toxæmic headache may result from chronic alcoholism, uræmia, lithæmia, fevers, secondary syphilis, or diabetes. In most of these cases it is frontal and deep-seated, and is sometimes very severe; in uræmia, it may be so overwhelming as to raise the suspicion of cerebral tumor. That of secondary syphilis is of the neuralgic type, limited to the temples, and recurring with great regularity every evening. In lithæmic subjects indiscretions of diet, or constipation, may induce headache, which, coming on in the morning, may last a short time or persist for days. Badly ventilated or overcrowded rooms, in which respired air is necessarily breathed, produce, in many people, a heaviness or actual pain in the head. The same thing is often experienced before a thunderstorm, when the air is so still that the products of respiration are not carried away. Headaches resulting from stomachic and hepatic derangements are possibly also toxæmic in origin. They are usually occipital or vertical, but may also be frontal or generally distributed.

Treatment.—Must be mainly directed toward the condition which is the cause of the headache. Little can be done to alleviate the agonizing pain of organic cerebral disease other than syphilitic. If narcotics be prescribed, it should be remembered that sudden death is by no means rare in these cases, and may possibly be ascribed to the drug if no warning have previously been given to the patient's friends. Toxæmic headache is often relieved by diuretics and mild aperients. Anæmic states must be treated with iron, and in these and some other cases arsenic is also of use. In all cases of doubtful origin the eyes should be examined, and any error of refraction remedied by the use of spectacles. The instillation of atropine into the eyes for a week or two is of great service when the headache depends upon spasm of the ciliary muscle. Paroxysmal and neuralgic headaches should be treated on the same principles as neuralgia. In these the administration of quinine, arsenic, gelsemium, butyl-chloral, cannabis indica, and antipyrin meets with success in different cases, but, in addition, the general sur-

roundings and habits of the patient must be carefully considered. Local applications are of comparatively slight value; but a mustard plaster applied to the nape of the neck sometimes greatly relieves an occipital headache, and menthol and stimulating liniments, such as chloroform, belladonna, or aconite, are occasionally distinctly beneficial.

WILLIAM GAY.

Symptomatic Indications.—The most generally useful remedy for nervous and congestive headache is *belladonna*; congestion to the head, with throbbing pain, sensitiveness to light and noise; aggravation from motion, lying down. *Belladonna* is especially adapted to headache in women and children. Headaches from disturbance of digestion, bilious, or sick headaches may be relieved by *nuxvomica*. It is especially adapted to men and persons of sedentary habits. *Ignatia* is useful in "clavus," coming monthly or bimonthly with sensations of weight at the back of the head. *Cimicifuga*, in nervous or hysterical women, especially in headache occurring at the menstrual period, does good service, the pain is severe, often through the eyeballs. *Nitroglycerine* in congestive headache, with great determination of blood to the head, throbbing pain, especially when due to heat, or effects of the sun, is specific. *Irisvers.* does excellent service in headaches from liver derangements, especially when attended with blinding pain in right supra-orbital region, nausea and vomiting; the headache often begins with blur before the eyes. *Bryonia* is useful in bilious headache, or headache from cold, worse from every motion, patient wants to keep perfectly still. *Arsenicum* will often relieve neuralgic headache coming periodically. The pain is better from warmth, worse from cold. *Pulsatilla*, in menstrual headache is often effective. The patient is chilly, yet craves cool, fresh air.

HEART, DISEASES OF THE MUSCULAR WALLS.—The diseases of the cardiac walls are many and various, including degenerative, inflammatory, and suppurative affections, fatty infiltration, simple atrophy, and morbid growths of different kinds.

The degenerative group comprises granular, fatty, fibrous, amyloid, pigmentary, vitreous, and calcareous transformations.

Myocarditis, or acute inflammation,

evidenced by a cellular exudation, is practically always consecutive to pericarditis or endocarditis. Abscess of the heart's wall is usually multiple, and is a symptom of pyæmia or allied conditions, such as ulcerative endocarditis, in which minute infective emboli become impacted in the branches of the coronary arteries.

The morbid growths to which the heart is liable are carcinoma, sarcoma, lympho-sarcoma, lipoma, myoma, fibroma, myxoma, tubercle, syphilitic gummata, hydatid cysts and cysticercus. Malignant growths are almost invariably secondary to similar disease within the thorax or in other parts of the body, though instances of primary sarcoma and lympho-sarcoma have been recorded. The commonest forms of morbid growths are secondary carcinoma and tubercle, the latter being associated, as a rule, with pericardial tuberculosis. All other growths are extremely rare.

Simple atrophy of the heart may occur in many different diseases, but is devoid of any special clinical significance. Morbid conditions of the cardiac walls are only of clinical importance so far as they lead to interference with the functions of the heart. Lesions of the myocardium, of whatever kind, when they are of sufficient degree and extent, have as their necessary consequence impairment of the heart's contractile power.

Impairment of the heart's contractile power, as shown by cardiac weakness or insufficiency, is the fundamental point from which our diagnosis must start in all myocardial affections.

Dilatation.—As a necessary result of muscular weakness, the walls of the heart yield to the intracardiac blood-pressure, and some or all of the chambers undergo dilatation according to circumstances. Such dilatation must be distinguished from the temporary distention which is the consequence of physiological increase of the heart's work. A rise of tension in the systemic arteries, induced by muscular exertion or other causes, leads to heightened pressure in the left ventricle in the first instance, but this condition soon reacts backward on the left auricle, the pulmonary circulation, and the right heart, the result being a general increase of intracardiac pressure. The moderate distention of the heart induced by physiological causes is unaccompanied by any failure of the circulation, for the

heart is possessed of a remarkable fund of reserve force, which enables it to meet increased demands on its functional activity within very wide limits. When the cause of the increased intracardiac pressure is removed—for example, when violent muscular exercise is discontinued—the heart regains its normal size without any resulting deterioration of its muscular fibers.

Pathological dilatation differs from physiological distention in that it entails some degree of disturbance of the circulation. In this instance the enlarged condition of the cardiac chambers is more or less persistent, the cause being abiding, as in the case of extensive myocardial degeneration or valvular disease; or, if temporary, acting with great intensity—for example, the dilatation due to overstrain of the heart.

The development of pathological dilatation may be associated with gross changes in the muscular tissue of the heart, such as fatty degeneration; but more often no anatomical alteration can be detected. No sharp line of distinction can be drawn between slight degrees of pathological dilatation and physiological distention. Enlargement of the heart's cavities probably represents an exaggeration of the normal state in each case.

Experiments on the healthy living heart have shown that, although the greater part of the ventricular cavity is obliterated during systole, a certain amount of blood always remains in the upper part of the chamber, between the valves and the papillary muscles. When the resistance to the discharge of blood from the left ventricle into the arteries is increased, the amount of this residual blood becomes larger, and the ventricle now contains more blood during diastole as well as systole. When, as commonly happens at first, the quantity of blood poured into the heart from the veins in a given time remains unchanged, the left ventricle at the end of diastole contains the normal quantity received from the auricle and lungs, plus the increased residual blood that remained in the ventricle at the close of the previous systole. Enlargement of the ventricular cavity is, therefore, a necessary consequence.

This diastolic distention may be temporary or persistent. If the reserve force of the cardiac muscle be not exceeded, the quantity of blood discharged

from the ventricle at each systole suffers no important diminution, and no circulatory derangement occurs. When, on the other hand, the mechanical work required of the heart reaches a certain point, which differs widely in individual cases, the limits of the heart's power of accommodation are exceeded. The ventricle can no longer sufficiently empty itself into the arterial system, owing to exhaustion of its muscular fibers, and the amount of blood discharged at each systole falls below the normal. The cardiac walls yield to the internal pressure, and blood gradually accumulates in the distended ventricle, with consecutive dilatation of the left auricle and right heart.

When the engorgement becomes excessive, the muscular fibers of the auriculo-ventricular rings become stretched, the less yielding mitral and tricuspid curtains no longer completely close the dilated orifices, and regurgitation ensues. The immediate effect of dilatation of the left ventricle is seen in incomplete filling of the arteries, owing to the feeble contraction of the muscular walls. This diminution of the driving power of the ventricle is speedily followed by backward congestion, reacting first on the lungs, and subsequently on the right heart and veins of the systemic and portal circulation.

Dilatation of the heart may be due to increased work, or to changes in the muscular walls tending to impair their contractility. The work of the heart may be raised by an increase in the volume of blood which it has to discharge in a given time, or by increased peripheral resistance in the arteries or capillaries.

Hypertrophy is divided into : (1) simple, where the walls are thicker than usual, the size of the cavities remaining unchanged ; (2) concentric, where the size of the heart remains the same, but its walls are increased in thickness and encroach upon the capacity of its chambers ; (3) eccentric, where the heart is both dilated and hypertrophied.

Simple hypertrophy is perhaps found in some cases of renal and other diseases, but eccentric is the condition almost always met with. The existence of concentric hypertrophy is very doubtful. The weight of the heart is probably the best test of hypertrophy that we possess. Increased thickness of the heart's wall is mainly the result of a numerical hypertrophy of the muscular fibers, though a

few have contended for the enlargement of the primitive fibrils.

Hypertrophy may be divided into *true* and *false*. In true hypertrophy the muscular tissue itself is increased, whereas in the false variety the thickening is due to some extent to an adventitious fibrous growth. True hypertrophy : the origin of hypertrophy is to be sought in some increase in the work required of the heart. A rise of arterial pressure representing augmented resistance to the ventricular discharge must therefore tend to produce hypertrophy. Taking the left ventricle as a type, we have seen that increased peripheral resistance in the arteries involves enlargement of this chamber. As the ventricle must now contain a larger amount of blood, more powerful contractions are required to propel its contents ; in other words, the work of the ventricle is increased. Thus it appears that dilatation is indirectly a cause of hypertrophy. Valvular defects also throw extra work on the heart, and are prolific sources of hypertrophy and dilatation.

When a hindrance to the circulation occurs in the systemic arteries and capillaries, or in the aorta itself, the walls of the left ventricle and auricle undergo an increase in thickness. The main causes are : (1) certain valvular diseases ; (2) diseases of the aorta and its branches, involving loss of elasticity of their coats, which may or may not be associated with narrowing or dilatation of their lumen ; (3) diseases of the kidney, especially cirrhosis ; (4) stenosis or coarctation of the aorta at the point of entry of the ductus arteriosus ; (5) general contraction of the arterioles from prolonged muscular exercise or from other causes.

Causes of hypertrophy of the right side of the heart are conditions that occasion obstruction to the pulmonary circulation, or that interfere with the passage of blood through the right heart, viz., certain valvular affections, and chronic diseases of the lungs, *e. g.*, emphysema, cirrhosis, collapse, and phthisis.

The following are doubtful causes : plethora, or an increase in the volume of blood, pregnancy, over-action of the heart from nervous causes, and adherent pericardium (*see* PERICARDITIS). For the development of hypertrophy certain conditions are required in addition to increased work. In the first place, an adequate circulation of healthy blood through the

coronary arteries is of vital importance for the nutrition of the myocardium. In wasting diseases, such as carcinoma and phthisis, the mechanical conditions necessary for the development of hypertrophy may be present without any corresponding increase in thickness of the cardiac walls, owing to the impoverished state of the blood. It is obvious that hypertrophy, once established, will itself tend to promote a more rapid and copious flow of blood through the coronary arteries. Secondly, distention of the heart's cavities must not be too sudden or excessive, the effect of this being seen in a paralytic dilatation of the heart, as is the case in asphyxia.

It being the result of increased demands on the heart's functional activity, it is essentially a conservative process. The strengthening of its muscular power enables the heart to overcome in a greater or less measure the obstacles which have called forth the hypertrophy. Another important and beneficial result of hypertrophy of the cardiac walls consists in an augmented power of resistance to the internal pressure of the blood, which is manifested by a diminution or disappearance of the signs of dilatation. Hypertrophy is therefore fitly described as *compensatory*.

Hypertrophy may be sufficient or insufficient, but is never excessive. The functional effects of dilatation and hypertrophy are combined with certain changes in the heart itself. Dilatation frequently causes thrombosis in the different chambers owing to the slowing of the circulation. Cardiac thrombi sometimes attain a considerable size, and may give rise to mechanical interference with the bloodstream. More frequently, by detachment of fragments, they afford materials for the production of embolism in other organs. Thrombosis of the right heart is a common source of pulmonary embolism. Fibrinous emboli derived from the left side of the heart may become impacted in the arteries of distant organs, such as the brain, kidneys, spleen, or even of the heart itself. See EMBOLISM and FIBROID DISEASE OF THE HEART.

The high pressure which prevails in dilated and hypertrophied hearts leads, in course of time, to more or less fibrous thickening of the valves, papillary muscles, chordæ tendinæ and endocardium, both sides of the heart or only one side being

involved, according to circumstances. Degenerative changes in the muscular walls are probable; parts like the left ventricle, with its papillary muscles, which are most liable to high pressure and whose functional activity is greatest, showing a special tendency to undergo these changes.

Owing to its increased size and weight, the heart is apt to fall downward and take up a more transverse position, depressing the diaphragm, and interfering with the free action of this important muscle. Respiration is further impeded by the encroachment of the enlarged heart on the intra-thoracic space. Emphysema of the anterior margin of the lungs is not uncommon in such cases, and is partly the result of concomitant bronchitis, but is also to some extent to be regarded as compensatory.

The influence of hypertrophy is also shown by alterations in the vessels, especially in the arteries. Thus hypertrophy of the left ventricle, of long standing, may cause endarteritis of the aorta and its branches in consequence of the strain to which they are exposed by the powerful stroke of the ventricle. A similar condition may also be observed in the pulmonary artery when it is subjected to very high pressure from hypertrophy of the right ventricle.

Symptoms and course.—The symptoms of myocardial lesions depend on derangement of the heart and peripheral circulation. Dyspnœa, palpitation, a sense of constriction, pressure, uneasiness or actual pain in the region of the heart are often complained of. At times such symptoms as headache, drowsiness, apathy, giddiness, flatulence, epigastric pain or weight after food, nausea, vomiting, constipation, diarrhea, and hemorrhoids, depending on venous stasis of the cerebral or gastro-intestinal vessels, so engross the attention of the patient that he omits all mention of the more characteristic cardiac symptoms. Varying degrees of cyanosis and dropsy are seen in different cases. While it may be said that no single symptom is pathognomonic, the association of dyspnœa and palpitation with signs of venous congestion and dropsy is very significant of the existence of cardiac failure, though no information is thereby afforded as to whether the disturbance of the circulation is primarily cardiac.

Dyspnœa.—Of the symptoms enumerated dyspnœa furnishes the most constant and important information as to the functional activity of the heart. It may be defined as increased action of the muscles of respiration, whether as regards frequency or degree of contraction. This symptom is described in different terms by patients. Some complain of a difficulty or tightness of breathing. Others that they have no difficulty in the mechanical performance of respiration, but their utmost efforts fail to remove the distressing sensation of shortness or want of breath.

Dyspnœa may be either inspiratory or expiratory, according as it is mainly manifested by the muscles of inspiration or expiration; or it may be both. Inspiratory dyspnœa is characteristic of obstruction of the larynx and trachea. The dyspnœa of bronchial asthma is typically expiratory. Cardiac dyspnœa, on the other hand, is both inspiratory and expiratory.

The *pathology* of cardiac dyspnœa is not simple. An excess of carbonic acid or a deficiency of oxygen in the blood, the two being for the most part combined, provokes increased action of the respiratory muscles. This effect is partly the result of stimulation of the respiratory center in the medulla oblongata by the altered blood, but another influence is probably also concerned. The asphyxial state of the blood at the same time excites the vasomotor center, the effect of which is seen in contraction of the small arteries throughout the body and in a rise of blood pressure. Recent experiments have shown that increased tension in the systemic arteries, in whatever manner produced, is invariably followed by a rise of pressure not only in the left side of the heart, but also in the pulmonary circulation and right heart, and that when the tension in the pulmonary vessels is raised the lungs swell up and become more rigid. In virtue of this change increased efforts on the part of the muscles of respiration are required to produce the requisite degree of expansion. This rigidity of the lungs is due to an erection depending on distention of the capillaries, which unfolds the alveolar walls, and thereby enlarges the lumen of the air sacs. This condition, if long continued, may lead to vesicular emphysema.

Dyspnœa, or the increased activity of the respiratory muscles, is thus explained to be the result of vascular turgescence on the part of the lung. This view is applicable not only to cases of high arterial tension, but also to the opposite condition, in which the blood-pressure is lowered as a result of weakness or insufficiency of the left ventricle, for in the latter event the dilatation of the ventricle allows the blood to collect in its cavity, and must have the effect of inducing a backward congestion of the pulmonary vessels and right heart. Pulmonary engorgement is a result common to widely different affections of the heart, and may be regarded as the main element in the production of cardiac dyspnœa in virtue of a twofold action; (1) direct, on the lung, producing alveolar erection and rigidity; (2) indirect, on the respiratory center, through the influence of asphyxial blood.

The dyspnœa may be due to other causes. Any diminution of the aërating surface of the lung, by its interference with the diffusion of gases in the blood of the pulmonary capillaries, will cooperate in producing dyspnœa, owing to the stimulating effect of the altered blood on the respiratory center. Thus, pleural effusions compressing the lung, consolidation, collapse or œdema of the lung, bronchitis and emphysema are all efficient causes, and may complicate any case of heart disease, but in such conditions the dyspnœa is no longer purely cardiac.

In some, dyspnœa is objective—that is to say, the activity of respiration is increased, although the patient perhaps makes no complaint on this score. At other times shortness of breath is a prominent complaint, and here, as a rule, the dyspnœa is considerable. For patients do not commonly complain of this symptom until it becomes pronounced. It is important to determine whether dyspnœa occurs as the result of exertion, change of posture, excitement, indigestion of food, or other definite external influences, or whether its development is apparently spontaneous. If the former, its development on relatively slight provocation argues a certain degree of cardiac insufficiency which may not be incompatible with fair health, if the causes of dyspnœa can be avoided. On the other hand, spontaneous dyspnœa is a

sign of more serious impairment of the heart's functional capacity.

Dyspnœa, though a most valuable symptom, cannot alone be trusted to as a reliable indication of failure of the heart, for muscular exertion may occasion dyspnœa and increased rapidity of the pulse in cases of cardiac enlargement where dilatation is satisfactorily compensated by hypertrophy. The development of dyspnœa on relatively slight provocation should, however, lead us to suspect that rupture of compensation has commenced. But the determination of the precise period at which failure commences is rarely possible, owing to the gradual manner in which the transition is effected. Signs of stasis in the lungs and portal system are among the earliest indications of insufficiency of the heart.

Orthopnœa is the condition in which the patient is compelled to sit upright. The relief obtained by this means is due to more than one cause. In consequence of the erect position, the liver and abdominal viscera sink downward, owing to the force of gravity, and the inspiratory descent of the diaphragm is thereby facilitated. Moreover, the vertical position impedes the flow of blood from the vena cava inferior into the heart, and reduces the engorgement of the right heart and pulmonary vessels. Again, when the patient sits up, the accessory muscles of respiration can act more freely, and are less hampered by friction. Orthopnœa is a more favorable symptom than the apathetic state in which some cardiac patients sink down in bed, for the former posture argues a degree of vigor which is wanting in the latter case.

Paroxysmal attacks of dyspnœa or **cardiac asthma** are comparatively uncommon, and are not specially characteristic of any particular form of heart disease.

Palpitation is a subjective sensation, and possesses less diagnostic value than dyspnœa. When the patient is conscious of the heart's pulsation he is said to have palpitation. The sense of palpitation may be combined with violent action of the heart, that can be recognized by the physician, but at other times no external evidence of cardiac disturbance can be discovered. Moreover, the forcible pulsations of a greatly enlarged heart are often unassociated with any subjective sensations on the part of the patient.

The pulse is usually, but not invariably, increased in frequency, and the rhythm of the heart's action is generally to some extent deranged.

Palpitation is of common occurrence in all organic affections of the heart, especially when failure is threatened or actually established, but it is also a common symptom in cases where there is reason to believe that the heart is healthy. In either case the sensation is always more or less paroxysmal in character. Emotional, gastro-intestinal, uterine, and other impressions may cause palpitation in a reflex manner. Palpitation in organic affections is, generally speaking, a sign of cardiac debility, and in case of severe dilatation it may be an expression of disordered action of the cardiac ganglia, in consequence of the stretching to which the muscular parietes are subjected. A sense of palpitation is at times connected with attacks of extremely rapid action of the heart, the pulse rising as high as 200, an uncommon affection known as "tachycardia." No constant relation exists between palpitation and dyspnœa.

Pain.—Sudden paroxysmal attacks of agonizing pain in the region of the heart, associated with a sense of impending death, and with other symptoms, may complicate various affections of the heart (*see* ANGINA PECTORIS). Apart from anginal attacks, cardiac patients seldom suffer from severe pain, though a sense of oppression or pressure about the heart is common. When præcordial pain is present it is apt to radiate to the arms, and especially to the left arm.

Rheumatic pains about the chest are sometimes incorrectly referred to the heart. In some cases there is marked tenderness on pressure or percussion, over the whole cardiac area, but localized painful spots may be sometimes discovered. Whether these tender points are really due to any lesion of the cardiac nerves is very doubtful. In some instances the pain and tenderness appear to be very superficial, and to depend on some affection of the intercostal nerves.

Pulse.—The pulse of dilatation and cardiac insufficiency is weak, small, frequent, and generally of low tension, these characters being developed at an earlier date than when the left ventricle is primarily affected. The presence of extensive arterial degeneration or chronic renal disease may modify the pulse of dilatation,

a relatively high arterial tension persisting even when the cardiac debility is considerable. When dilatation is more or less compensated by hypertrophy, the pulse may give no indication of disease. The rapidity of the pulse, speaking generally, is increased on all cases, though exceptions to this rule are not wanting. In the terminal stages a frequent pulse is almost invariable.

Cardiac rhythm.—In most cases of cardiac insufficiency the heart and pulse exhibit some degree of irregularity in the force and volume of the individual beats, as well as in the intervals separating them.

Curious modifications of the heart's rhythm are sometimes noticed. In one form the beats run in pairs in regular succession, the second beat being usually weaker than the first, and being followed by a longer interval. The second weaker beat may fail to reach the wrist altogether, and what was at first regarded as a very infrequent pulse, proves, on auscultation of the heart, to represent only half the number of contractions of the ventricle. At times a triple rhythm occurs where three beats follow each other at regular intervals, and are then succeeded by a pause. To these and other perversions of rhythm the term *allorhythmia* has been applied. Allorhythmia and arrhythmia have been ascribed to derangement of the intrinsic nerve apparatus of the heart, but the possibility of the nervous affection being central, in some cases where no other evidence of cardiac disorder is present, must not be lost sight of.

The occurrence of arrhythmia or allorhythmia is of bad omen, and is significant of profound dilatation, with or without structural changes in the myocardium, the irregularity being due possibly to disordered action of the intracardiac nerve ganglia, consequent upon stretching of the muscular walls. This statement, however, must be made with considerable reservation, as cases of extreme cardiac failure may run a fatal course without any important alterations of the heart's rhythm, and, on the other hand, a considerable degree of arrhythmia or allorhythmia is not incompatible with complete integrity of the heart. The action of certain drugs, especially digitalis, must be mentioned as a relatively common cause of perverted cardiac rhythm.

Patients suffering from severe dilatation

and insufficiency of the heart sooner or later present signs of **Venous Congestion and Dropsy**. The skin of the face and extremities becomes livid and cyanosed, the veins of the neck are distended and exhibit slight oscillations, or even systolic pulsation, in cases where tricuspid incompetence has developed.

The effects of venous stasis are felt at an early date by the lungs and abdominal viscera.

Lungs.—Passive congestion of the lungs is one of the first consequences of cardiac insufficiency, and is manifested by symptoms of which dyspnœa is the chief. Accentuation of the second sound in the pulmonary artery is regarded as a valuable sign of high pressure in the vessels of the lungs, but it must be remembered that it also shows that the vigor of the right ventricle is not seriously impaired. For when failure of this chamber occurs, the accentuation of the second sound may disappear, although the pulmonary stasis is as great as ever.

Congestion of the vessels is very apt to lead to serous transudation into the air sacs, which greatly aggravates the existing dyspnœa.

The pathology of *œdema of the lungs* is not altogether clear. Slight degrees of pulmonary œdema may be quickly recovered from, but the presence of this complication is to be regarded as a grave symptom, partly as showing the existence of serious mechanical hindrance to the circulation, and partly on account of the restriction of the aërating surface of the lung which it involves.

Liver.—The low pressure at which the blood of the portal vein enters the liver explains the great tendency to passive congestion and enlargement displayed by this organ in response to any condition that impedes the entry of blood into the right auricle. When cardio-pulmonary stasis occurs the liver speedily becomes enlarged and tender, and, if there be leakage at the tricuspid orifice, expansile hepatic pulsation may be detected. Inasmuch as prolonged passive congestion is wont to cause induration and contraction, an enlarged liver may gradually decrease in size, although the venous stasis persists, and the typical nutmeg change, or congestive atrophy of the liver, is then developed. This condition of the liver may be accompanied by a slight degree of jaundice, owing probably to passive duodenal

catarrh. It is important to remember this fact, lest the gradual diminution of hepatic enlargement should give a wrong impression.

Spleen.—Enlargement of this organ can sometimes be recognized by palpation, but in the latter stages the spleen is usually contracted.

Kidneys.—Congestion of the kidneys is shown by the excretion of scanty, high-colored urine of high specific gravity, containing a small quantity of albumen, and often depositing copious urates on standing. Hyaline casts may occasionally be detected on microscopical examination.

Dropsy of the subcutaneous tissue, beginning in the lower extremities, but involving at an early date parts, like the scrotum and eyelids, where the skin is lax, is often followed, and is occasionally preceded by transudation into serous cavities, such as the pleura or peritoneum. Dropsy of the pericardium is much less common, and is generally developed at a later stage.

The pathology of cardiac dropsy cannot be said to be satisfactorily explained by increased pressure in the veins alone, though this is undoubtedly an important factor. It is probable that a direct influence must be attributed to alterations in the chemical composition of the blood, dependent on the malnutrition of cardiac disease.

Physical examination of the heart.—The physical signs of dilatation and hypertrophy may be very pronounced, but from various causes this is by no means invariably the case. The most reliable information is derived from palpation and percussion.

When hypertrophy is well marked, the præcordial region may show evident bulging, and the heart's pulsations may be unduly visible. Palpation shows that the impulse is forcible, heaving, and often diffused.

When dilatation preponderates over hypertrophy the impulse is weak, undulating, or impalpable. The præcordial dullness is increased in cases of enlargement of the heart, whether this be due to hypertrophy or dilatation.

In the examination of the heart gentle percussion which determines the area of absolute cardiac dullness—*i. e.*, the extent of the heart's surface uncovered by lung—gives better results than attempts to

map out the actual size of the organ by forcible percussion. A careful cultivation of the sense of resistance, coupled with light percussion, is of the utmost importance in estimating slight degrees of cardiac enlargement. The elasticity of the sternum, and its tendency to conduct vibrations to the neighboring parts of the lungs, are so great that at times we may feel the pulsations of an hypertrophied right ventricle beneath this bone, and may yet be unable to detect any corresponding dullness on percussion. If, in such cases, the left hand be firmly pressed on the upper part of the sternum, while percussion is made on the first finger placed over the lower end, we may sometimes succeed in damping the vibrations of the sternum, and in eliciting the dullness of the subjacent heart. Emphysema of the lungs and retraction of their anterior margins are also sources of error, and the presence of these conditions must be carefully taken into account.

In the presence of emphysema, extensive cardiac enlargement may be entirely masked by the resonance of the distended lungs overlapping the heart. Retraction of the edge of the lungs, more particularly the left, uncovering the heart, is very common in cases of chronic phthisis, and may simulate cardiac hypertrophy and dilatation, owing to the increased surface of the heart brought into contact with the chest-wall.

The existence of auscultatory signs of phthisis in the corresponding lung, with evidence of flattening and impaired movement of that side of the chest, will generally prevent mistakes. At times the heart is evidently dislocated to one or other side, and no actual increase in the area of præcordial dullness exists. When, as sometimes happens, retraction of the lung occurs without falling in of the thoracic walls, difficulties are more likely to arise. In such cases the absence of the symptoms and consequences of cardiac disease will point to the conclusion that the enlargement of the heart is only apparent.

Auscultation usually gives little assistance in the diagnosis of hypertrophy and dilatation, except in a negative way, though the absence of characteristic murmurs in a case of enlargement of the heart is of much importance, as tending to show that the efficiency of the valves is unaffected. It will be seen, in the section on

diseases of the valves, that the complete absence of murmurs is not incompatible with the presence of a valvular lesion under certain circumstances, but speaking generally, the fact that no murmur is audible has the significance above stated. At times the ear may detect the impulse of a large weak heart, which is scarcely to be recognized by palpation, and here auscultation (with a rigid stethoscope) possesses a direct value. The sounds of an hypertrophied heart are clear and distinctly audible, but the first sound is apt to be somewhat duller than usual.

When dilatation predominates, the first sound is shorter, sharper, and of higher pitch than in health, and resembles the normal second sound. The second sound is not altered in either condition, except as the result of increased tension in the aorta or pulmonary artery.

Physical Signs of Enlargement of the Left Ventricle.—The apex beat is displaced downward and to the left, and the cardiac dullness is increased in the same direction—that is to say, in its longitudinal or oblique axis. With hypertrophy the apex beat is strong and heaving, whereas the impulse of a dilated heart is weak and diffused, or may be quite imperceptible.

In hypertrophy of the left ventricle the heart sounds are louder at the apex than over the right ventricle.

Physical Signs of Enlargement of the Right Ventricle.—The apex beat is in the normal position, or slightly displaced outward. The cardiac dullness is increased to the right, and not infrequently somewhat to the left also. Hypertrophy is shown by forcible pulsation over the lower end of the sternum and in the epigastrium, the heart sounds being louder over the right ventricle than at the apex.

Extreme dilatation of the ventricles may lead to incompetence of the auriculo-ventricular valves, hence a systolic murmur in the mitral or tricuspid area is not uncommonly developed in cases of severe dilatation.

If the patient should come under observation at this stage, it may be impossible at first to decide whether the valvular incompetence is absolute or relative—that is to say, whether it is due to structural changes in the curtains, or to simple dilatation of the orifice. The course of the disease will often solve the question. Great variations of intensity, or still more,

a complete disappearance of the murmur as the heart's power is gradually restored, point to a relative incompetence of the valve.

The coexistence of a marked degree of enlargement with a weak, small pulse, that cannot be accounted for by any valvular defect or other mechanical impediment, is very significant of dilatation. Disappearance of the apex beat points in the same direction if the existence of emphysema and pericardial effusion can be excluded.

Dilatation and hypertrophy are always associated in varying proportions, and when we speak clinically of hypertrophy or dilatation being present, we mean that one of these conditions predominates. The existence of enlargement of the heart without disturbance of the circulation argues hypertrophy; enlargement with evidence of circulatory derangement implies dilatation.

PERCY KIDD.

Symptomatic Indications.—The principal remedy in dilatation is *digitalis*, particularly where there is much dilatation, without valvular disease, irregular pulse. *Veratrum viride* is valuable in hypertrophy with dilatation. *Arsenicum iod.*, in hypertrophy with dilatation, will do good service, especially when severe and violent palpitations, anxiety, asthma, and dry cough are present. *Cactus grand.* in hypertrophy with enlargement, is frequently useful, particularly when constricted pain, as though the heart was grasped, is present. Hypertrophy from rheumatic inflammation may require *aconite*.

HEART, FATTY DISEASE OF.—

Includes two different forms.

I. Fatty Degeneration of the Heart.—

Symptoms and diagnosis.—The symptoms are very uncertain; indeed, this affection can only be suspected when it gives rise to dilatation and insufficiency of the heart; consequently dyspnoea, palpitation, a small, irregular pulse, and other symptoms of dilatation are the first indications.

Extensive fatty degeneration may exist without giving rise to any disturbance of the heart's functions, and there is no essential relation between a fatty change and cardiac derangement. In the absence of signs of dilatation it is quite impossible to diagnose fatty degeneration of the heart.

The presence of conditions that are known to predispose to fatty degeneration may suggest the possibility of the lesion being present in a case characterized by dilatation and weak action of the heart, but it is seldom feasible to arrive at more than a probable diagnosis. A pulse falling to 50 or even lower, attacks of angina pectoris and cardiac asthma, Cheyne-Stokes' respiration, a tendency to syncope and sudden death, may be occasionally met with, but these symptoms are not especially characteristic of this condition, and possess only a relative value. The existence of arcus senilis is no longer believed to have any special relation to fatty changes in the heart.

Pathology.—It is customary to distinguish various forms of degeneration—parenchymatous, granular, and fatty—but it is probable that these are only different stages of one and the same process.

The morbid change in each instance consists in a transformation of the protoplasm of the muscular fibers, which lose their normal striation in varying degrees, the muscle fibers and nuclei becoming filled with albuminous and fatty granules.

Parenchymatous degeneration of the myocardium may exhibit all stages, from a mere reddish gray discoloration, or "cloudy swelling," to an advanced condition of fatty degeneration, in which the substance of the heart is soft and yellowish, and exudes an oily fluid on pressure. In the common forms of fatty degeneration the deeper or subendocardial layers of the muscular tissue are marked with small yellowish patches and lines, the change being usually most pronounced in the case of the muscoli papillares and trabeculæ of the ventricles, though a similar condition may be widely diffused through the heart's substance.

Slight degrees of fatty degeneration are probably capable of complete removal, but our knowledge of the extent to which repair is possible in this and allied conditions is mainly conjectural. Fatty degeneration occasionally leads to rupture of the heart and to fatal hemorrhage into the pericardium, the left ventricle being nearly always the seat of spontaneous rupture.

Ætiology.—The cause is to be sought in a deficient supply of duly oxygenated blood to the muscular tissue of the heart. This may be the result of changes in the

blood, as in anæmia (especially "pernicious" anæmia), phosphorus poisoning, specific fevers, the puerperal state, and long-continued pyrexia of any kind, or of any condition that interferes with the circulation through the coronary or nutrient arteries of the heart. Defective coronary circulation may be caused either by local obstruction or by failure of the heart's driving power. Thus, fatty degeneration may be the consequence of atheroma of the root of the aorta, involving the orifices of the coronary arteries, as well as of similar disease of these vessels themselves, or again it may be due to cardiac insufficiency resulting from any cause. It may lead to dilatation, and therefore indirectly to hypertrophy, but more often cardiac enlargement is the primary condition, and granulo-fatty changes are only secondary effects. It has no connection with general obesity.

II. Fatty Infiltration or deposit consists in an overgrowth of the subpericardial fat, which is normally most abundant along the auriculo-ventricular sulci, and in the course of the larger branches of the coronary arteries, over the right ventricle and at the apex of the heart.

Symptoms.—Practically the same as those of fatty degeneration, and depend upon the degree of dilatation and cardiac insufficiency present in individual cases. Attacks of angina and cardiac asthma may occur in this form of fatty heart. It is doubtful how far dyspnœa is due to the condition of the heart in cases where little evidence of cardiac dilatation exists. It is probable that a tendency to shortness of breath is a direct consequence of obesity, extra work being thrown upon the heart by the great increase of bodily weight. The occurrence of hypertrophy in fat persons may be thus explained in uncomplicated cases, but obesity is apt to be associated with other conditions which are known to cause hypertrophy, such as chronic renal disease, arterio-sclerosis, or degenerative changes in the heart's muscle.

Diagnosis is more uncertain than that of fatty degeneration. It may be suspected in a fat person with a weak dilated heart. Physical examination is often greatly impeded in such cases, especially in women in whom the excessive development of the panniculus adiposus and of the mammary gland may render accurate percussion almost impossible. The position of the apex beat may assist in the

determination of cardiac enlargement. Such cases occasionally terminate with the usual symptoms of dilatation and cardiac failure, or the patient may die suddenly from syncope.

Pathology.—The heart is buried in an envelope of fat, and the muscular substance seems to be thinned out and encroached upon by the adipose growth, which may extend deeply into the wall of the heart between the muscular fibers. Microscopical examination reveals a fatty infiltration in the form of large oil globules separating the muscular fibers, these latter showing little or no qualitative change. The atrophy of the muscular wall has been attributed to the pressure of the fatty covering, but there can be little doubt that the muscular atrophy is not the result of the fatty growth. It is possible that the muscular change is the primary one, and is followed by an overgrowth of fat, just as in the case of the voluntary muscles in pseudo-hypertrophic muscular paralysis. On the other hand both changes may be the result of a common cause.

Ætiology.—It is commonly an expression of general obesity, but at times an accumulation of fat on the surface, and in the substance of the heart, occurs in wasting disease like cancer and phthisis. Many fat people suffering from cardiac symptoms, and thought to be the subjects of "fatty heart," are found on post-mortem inspection to have greatly dilated and hypertrophied hearts without any excessive development of fat. It is not unusual to discover an excessive degree of fatty overgrowth on making a post-mortem examination in cases where no cardiac symptoms whatever were manifested during the patient's lifetime. It is a moot point whether plethora, resulting from excessive ingestion of food, is or is not to be credited with some influence in the production of cardiac hypertrophy in cases of this description.

The *prognosis* of both forms of fatty heart turns on the pathology of the individual case. When the cause can be removed, as in some forms of anæmia and obesity, recovery is possible. When degenerative changes depend on local vascular causes we cannot expect to repair, but when cardiac failure is the efficient cause of degeneration, considerable relief may be obtained if the contractibility of the cardiac muscle can be restored.

Treatment of both forms of fatty heart is that of cardiac disease in general, and consists in the administration of digitalis, strophanthus, strychnine, ether, and other cardiac tonics, with a moderate amount of alcohol, rest, and a light, nutritious diet. Direct treatment by means of drugs is only required when signs of cardiac failure are present. When these symptoms have disappeared or have been mitigated, endeavor to improve the nutrition of the cardiac muscle by cautious and gentle bodily exercise. Special attention must be paid to the regular evacuation of the bowels.

Where obesity exists, treatment must be judiciously directed to the reduction of this condition, and should include a regulation of the diet, gentle and regular exercise, and other suitable measures. In all cases of this description a rational general treatment is of the first importance. The patient should lead a quiet, regular life, and should be warned to avoid excitement and sudden exertion as far as possible. Moderation in the use of alcohol and tobacco must be insisted upon.

PERCY KIDD.

Symptomatic Indications.—The principal remedies in this condition are *digitalis*, *ferrum*, *arsenicum*, *phosphorus*, and *arnica*, according to indications given under the different headings.

HEART, FIBROID DISEASES OF (includes Cardiac Aneurism, Chronic Myocarditis, Fibrous Transformation).—A fibrous change in the walls of the heart, either diffused or circumscribed, the latter variety often leading to the formation of a cardiac aneurism.

The *symptoms* of this affection are almost as uncertain as those of "fatty heart." It has been demonstrated that a considerable degree of fibrous transformation of the heart's muscle is not incompatible with perfect functional activity of the organ. But cases of serious dilatation and insufficiency have been recorded, in which limited fibroid disease of the ventricle was the only morbid change discovered to account for the cardiac failure.

The positive symptoms of cirrhotic changes in the myocardium are those of cardiac affections in general—dyspnœa, palpitation, a sense of constriction, signs of passive congestion of the lungs, abdominal viscera, and systemic veins, with

or without dropsy. The immediate cause of these symptoms is to be found in dilatation and insufficiency of the heart. In addition to the above signs of disturbance of the circulation, common to all organic affections of the heart, there are certain symptoms that have been more particularly connected with fibroid disease. Attacks of cardiac asthma and of angina pectoris, a tendency to syncope, and a marked slowing of the pulse, which may fall to 30, or even lower, have been noted in some cases. Marked irregularity of the force and rhythm of the pulse is commonly present, especially where dilatation exists. Ruehle attributes the arrhythmia to the failure of the left ventricle, which is the chamber usually affected with fibroid disease. Rigel maintains that arrhythmia may often be present before any symptom of insufficiency has arisen, and also that when dilatation and failure of the heart have yielded to treatment, arrhythmia may, nevertheless, persist as the sole cardiac symptom, and in such cases is almost a pathognomonic sign. Arrhythmia is a common symptom in cardiac dilatation from whatever cause, and when once developed, no special diagnostic value can be attached to its presence.

Aneurisms of the heart frequently form as the result of circumscribed fibroid disease, and may rupture into the pericardial cavity and cause sudden death; or they may open up communication between the various chambers of the heart, and occasion more or less disturbance of the circulation; but it is doubtful whether they are ever accompanied by any special symptoms that enable us to recognize their presence.

One of the most clearly established clinical characteristics of fibroid disease is the fact that death is very apt to occur in a sudden, apoplectiform manner, not only in cases with actual cardiac symptoms, but in persons that were apparently in perfect health. It is not improbable that the sudden end of patients suffering from fibroid disease is due, in some cases, to an attack of angina pectoris. The frequency with which lesions of the coronary arteries are found in both affections lends some support to this view.

In exceptional cases sudden death has been the result either of rupture of the heart, an event especially likely to happen when cardiac aneurism exists, or of em-

bolism of one of the main coronary arteries, the latter condition being exactly analogous to ligature of one of the coronary arteries, which speedily leads to permanent diastolic arrest of the heart's action. Cases of cardiac cirrhosis may terminate suddenly with embolism of the brain, or death may occur with the ordinary symptoms of cardiac failure, asthenia, venous stasis, and dropsy.

Diagnosis.—It is very doubtful whether it is possible to distinguish this affection from other forms of myocardial disease. In a given case of dilatation and hypertrophy of the heart, associated with generalized atheroma of the arteries, the presence of fibroid disease may be suspected when extrinsic causes of cardiac enlargement can be excluded. Evidence of past syphilis strengthens this suspicion. But when efficient causes of hypertrophy and dilatation, such as lesions of the valves or renal disease coexist, the diagnosis of fibrous changes in the heart is impossible. When dilatation gives rise to relative incompetence of the auriculo-ventricular valves, with a systolic mitral, or tricuspid, murmur, the existence of fibroid disease may be overlooked, and the state of the heart attributed to a primary affection of the valves. The diagnosis of cardiac aneurism can rarely be more than conjectural.

Pathology.—Fibroid disease of the heart may be either **diffused** or **circumscribed**. The former variety, described as as connective tissue hypertrophy, occurs in dilated and hypertrophied hearts, the thickening being due to a diffuse overgrowth of the perimysium. Great distention of the cavities of the heart must impede the return of blood by the coronary veins, and passive congestion of the viscera is known to lead to a certain degree of fibrous thickening. A diffuse intermuscular growth of connective tissue would have the effect of interfering with the heart's contraction, and would predispose to dilatation.

In the **circumscribed** form, patches of whitish, tough, fibrous tissue are found in the myocardium, especially at the apex, but they may be met within other parts of the left ventricle. When the right ventricle is affected, the disease commonly appears to have spread from the left ventricle. These patches may involve the whole thickness of the cardiac wall, but not unfrequently they are most marked in the

middle layers of the myocardium. Occasionally they are imbedded in the muscular tissue, and are only discovered on making sections of the heart's wall.

Fibrous thickening of the papillary muscles and endocardium is very common in all cases of high intracardiac pressure, but this condition must not be confounded with the present affection.

Microscopically examined, these patches consist of a dense fibrous tissue which is very poorly supplied with nuclei, though small areas of cellular infiltration may be seen in places, especially toward the margins. Muscular fibers are generally absent where the sclerotic process is most advanced, but a few isolated atrophic fibers, remains of blood pigment, or extravasated blood corpuscles, may be sometimes recognized among the scarlike tissue.

A varying degree of thickening of the perimysium is usually present at the margins of fibrous tracts, and may extend widely beyond the primary seat of disease. The intervening muscular tissue, as a rule, presents a healthy appearance, though some few fibers may exhibit granulo-fatty degeneration. Where the walls of the heart have undergone this transformation, they are usually somewhat thinned out, the fibrous parts being depressed below the level of the surrounding muscular tissue. The effects of this change on the functional activity of the heart vary considerably. When the cirrhosis is limited and of slight degree, it may give no evidence of its presence; but a more extensive transformation of the myocardium frequently causes a marked degree of general dilatation and hypertrophy, the former as a rule predominating. The occurrence of general dilatation is to be explained partly by the extension of the cirrhotic change beyond the confines of the primary disease, and partly by the interference with the intrinsic nerve structures which the fibrous growth involves.

In certain cases the cirrhotic tissue gradually yields at some point to the internal pressure of the blood, and a partial dilatation or **aneurism of the heart** is produced. This represents the usual method of development of cardiac aneurisms.

Circumscribed thickening and adhesion of the pericardium are very commonly met with. The pericardial cavity

may be entirely obliterated, but in general the adhesion and thickening attain their highest development over the fibroid area, and are usually confined to this point. Thrombosis is extremely common, and is usually limited to the portion of the ventricle corresponding to the myocardial disease.

Fibrous induration of the myocardium may be a sequel of pericarditis or endocarditis, the inflammatory process being propagated directly to the muscular substance. In such cases, which merit the term **chronic myocarditis**, the morbid process is always more or less limited to the subpericardial or subendocardial layers, and does not give rise to the extensive cirrhotic changes that have just been described.

Recent observations have shown that in many, probably in most, cases, fibroid induration or degeneration is closely associated with **obstruction of the coronary arteries**. The vascular obstruction may be partial or complete, and may involve one of the main coronary arteries or may be confined to one of their finer twigs. Moreover, owing to the great frequency with which atheroma attacks the root of the aorta, the orifices of the coronary arteries are very liable to become obstructed. Narrowing of these vessels, whether it be due to arterio-sclerosis, endarteritis obliterans, thrombosis, or embolism, causes anæmia and necrosis of the muscular bundles supplied by the corresponding arterial branch. When the occlusion is sudden and complete—an event more likely to occur in the case of embolism—infarction and coagulative necrosis of the myocardium may be followed by rapid softening and rupture of the heart's wall. In other instances a reactive hyperplasia of the connective tissue is produced. In the more ordinary form, where obstruction is gradual, atrophy of the muscular substance is also associated with fibrous changes. It is sometimes difficult to decide whether the connective tissue found in the cardiac wall is the result of a new formation or represents merely the normal interstitial framework stripped of the proper muscular elements; but the relative proportions of muscular atrophy and fibrous development are liable in all probability to considerable variations. In either case, however, the primary lesion is a vascular one, necrosis or atrophy being

followed by a species of secondary scar formation. This process is strictly analogous to the development of cicatrices in the kidney as the result of infarction.

Fibrous transformation, however, is not an invariable result of narrowing of the coronary arteries, for this condition may induce a fatty degeneration of the muscular tissue, and in some cases is followed by no definite change whatever. These different results possibly depend on the degree of obstruction, as well as on the amount of collateral circulation that is developed. We know that the larger branches of the coronary arteries do not inosculate, but the result of injections shows that a considerable degree of anastomosis nevertheless exists; and this is probably affected by communications between the finer arterial branches. Complete occlusion of the coronary arteries, unless collateral circulation be speedily effected, leads to necrosis, with its results, softening or cicatrization. When obstruction is incomplete, the effects are more uncertain. Slight degrees of narrowing may have no injurious effects, whereas further restriction of the circulation may give rise to granulo-fatty degeneration, or to atrophy, necrosis, and fibrous changes.

The predilection shown by fibrous transformation for the apex and neighboring parts of the ventricles—*i. e.*, the distal points of the coronary circulation—the special liability to disease of the middle layers of the myocardium; the limited distribution of the change, and lastly, the frequent association with disease of the coronary arteries, accord better with the theory of a vascular origin than with the hypothesis of a primary inflammation or chronic myocarditis. The fact that pericardial adhesions are so often strictly confined to the area of the fibroid patch is also opposed to the notion that the lesion is primarily pericardial. The *ætiology* of fibroid disease is to a large extent the same as that of affections of the coronary arteries and of arterio-sclerosis in general.

Diffuse atheroma is known to be related to gout, syphilis, alcoholism, excessive muscular work and senile changes. The male sex is specially liable to arterial degeneration, and also to fibroid disease. Syphilitic gummata have occasionally been found in the heart's walls, and possibly some of the comparatively

rare cases of chronic interstitial myocarditis may represent sequelæ of gummatous processes. Endarteritis obliterans of the coronary arteries has been ascribed to syphilis.

Treatment.—Same as cardiac disease in general. (See FATTY DEGENERATION OF HEART.) When insufficiency of the heart is pronounced, digitalis should be given cautiously; but the effect of this drug must be carefully watched, as it sometimes increases the irregularity of the pulse.

When the pulse is very infrequent, digitalis is contra-indicated. Other cardiac stimulants, such as ether, ammonia, strychnine, alcohol, are sometimes of more service than digitalis, and may be more safely administered. A course of iodide of potassium should be tried if the patient has suffered from syphilis.

Anginal attacks must be treated similarly to ANGINA PECTORIS (*q. v.*).

Cardiac asthma is often benefited by stimulant remedies like ether and ammonia, but at times injections of morphine alone give relief.

PERCY KIDD.

Symptomatic Indications.—*Aconite* is valuable in diminishing excitement and irritability, particularly when attended with anxiety, restlessness, and fear of death. *Cactus* is useful in all overactions, and cardiac spasms, sensation as if the heart were tightly grasped, or compressed by a band of iron. *Digitalis* for irregular pulse, dilatation, hypertrophy, weak action. *Cimicifuga* often renders good service in fatty degeneration and in fibroid degeneration. It is stimulating and tonic in its effects, relieving cardiac dyspnoea when from weakness of the heart. *Spongia* may be useful to relieve sense of suffocation.

HEART, HYPERTROPHY AND DILATATION OF, FROM OVER-STRAIN.—The hearts of stags that have been hunted are often found to be enormously hypertrophied, and similar observations have been made in the case of racehorses. Research has shown that the human heart is also liable to hypertrophy and dilatation under analogous conditions.

Instances of marked insufficiency of the heart, presenting the usual signs of hypertrophy and dilatation, are frequently met with, in which none of the ordi-

nary causes of cardiac enlargement can be discovered. That is to say, the most careful investigation, both clinical and anatomical, shows a complete absence of disease of the muscular walls or valves of the heart, of arterial degeneration, renal disease, and emphysema or other chronic affection of the lungs. In many, a review of the conditions under which the patients have lived establishes the fact that their occupation involved prolonged and heavy muscular work.

The *symptoms* of overstrain do not differ from those of dilatation and hypertrophy from other causes. All degrees of insufficiency or failure of the heart may be observed in different cases.

The *course* of the disease may be progressive, terminating gradually with signs of venous stasis, dropsy, and exhaustion; or death may occur more suddenly as the result of embolism or other accidental complications. In others temporary improvement, even complete recovery, is not impossible if the affection be recognized at an early stage.

The *diagnosis* turns partly on the presence of dilatation and hypertrophy, without any evidence of valvular lesion or other recognized causes of cardiac enlargement, and partly on the laborious nature of the patient's occupation. As a rule, the exclusion of some degree of renal or myocardial disease is extremely difficult, and often impossible; and when, as sometimes happens, more than one of these conditions is present, the diagnosis is uncertain. Enlargement of the heart occurring in a young man engaged in very heavy work may, with probability, be ascribed to overstrain when no other condition favoring hypertrophy and dilatation can be recognized.

Pathology.—The cardiac enlargement is commonly most pronounced in the case of the left ventricle, but some degree of general hypertrophy and dilatation is almost always present. This fact strongly supports the connection between bodily labor and enlargement of the heart, for, as stated in the article on the MUSCULAR WALLS OF THE HEART (*q. v.*), the effects of muscular exercise are primarily exerted on the left ventricle.

It is probable that the initial change is a yielding of the left ventricle to the increased arterial pressure, dilatation being rapidly followed by an amount of hypertrophy that is liable to considerable varia-

tion. When prolonged and excessive demands are made on the activity of the heart, the development of a moderate degree of hypertrophy must be beneficial, as tending to counteract the effects of dilatation. But in the cases under consideration, the hypertrophy which results is insufficient for this purpose, and it would seem that such hearts were not originally possessed of the average power of resistance or reserve force.

Ætiology.—An adequate supply of healthy blood to the cardiac muscle is a condition necessary for the development of hypertrophy, and Allbutt has emphasized this point by insisting upon the influence of bad feeding in the causation of overstrain of the heart. This affection has been comparatively rarely met with among the wealthier classes, most of the cases having occurred among blacksmiths, and workers at various trades, in whom the effect of heavy manual work and insufficient food are more apt to be combined. Cardiac overstrain is very seldom met with in the female sex.

Treatment.—Rest is indispensable, and is of more value than any other measure. The patient's occupation must be modified so as to allow, if possible, of the removal of the cause. Digitalis should be exhibited only when signs of cardiac failure are manifested, and its effects must be carefully watched. If irregularity of the heart's action appear, or become aggravated, discontinue the drug. Ether, ammonia, strychnine, and other cardiac tonics may be used under the same circumstances, and may at times be advantageously combined with digitalis. Da Costa recommends aconite when hypertrophy is commencing. It is doubtful, however, whether hypertrophy *per se* requires any special treatment beyond rest. The diet should be moderate, but nutritious, and alcohol in small quantities may be allowed. The importance of a regular action of the bowels must be insisted on.

PERCY KIDD.

HEART, NEUROSIS OF.—Includes all cases in which symptoms of cardiac derangement occur without physical signs of organic disease. The *symptoms* are mainly palpitation, arrhythmia, and alterations in the frequency of the heart's action. It is characteristic of neurotic affections of the heart that they are always more or less paroxysmal in character.

Palpitation may be a purely subjective sensation, though it is usually associated with overaction of the heart and signs of vascular excitement. Some degree of præcordial discomfort or even pain is at times connected with this symptom.

Palpitation may be due to increased reflex excitability of the heart, or to abnormal sensitiveness of the patient to the pulsation of the organ. In the first case, palpitation is the result of impressions transmitted from the digestive, sexual, or respiratory organs, or it may be due to mental disturbance of various kinds. Flatulent distention and simple dyspepsia are perhaps the commonest causes of reflex palpitation; but, it is important to recognize the fact that gastro-intestinal derangement and palpitation may both be the consequence of some disorder of the nervous system. Sexual excesses and masturbation are frequently concerned in the production of nervous palpitation. The same symptom may be induced by such trifling causes as lying on the left side, slight exertion, or the mere entrance of food into the stomach; and palpitation is not uncommonly directly traceable to the influence of tobacco, tea, coffee, or alcohol.

When the sense of palpitation is unassociated with any marked objective signs of cardiac derangement, it will often be found that the patients are the subjects of functional nervous affections, such as neurasthenia and hysteria.

Nervous palpitation in some cases is relieved by physical exertion—a point which distinguishes it from the palpitation of organic disease.

Persons suffering from anæmia and debility of various kinds are very liable to palpitation, and a similar tendency is at times observed in plethoric conditions. Nervous palpitation is not confined to either sex, though it is undoubtedly most often met with in women (*see* MUSCULAR WALLS OF THE HEART).

Arrhythmia.—All degrees may occur, including simple intermission, where one or more beats of the heart are dropped at intervals without further disturbance, inequality of volume of the individual beats, or a combination of these and allorhythmia. In some cases the patient may be unconscious of any cardiac derangement, or, an intermission is followed by a thump: *i. e.*, by a forcible contraction of the

ventricle which attracts attention. Some persons are very sensitive to the least cardiac irregularity, and take notice of a simple intermission even when it is not succeeded by a thump. Irregularity of volume is, generally speaking, of more significance than simple intermission, and should always suggest the necessity of repeated examination of the heart under different conditions; but cases are met with in which both forms of arrhythmia are habitually present without any ill effects, even with the patient's knowledge; like palpitation, it may be a reflex symptom of gastro-intestinal, sexual, or emotional origin, and is a common result of the abuse of coffee, tea, tobacco, or alcohol. Gout is also believed to be a frequent cause.

Alterations in frequency.—The frequency of the heart's action is more often increased than diminished. A frequent pulse is often, but not necessarily, associated with a feeling of palpitation.

Tachycardia, a condition characterized by paroxysms of extremely rapid cardiac action, has been referred to under the head of *Palpitation*. This comparatively rare affection, which represents a true neurosis of the heart, may be the result of a transient paralysis of the vagus or of irritation of the accelerator nerves of the heart, and has been attributed to errors in diet, the action of tobacco, alcohol, etc. A similar condition has been observed in combination with severe dyspnœa and palpitation in cases of nephritis, mostly of scarlatinal origin, but speedy recovery ensued in nearly every instance.

Uterine displacements and pregnancy have been said to produce a condition of tachycardia. Lesions of the cardiac plexus, vagus nerve, and medulla oblongata have occasionally been found where the pulse had been very rapid during life.

A very **infrequent action**, falling as low as thirty beats in the minute, is sometimes the only sign of any cardiac disorder. In such cases the pulse should always be controlled by auscultation. Apoplectic attacks are occasionally associated with infrequent action, and are possibly due to cerebral anæmia.

Extreme retardation of the pulse, or the opposite condition of increased frequency, and arrhythmia, are sometimes produced by diphtheria, probably from some lesion of the cardiac nerves.

Changes in the frequency of the pulse have also been observed in cases of *tabes dorsalis*.

The term **Irritable Heart** is given to a class of cases occurring among soldiers, in which the leading features were palpitation, cardiac pain, dyspnoea on exertion, irregularity of the heart, and a remarkable tendency to increased frequency of the pulse on slight provocation. In these cases a change from the reclining to the upright position alone sufficed to raise the pulse rate to the extent of thirty or forty beats per minute. These symptoms were traced, in many instances, to hard muscular exercise, such as forced marches. In others, an attack of diarrhea or fever seemed to be the starting-point of the disorder, the symptoms developing as soon as the soldier returned to his active life.

Cases such as these furnish a connecting link between the two groups of functional and organic disease of the heart, and are, in all probability, connected with cardiac overstrain. A similar strain of symptoms occasionally develops as a sequel of acute rheumatism, and is observed in neurotic or delicate persons of both sexes in whom the heart is constitutionally weak.

Diagnosis depends on the presence of characteristic cardiac symptoms without signs of structural disease. The heart sounds are clear, and the first sound is apt to be short and sharp, resembling the normal second sound. Accidental murmurs are occasionally heard, especially when the heart's action is excited, and are, almost invariably, systolic. Such murmurs may be of cardio-pulmonary origin, or they may be the result of anæmia or relative incompetence of the auriculo-ventricular valves. In all such, and where anæmia or persistent arrhythmia exists, careful and repeated examination, in the reclining as well as in the upright position, is necessary to enable us to exclude the presence of organic disease. In some cases of anæmia the diagnosis presents great difficulties. Where the frequency of the heart's action is persistently increased, the question of Graves' disease must be taken into consideration, as the development of proptosis and goiter may be preceded for some time by signs of cardiac excitement. In most the neurotic constitution, the exaggeration of the cardiac symptoms as

compared with the physical signs, and the paroxysmal and capricious character of the attacks will point to a correct conclusion.

Prognosis.—The prognosis is favorable as regards the duration of life, but the chances of recovery or improvement depend on the nature of the neurosis. Where the origin is most obscure, as in habitual arrhythmia, the prospects of improvement are not hopeful.

Pathology.—It is necessary to distinguish, as far as possible, reflex neurosis from direct. The derangement of the nervous mechanism of the heart may be the result of some cause acting on the vagus or accelerating nerves, or on corresponding nerve cells in the medulla oblongata, or in the heart itself. A preponderance of the inhibitory or accelerating centers, or paresis of one or other center, would account for changes in the rhythm and frequency of the heart's beats, but we know little of the exact mutual relations of these antagonistic influences in the human heart. The intrinsic cardiac ganglia are believed to be concerned in the co-ordination of the heart's muscular contraction, and it is reasonable to suppose that lesions of these structures may give rise to arrhythmia.

The subjective sensation of palpitation must be conveyed by afferent fibers of the vagus and sympathetic nerves, but the conditions of the heart that originate this sensation are unknown.

It is still a matter of dispute whether neurosis of the heart can lead to organic lesions. This may occur in Graves' disease, which is, to some extent, a cardiac neurosis; but, with this exception, such a transition is exceptional. It has been suggested that one reason for this difference is to be found in the fact that, in the ordinary forms of cardiac neurosis the functional disturbance is essentially paroxysmal, the heart having time to recover in the intervals separating the individual attacks; whereas, in Graves' disease, the overaction of the heart is continuous, and is, therefore, more liable to lead to debility and dilatation.

Treatment.—The general condition and constitution of the patient require careful consideration. Undue emotional excitement, mental overwork, worry, or anxiety obviated. Moral treatment is of great importance. The patient must be encouraged to believe that the heart

is not actually diseased, and too much attention should not be directed to this organ by the physician. Anæmia, debility, neurasthenia, hysteria, or gout must be met by appropriate treatment. In such cases, a judicious exhibition of iron, strychnine, arsenic, quinine, valerian, iodide of potassium will often give good results. Plethoric conditions may be relieved by moderate saline purging.

If we have to do with nervous irritability, whether general or cardiac, bromide of ammonia and the application of a belladonna plaster to the præcordia may be of much service.

When irregularity of the heart's action is a permanent feature, give belladonna or atropine. In all cases of reflex origin the cause should, if possible, be removed, but the determination of the cause is not always easy. The relief of dyspepsia and of morbid conditions of the uterus is sometimes effectual in removing the symptoms of cardiac derangement. The investigation of the question of sexual excesses is a matter requiring great delicacy and tact; but in the case of young men suffering from neurotic disturbance of the heart, which is not explicable on other grounds, this possibility should be kept in mind. Proscribe excessive use of tobacco, tea, coffee, and alcohol. Cases of habitual arrhythmia, or where the pulse is very infrequent, often resist all treatment, but the general health may not be affected.

In uncomplicated neuroses of the heart digitalis is not generally of much use; but in cases of "irritable heart" depending on overstrain, or when the cardiac action is very feeble and rapid, this drug may be prescribed with advantage. For the relief of the paroxysm, rest, the administration of ammonia, ether, or brandy, smelling salts, and the application of an icebag to the præcordial region are recommended, and, in exceptionally severe cases, a hypodermic injection of morphine may be resorted to when other measures fail.

PERCY KIDD.

Symptomatic Indications.—Palpitation of the heart, with anxiety, from excitement or fright, usually yields to *aconite*; when attended with irregularity of action, great distress, to *digitalis*. For paroxysms of irregular and tumultuous beating, with violent impulse, *veratrum viride* does good service. Paroxysms occurring

in debilitated persons are relieved by *veratrum album*. For nervous and functional palpitation and those of hysteria, *nux muschata* or *moschus*; when, with depression of the nervous system, melancholy, hypochondriasis, *iodine*; when reflex from uterine disorders, *lilium tig.*; when from tea drinking, *cinchona*. In simple nervous palpitation, *belladonna*.

HEART, ACUTE DISEASE OF THE VALVES (Acute Endocarditis).

—Inflammation of the endocardium may be either **acute** or **chronic**, the latter being often the sequel of the former. In the "great majority the affection of the endocardium is limited to the valves of the heart, or occurs in their immediate neighborhood.

Acute endocarditis may be divided—*simple* and *malignant*. Although at times it is difficult, even impossible, to distinguish the two varieties clinically, it will be convenient to discuss them separately. The diagnosis is further complicated by the fact that transitional forms are not uncommon, and cases of simple endocarditis may subsequently assume a malignant type.

Simple endocarditis.—*Symptoms and course.*—Acute endocarditis in its early stages gives rise to no characteristic cardiac symptoms. The fever, which is always present in some degree, is to be attributed, mainly, to the rheumatic or other process on which the endocarditis has supervened. At the same time there is no doubt that endocarditis is in itself an efficient cause of pyrexia, and in certain circumstances exacerbations of fever may, with some probability, be attributed to the endocardial inflammation—*e. g.*, when the rise of temperature coincides with an aggravation of general symptoms that cannot be accounted for by a fresh outburst of rheumatism.

Physical examination of the heart is the only means that enables us to detect the presence of endocarditis. The appearance of a systolic murmur, or a prolonged first sound at the apex, is commonly the earliest and only indication that the endocardium is affected, the mitral valve being more prone to the disease than the aortic. Diastolic and præ systolic murmurs may occasionally be detected, and are certain signs of valvular disease; but they are much less common than systolic murmurs in the

early stages. It is at times impossible to say whether a systolic murmur is due to structural changes, to relative incompetence, or to anæmia.

Enlargement of the heart as a consequence of valvular defects requires time for its development, and is rarely met with at this period. Acute dilatation may, however, ensue at a comparatively early date as a result of inflammatory or other affections of the myocardium. When the endocardial lesions are progressive, the functions of the valves sooner or later become impaired, and mechanical disturbance of the intracardiac circulation is necessarily followed by some degree of dilatation of the various chambers. In lesions of the valves (*see* CHRONIC ENDOCARDITIS) pericarditis or myocarditis may arise as complications, or they may occasionally precede endocarditis. In other cases they seem to develop simultaneously. Embolic manifestations are rare accidents of the initial stages of simple endocarditis. Repair is possible when the process has not advanced too far; but in the majority of cases the acute stage is succeeded by contractile fibrous changes, and the patient is left with the signs of chronic valvular disease.

Malignant endocarditis is also known as *ulcerative, diphtheritic, infectious,* and *septic endocarditis*, but the term "malignant" is adopted as the least objectionable.

Symptoms and course.—The onset may be marked by rigors, headache, vomiting, a sudden rise of temperature, and other signs of acute constitutional disturbance, or, occasionally, the disease may develop insidiously. In either case the condition of the heart is apt to be overshadowed by the general symptoms, and except in cases where endocarditis supervenes on old valvular disease or appears in the course of rheumatic fever, when the heart is, as a matter of routine, examined frequently, the affection may escape notice.

Profound prostration is always an early and important symptom. Fever is usually high, and may present an irregular, remittent, or even intermittent type, comparable to that of ague. Very severe cases, on the other hand, may sometimes be attended with a comparatively slight elevation of temperature.

Cardiac symptoms are usually late in

appearing; but dyspnœa, palpitation, pain, and marked physical signs of valvular disease occasionally rapidly develop. The information derived from physical examination, however, is apt to be equivocal, especially in the case of faint systolic murmurs. When a murmur suddenly appears, or alters in character under observation in a febrile case of doubtful nature, the possibility of ulcerative rupture or laceration of valves should always be carefully considered.

The occurrence of such symptoms as coma, delirium, convulsions, hemiplegia, pain in the region of the spleen, hematuria, purpuric skin eruptions, and retinal hemorrhages, pointing to multiple embolic infarctions, would furnish very strong evidence in favor of the existence of malignant endocarditis. The development of abscesses in different parts of the body, either with or without hemorrhages, would point in the same direction.

Enlargement of the spleen is almost a constant feature, independently of embolism; and profuse sweats are very frequent. Diarrhea, meteorism, slight jaundice, albuminuria, pneumonia, and pleurisy are also not uncommon complications. Secondary inflammation of the joints is said to occur in some cases without suppuration.

Malignant endocarditis commonly manifests a more or less typhoid or else a pyæmic character. The resemblance to typhoid fever is sometimes very close, the state of the abdomen, marked with a suspicious skin eruption, the gastrointestinal symptoms, enlargement of the spleen, the characteristic temperature chart, and the general condition, all combining to mislead. The pyæmic type, with its repeated rigors, perspirations, hectic, irregular temperature, and slight icterus, is less common than the preceding. Most cases fall into one of these two categories, though pyæmic and typhoid features are apt to be associated in varying degrees, and no strict classification is possible. Fallacies inevitably arise in attempting to decide whether recovery is possible, owing to the difficulty of distinguishing milder forms of the malignant affection from severe cases of simple endocarditis. A fatal issue ensues in nearly all well-marked examples, and is frequently preceded by coma or other cerebral symptoms. Life is rarely prolonged beyond a few weeks.

Diagnosis must be based on the results of physical examination. The malignant form is distinguished mainly by the gravity of the general condition, and by the presence of typhoid or pyæmic symptoms. The generally higher range of temperature, and the marked tendency to splenic enlargement and multiple embolism, are also important characteristics. The diagnosis of malignant endocarditis from typhoid fever, pyæmia, meningitis, and acute disseminated tuberculosis may at times be extremely difficult; but the condition of the heart, the occurrence of cutaneous and other hemorrhages, and the development of acute nephritis are the chief points that would serve to indicate endocarditis. The course of the fever, and ætiological considerations, may assist us in arriving at a correct diagnosis.

Prognosis.—In simple endocarditis the prognosis is favorable as regards the immediate present, but the great probability of chronic valvular disease becoming established makes the patient's future very uncertain. In the case of the malignant form the prospect is all but hopeless.

Pathology.—Any part of the endocardium may be invaded, but the valves are nearly always the parts affected, owing to the greater strain to which they are subjected. In adult life endocarditis is almost confined to the left side of the heart, whereas, in the fetus, the right heart is alone affected. Affections of the right heart in adults are nearly always secondary to similar disease of the left side. The mitral valve is rather more liable to become affected than the aortic.

The presence of endocarditis in the early stages is shown by the appearance of small transparent nodular projections of the endocardium, which subsequently become invested with a varying degree of fibrinous deposit from the blood. The development of these **vegetations**, as they are called, is the result of a small-celled infiltration in the subendothelial connective tissue of the valves, which gives rise to small elevations of the endothelial membrane. The inflamed condition of the endocardium occasions a localized thrombosis, in consequence of which the granulations increase in size, and acquire a grayish color and a more or less granular or uneven surface. In some instances the cellular growth shows a marked disposition to necrosis or ulcer-

ation, so that the main change appears to consist in a loss of substance. In malignant or ulcerative endocarditis various kinds of micrococci are always found in the floor of the ulcers, extending to a varying distance into the subjacent tissues. Micro-organisms may also be frequently detected in the superficial fibrinous layers of the vegetations, sometimes in masses. Cases in which they are found in large numbers generally present affinities with the ulcerative form, and belong to the malignant type of endocarditis. Vegetations may vary in size from a pin's head to a bean or a small cherry, the largest growths being generally composed of aggregations of smaller ones. In most cases they are sessile, but they may be pedunculated, and swing freely to and fro in the blood. The lesions, whether watery or ulcerative, may be developed on healthy valves or on valves that are the seat of old disease.

Cases of simple chronic endocarditis may acquire a malignant type independently of the coexistence of any febrile disease, the injured valves apparently affording a favorable nidus for the development of the pathogenic microbes.

The seat of valvular vegetations is determined by the point of maximum pressure. This corresponds, not with the edge, but with a line more or less parallel to, but slightly removed from, the free margin. The auricular surface of the mitral and tricuspid, and the ventricular aspect of the semilunar valves, are the parts that are mainly or exclusively affected. The chordæ tendineæ of the mitral valve, and the posterior wall of the left auricle, are also frequently studded with granulations, those on the latter site often marking the course of the regurgitant stream. In the early stages of their development, the vegetations may be completely absorbed, without any permanent alteration of the valve taking place, or they may gradually disappear, and be transformed by a process of cicatrization into dense fibrous tissue. For results of this process, see HEART, CHRONIC DISEASE OF THE VALVES.

Detachment of fragments of the granulations, or of portions of the valves, is not uncommon, and gives rise to embolism and hemorrhagic infarction in the brain, spleen, kidney, myocardium, retina, or other parts. Pyæmic abscesses, and purulent meningitis, may also develop in the

same manner in malignant forms of endocarditis, from the entrance into the blood of pathogenic microbes derived from the diseased endocardium. Multiple hemorrhages may occur in both forms of endocarditis, but they are far less common in the simple variety. In some cases, especially of the severe type, embolism is succeeded by inflammatory softening of the coats of the arteries of the brain, mesentery, or extremities, leading to the production of embolic aneurisms.

Ætiology.—Simple endocarditis, in the great majority of cases, is the result of rheumatic fever, and only occasionally occurs in connection with other specific diseases, such as scarlatina, diphtheria, measles, typhoid fever, puerperal fever, and other septic conditions, pneumonia, gonorrhea, and syphilis.

Malignant endocarditis may arise in connection with acute rheumatism, scarlatina, diphtheria, pneumonia, and other specific fevers; but, more frequently, no such relation can be established. Rheumatic endocarditis is more common in women than in men, and shows a special tendency to attack young persons.

Nephritis and chorea are not uncommon antecedents of endocarditis; and certain ulcerative diseases, more particularly phthisis pulmonalis, seem to be associated with the development of similar lesions of the valves.

Treatment of simple endocarditis partially merges in that of acute rheumatism; but, unfortunately, remedies like the salicylates, which have a beneficial action on the rheumatic process, seem to have no effect in preventing the development of endocardial complications. Complete and prolonged rest in bed is essential. In cases of malignant endocarditis, we can only adopt measures suitable for other septic conditions—a nutritious diet and stimulants being of the most importance. Drugs like quinine, arsenic, and sulpho-carbolate of sodium have been tried without much result. Cardiac symptoms depending on the secondary effects of valvular lesions must be dealt with on the principles set forth in the following article. PERCY KIDD.

Symptomatic Indications.—The principal remedy in this condition is *aconite*, particularly when the febrile symptoms are marked with great restlessness, anxiety, and fear of death. It is also indicated when endocarditis is complicated with

pericarditis, and stasis of the lungs is marked. Its use should not be continued too long, and some other remedy should be substituted when the temperature is reduced to 100° F. *Veratrum viride* may be used in place of aconite for similar symptoms, but without the anxiety of the latter. With veratrum the action of the heart seems more forcible, the temperature higher, the pulse harder and more tense than with the aconite. *Spi-gelia* is valuable in endocarditis of rheumatic origin, particularly after subsidence of acute symptoms. The impulse of the heart is violent and feeble by turns, purring murmur, trembling of the heart, great dyspnœa. *Arsenicum* is valuable in malignant endocarditis, when the pulse is feeble and irregular, the breathing difficult, the skin pale and cool, covered with moisture, and the patient suffering from great anguish and restlessness. *Lachesis* may be useful in malignant endocarditis; irregular beat of the heart, great dyspnœa, particularly on waking. *Convallaria* may be useful after aconite or veratrum, when the temperature has fallen but the heart still acts too forcibly, and intense nervous erethism and dyspnœa are present. *Digitalis* may be called for when the pulse is irregular, feeble, slow, or intermittent. The heart may appear to beat violently, but its action is weak and threatens to fail.

HEART, CHRONIC DISEASE OF THE VALVES (Chronic Endocarditis).

- I. Aortic Incompetence.
- II. Aortic Stenosis.
- III. Mitral Incompetence.
- IV. Mitral Stenosis.
- V. Pulmonary Incompetence.
- VI. Pulmonary Stenosis.
- VII. Tricuspid Incompetence.
- VIII. Tricuspid Stenosis.
- IX. Combined Valvular Disease.

General Pathology of Chronic Endocarditis.—This condition consists in a fibrous or cirrhotic thickening of the valves, which is commonly associated with contraction, and in many cases with calcification. A fibrous change in the valves is a sequel of acute rheumatic endocarditis in a large number of instances, but similar lesions may develop insidiously as the results of chronic renal disease, arterio-sclerosis, gout, chronic alcoholism, cardiac overstrain, senile degeneration, and syphilis.

In perhaps all of these conditions the valvular thickening is an effect of increased blood pressure. The close relationship of gout to cirrhosis of the kidney and arterial degeneration probably explains the important part played by this disease in the production of chronic valvular lesions. The influence of syphilis may also be due to its tendency to induce arteritis.

The valves of the left side of the heart are, as a rule, alone affected, the tricuspid and pulmonary valves being rarely involved, except in a secondary manner, or as the result of congenital malformation or fetal endocarditis.

Chronic lesions of the mitral valves are almost always of rheumatic origin, whereas the aorta valves are very prone to degenerative cirrhotic processes, extending from the root of the aorta (atheroma, arterio-sclerosis). The fibrous thickening leads to puckering and distortion of the valves, to morbid adhesions of the individual segments, or to shortening of the chordæ tendineæ, whereby the efficiency of the valves is more or less impaired. A growth of vegetations is very liable to supervene on old fibrous induration of the valves, especially where rheumatic attacks recur from time to time. Small hernial protrusions or aneurisms are occasionally developed in the valves, and rupture of these sacs may give rise to incompetence of the valve.

Fibrinous deposits may form on the surface of the valves or in the dilated chambers. When complete closure of the valves is in any way prevented, some of the blood regurgitates or escapes backward against the current of the circulation, and we then speak of incompetence or insufficiency of the valve. If the lesion cause interference with the passage of blood through the ostium, the condition is described as stenosis, obstruction, or constriction. The two conditions are generally combined. Incompetence without obstruction is not uncommon, depending on contraction or ulceration of the margins of the valves, but stenosis is nearly always associated with some degree of insufficiency.

Disease of the Aorta Valves.—1. Aortic incompetence.—Pathology.—The morbid change usually consists in retraction of the edges of the rigid and thickened valves. A growth of vegetations, dilatation of the aorta, adhesions of the valves

to the aortic wall, laceration, rupture or perforation of the valves, are less common causes. It is not unusual to find at the same time slight degrees of narrowing of the orifice, depending on puckering or partial adhesion of the individual cusps or on the presence of vegetations.

As the result of these changes the valves do not meet accurately during diastole, and no longer fulfill their function of shutting off the blood contained in the aorta from the left ventricle. Some of the blood consequently leaks backward through the narrow opening between the valves into the wide space of the ventricle, and meets the stream pouring in from the auricle. The eddies that are thus produced give rise to a "fluid vein," as it is called, and the oscillations of the particles of blood are attended with a blowing sound or murmur. The murmur is heard during the diastole, and the closure of the valves being interfered with, the second sound of the heart over the aorta is effaced or modified.

Effects upon heart and circulation.
(1) The left ventricle, now receiving blood from two sources—viz., from the aorta as well as from the auricle, is overfilled, and its cavity becomes expanded. The dilatation of the ventricle is favored by the fact that distention of its cavity occurs during diastole, when relaxation of its muscular walls is proceeding. Embarrassment of the circulation would ensue if this condition were long maintained, but inasmuch as a larger amount of blood has now to be propelled at each systole, the work of the ventricle is increased, and hypertrophy of its walls is developed. These results succeed one another so closely, except in the case of rupture of the valves from traumatic or other causes, that no sudden disturbance of the circulation is induced.

The object of this hypertrophy is to counterbalance the mechanical impediment to the circulation entailed by the valvular defect, and to maintain a mean pressure in the aortic system approaching the normal. To do this a larger amount of blood than usual must be pumped into the arteries, so as to allow for the backward leakage of a certain amount into the left ventricle. If the degree of hypertrophy be sufficient, this result is secured. The systolic expansion of the arteries is consequently increased, and the pulse acquires certain characters to be subse-

quently considered. The dilatation of the left ventricle and the increased intracardiac pressure soon react backward on the left auricle, pulmonary circulation, and right heart, and a less degree of dilatation and hypertrophy is induced in these chambers. The relative proportions of dilatation and hypertrophy determine whether compensation is complete or incomplete.

Perfect compensation is at times effected, but in most it falls short of this standard, though sufficient as long as no excessive demands are made on the heart. The conditions necessary for the maintenance of compensatory hypertrophy are a sufficient supply of healthy blood to the muscular tissue of the heart, and an adequate degree of general nutrition.

(2) The effects of aortic regurgitation on the circulation are displayed in the first instance by insufficient filling of the arteries, and in a less degree by the engorgement of the lungs and veins of the systemic and portal circulation. In proportion as hypertrophy is developed the tendency to arterial anæmia is diminished. The strain to which the arterial walls are subjected by the contraction of the hypertrophied ventricle leads to atheromatous changes in the intima, and the loss of elasticity which results, adds to the already increased work of the ventricle. This condition of arterio-sclerosis may attain to extraordinary dimensions when hypertrophy of the left ventricle occurs, even in young persons, in whom a primary arterial degeneration can be excluded.

The duration of compensation is liable to great variations, depending on the state of the coronary circulation and the general quality of the blood, on the power of resistance possessed by the neuro-muscular tissues of the heart, on the nature of the mechanical defect of the valves, and on the age.

When valvular disease is progressive, and in the case of young, growing persons, compensation is less likely to be long maintained. Rupture of the valves, whether traumatic or spontaneous, is naturally unfavorable to the development of compensation, as, from the suddenness with which the lesion arises, the heart has not time to accommodate itself to the altered conditions. It is doubtful whether traumatic rupture ever occurs without some previous alteration in the structure

of the valves. Under the most favorable conditions a time comes in all serious valvular disease when the cardiac muscle becomes exhausted from the effects of distention and overwork, and compensation reaches its limits. Increasing distention of the left ventricle not infrequently brings with it dilatation and relative incompetence of the mitral valve, which may temporarily relieve the ventricle and afford time for a brief rally on the part of the heart. The transition from the stage of compensation is shown by progressive dilatation and insufficiency of the heart, visceral stasis, cyanosis, and dropsy; in other words, by the same results that follow dilatation of the heart from primary affections of the myocardium. The muscular element is thus seen to be the determining factor, as far as compensation is concerned, in all cardiac disease, whether myocardial or valvular.

Rupture of compensation has been considered as a very gradual process, except in the somewhat rare cases of traumatic rupture of the valves, but the same result is not uncommonly precipitated more or less acutely as the result of myocardial degeneration from any cause—overstrain, relapses of rheumatism, or acute intercurrent disease of any kind, especially pneumonia and bronchitis, effusions into serous cavities, uterine disorders (particularly pregnancy and the development of the menopause), digestive disturbances, mental anxiety, worry, or overwork, and the abuse of alcohol and tobacco.

Symptoms and course.—The symptoms of aortic incompetence depend on the existence and degree of compensation—that is, on the extent to which the mechanical defect of the valves and its consequent dilatation are counterbalanced by hypertrophy. In some cases the hypertrophy is, so extensive that the effects of the valvular lesion are completely masked. The mean pressure in the aortic system does not fall appreciably below the normal, and no backward congestion ensues. Great physical exertion may be undergone without difficulty. But it is the exception for compensation to be so perfect, and it usually happens, in what would be regarded as well-compensated cases, that some dyspnoea is experienced when the work required of the heart exceeds a certain moderate standard.

Dyspnœa is less common in aortic than mitral disease, owing to the fact that pulmonary engorgement is less pronounced in the former affection. In most cases a tendency to anæmia is observed in the subjects of aortic incompetence, even when compensation is fairly satisfactory. Throbbing and noises in the head, giddiness, faintness, and flashes of light depending upon the altered condition of the cerebral circulation, are also frequently complained of. When dilatation preponderates over hypertrophy the symptoms common to cardiac failure or insufficiency appear—dyspnœa, palpitation, a sense of depression, pain in the præcordia, together with signs of venous stasis, œdema of the lungs, and general dropsy. The signs of backward congestion develop earlier and are more marked in mitral disease, and will be further considered under that head.

The stage of failing compensation may be marked by various degrees of cardiac arrhythmia and by acceleration of the pulse, but, as before stated, there is no constant relation between arrhythmia and failure of the heart's contractile power; and disturbance of the heart's rhythm is seldom pronounced in aortic disease.

Complications.—Pericarditis, angina pectoris, cardiac asthma, embolism, thrombosis of the heart, hydrothorax, ascites, and general dropsy may complicate cases of aortic incompetence. Large effusions into the pericardium, pleura, or peritoneal cavity are very grave complications, owing to their interference with the heart's action and with the movements of the diaphragm.

Enlargement of the left ventricle at times is sufficient to cause collapse of the lower lobe of the left lung, owing to the pressure which it exerts, and thus increases the dyspnœa by curtailing the respiratory surface of the lung. The œdematous skin of the scrotum and lower extremities is very liable to erysipelas and other forms of spreading inflammation. Death commonly ensues with œdema of the lungs, general dropsy, and asthenia, but a sudden termination may occur, and is more frequent in aortic incompetence than in any other valvular affection. This may be due to anæmia of the brain or to diastolic arrest of the heart from over-distention of the ventricle. In exceptional cases sudden death may be the result of embolism of the coronary ar-

tery, or of cerebral hemorrhage, depending on rupture of a small aneurism or some atheromatous branch of an intracranial artery. Gangrene of the extremities is an occasional consequence of embolism. Mental derangement of the melancholic type sometimes develops.

Physical examination of the heart.

—*Inspection* shows displacement of the apex beat outward and downward, with diffused pulsation and bulging of the præcordia.

Palpation detects forcible, heaving impulse over the left ventricle, and occasionally a diastolic thrill at the base of the heart, or over the lower end of the sternum. When the amount of regurgitation is extreme, and compensation has failed, there may be a diastolic impulse at the apex.

Percussion.—Cardiac dullness is increased outward and downward, but not in other directions, as a rule. The dullness may, however, when the right ventricle has undergone secondary enlargement, extend farther to the right than the normal line, which corresponds with the left edge of the sternum, or when the increased size of the left heart has led to displacement of the right ventricle, toward the corresponding side.

Auscultation.—At the base of the heart and down the sternum a diastolic murmur is heard, wholly or partially replacing the second sound of the heart. This murmur, which is usually blowing and high-pitched in character, and may, at times, be musical, is often heard all over the sternum, and even at the apex of the heart. The area of maximum intensity usually corresponds with the left margin of the sternum, between the third and fifth ribs, or with the mid-sternum. The murmur is frequently inaudible above the third rib, and at times it is louder at the ensiform cartilage than elsewhere. The fact that the diastolic murmur is heard with greater loudness below and to the left of the aortic valves is to be explained partly by the conducting qualities of the sternum, which lies immediately over the valves, and also by the propagation of the murmur in the axis of the blood-stream regurgitating into the left ventricle from the aorta. The presence of a second sound with the diastolic murmur shows that the valves are capable of some degree of closure, and, consequently, that incompetence is not very extensive. Bal-

four believes that when the murmur is well conveyed down the sternum, and is heard at the apex, the valves are rigid, and permit of a free reflux toward the apex of the ventricle, whereas a limitation of the murmur to the immediate anatomical site of the aortic orifice indicates a more vibratile condition of the valves, attended with obstruction of the outlet.

The first sound over the aorta remains clear in uncomplicated cases of incompetence. But when, as often happens, some degree of narrowing of the orifice coexists, or when the aorta is dilated without alteration in the capacity of the opening, the conditions for the production of a fluid vein are present, and a systolic murmur, partially or wholly, replaces the first sound over the aortic valves. A systolic murmur in this region may also be the result of anæmia. The diagnosis of systolic basic murmurs will receive further attention in the next section, on Aortic Stenosis. In many cases a double aortic murmur is audible.

The heart sounds at the apex may be perfectly normal, or the diastolic murmur may be heard here also. The first sound is usually clear, but it may be feeble and dull even when the efficiency of the mitral valve is unaffected. Traube explained this in the following manner: The ventricle, receiving blood from the aorta as well as from the auricle, is more rapidly filled, and the mitral curtains are floated up, and come into contact before the diastole is complete; consequently, the ventricular contraction does not cause a sufficiently sudden tension of the valves to give rise to audible vibrations as usual, and the valvular element of the first sound is lost or modified. A systolic murmur at the apex may be due to actual mitral disease, or to relative incompetence of the valve from dilatation of the left ventricle.

Auscultation of large arteries, such as the carotid and femoral, sometimes reveals a double murmur, the result of compression of the vessel by the stethoscope, which gives rise to a fluid vein not only during the onward passage of blood past the point of constriction, but also during the diastolic reflux toward the ventricle. In other cases a diastolic murmur alone can be heard in the large arteries. A diastolic, or a double murmur in the ar-

teries is a proof that the aortic valves are highly incompetent.

The first sound in the carotid artery is often replaced by a systolic murmur when no appreciable narrowing of the aortic orifice exists, and when no systolic murmur is audible in the aortic area. The murmur is believed to be due to forcible stretching of the arterial wall by the powerful systole of the ventricle. When the valves are seriously incompetent the second sound can no longer be heard in the carotids. Traube's "double sound" in the femoral artery is no longer considered to be characteristic of aortic regurgitation, and doubts exist as to the interpretation of this sign.

Pulse.—The pulse has received many different names: Corrigan's, water-hammer, collapsing, jerking, quick or sudden pulse. Owing to the hypertrophy and dilatation of the ventricle, the volume of the pulse is large, the forcible and sudden expansion of the artery being followed by a rapid subsidence of the wave, corresponding to the diastolic emptying of the artery in two directions: viz., onward into the capillaries, and backward into the ventricle. The initial pressure is high, but the mean pressure in the arteries is low, which accounts for the tendency to anæmia observed in this disease. The peculiarities of the radial pulse are generally intensified by raising the arm. Sphygmograms show steep lines of ascent and descent, the apex of the tracing being very pointed.

It is usually more frequent than in health, but generally free from any form of irregularity, terminal stages excepted. The peripheral arteries are often thickened, dilated, and tortuous, and their pulsations are clearly visible, owing to the hypertrophy of the ventricle. In some cases a capillary pulse may be discovered in the skin, nails, mucous membranes, or retina. If the skin be gently rubbed, the flush which is produced can be seen to become slightly paler with each diastole. A systolic pulse may also occasionally be visible in the veins on the back of the hand or in other parts.

Capillary and venous pulsation are due to the fact that, in consequence of the hypertrophy of the left ventricle, combined with dilatation of the small arteries, the pulse-wave is transmitted into the capillaries, or even into the veins. Neither of these conditions is pathog-

nomonic of regurgitation through the aortic valves.

The *diagnosis* of aortic incompetence usually presents little difficulty, and depends primarily on the presence of a diastolic aortic murmur, associated with signs of hypertrophy and dilatation of the left ventricle, and with the characteristic collapsing pulse. A diastolic murmur has been absent in certain cases where the aortic valves have been found after death to be distinctly incompetent. Careful and repeated examination of patients in various positions—sitting, standing, and lying down—will, however, often prevent us from failing to detect a murmur in aortic regurgitation as in other valvular diseases. The extent of the incompetence of the valves is not to be gauged by the loudness of the murmur, but the presence of a diastolic murmur in the arteries, the absence of the second sound over the aorta and carotid artery, pronounced dilatation and hypertrophy of the left ventricle, and a jerking pulse, coupled with marked anæmia and subjective cardiac symptoms, would collectively show the lesion to be a severe one.

Nature of the lesion.—In attempting to decide whether the valvular disease is primarily due to endocarditis or to arterial degeneration, considerations of age, sex, and previous diseases, as well as the condition of the patient, have to be taken into account. In young persons, especially females, and in those with a clear history of acute rheumatism, the affection is almost certainly endocarditis. In older people, more particularly men, a history of hard muscular work, gout, chronic renal disease, syphilis, or alcoholic excess would point to arterio-sclerosis in the absence of rheumatic antecedents. Degenerative conditions of the peripheral arteries also possess much diagnostic importance; but it must be remembered that these changes may themselves be secondary effects of hypertrophy of the left ventricle. In cases of this description occurring in elderly patients who have had undoubted attacks of rheumatic fever, it may be very difficult to decide this point.

II. Aortic Stenosis. — *Pathology.* — Aortic stenosis depends on thickening, puckering, and calcification of the valves or adhesion of the individual cusps, which may be the result of endocarditis or atheromatous disease of the aorta. Vegeta-

tions may also assist in producing stenosis. Most likely to occur in elderly people. Conditions that interfere with the passage of blood from the ventricle into the aorta, also, as a rule, prevent the valves from fitting closely together during diastole. Consequently, stenosis is generally combined with a certain amount of incompetence. We are now concerned only with the rare cases in which stenosis exists alone, or preponderates over incompetence.

Effects upon heart and circulation.—

When the ventricle contracts, blood is forced through the constricted opening into the wide aorta beyond, and, the conditions for the production of a fluid vein being present, a systolic murmur replaces the first sound. Owing to the rigidity of the valves preventing their complete closure, the second sound is weak or is replaced by a diastolic murmur. At times the second sound is quite inaudible where no diastolic murmur is present. The effect of aortic stenosis is to cause hypertrophy of the left ventricle without much dilatation. The intra-ventricular pressure is increased during systole, but not during the period of diastolic relaxation, as in the case of incompetence; hence the slight degree of dilatation that results. When the amount of stenosis is considerable, the arteries receive a smaller quantity of blood at each systole, the volume of the pulse becomes reduced, and a condition of anæmia is developed.

In response to the increased resistance to its discharge the ventricle contracts in a slower and more prolonged manner in order to empty its cavity completely. Unless the obstruction be very great, the efficiency of the circulation is not appreciably affected, and the mean pressure in the arteries is fairly well maintained. Backward congestion develops even at a later date than in aortic incompetence, in consequence of the marked preponderance of hypertrophy over dilatation of the ventricle.

Compensation, as a rule, is longer preserved in aortic stenosis than in any other form of valvular disease, if the necessary conditions of cardiac and general nutrition are not wanting. Atheromatous obstruction of the orifices or trunks of the coronary arteries has a most injurious effect on the heart in cases of stenosis as well as of incompetence of

the aortic valves, involving, sooner or later, myocardial degeneration and debility. The remarks made in the last section concerning duration of compensation and causes of rupture apply equally to this affection.

Symptoms and course.—Symptoms do not appear until the lesion reaches such dimensions that the circulation in the arteries undergoes considerable diminution. A tendency to syncope, giddiness, epileptiform attacks, and other symptoms of cerebral disorder, coldness of the extremities and marked anæmia are then developed. Rupture of compensation is indicated by the signs and symptoms already described, and death may occur from the results of cardiac failure. In other instances a sudden termination may ensue from syncope, or from accidents such as apoplexy, cerebral embolism, and angina pectoris.

The *complications* liable to arise do not materially differ from those that occur in incompetence.

Physical examination.—Displacement of the apex beat and increased cardiac dullness outward and downward, a deliberate, but not very powerful impulse, a systolic thrill and murmur over the aortic valves, are the physical signs met with in well-marked instances.

The apex beat at times is weaker than normal, although hypertrophy of the left ventricle is a necessary result of the valvular lesion. Traube believed this to be due to the fact that the obstruction to the discharge of blood into the aorta hinders the systolic recoil of the heart, an important factor in the production of the normal apex beat. Others that the slow, deliberate contraction of the left ventricle accounts for the feebleness of the impulse.

The systolic murmur is usually loud and rasping, and is often, but not necessarily, accompanied by a thrill; but it may be soft, and occasionally is musical. The murmur is heard at the base of the heart, and is generally conveyed along the course of the aorta into the carotid arteries. It may also be diffused over the whole præcordia, but, on the other hand, it is sometimes confined to the right border of the sternum at the level of the second or third ribs. Occasionally the murmur may disappear, from weakness of the left ventricle. The second sound over the aorta is, in most cases,

either weak or replaced by a diastolic murmur. At times it may be quite inaudible.

The *pulse* of well-marked aortic stenosis is infrequent and of small volume, but deliberate and sustained. Arrhythmia is rare. Sphygmographic tracings exhibit a rounded apex and a gradual ascent and descent, depending on the prolonged systole and diastole of the ventricle.

The *diagnosis* of this lesion turns, not merely on the presence of a systolic murmur over the aortic valves, but on the condition of the left ventricle and on the nature of the pulse. The extent of the obstruction can best be estimated by attention to the last two points. Dilatation of the arch of the aorta may be mistaken for aortic stenosis, but the detection of the pulsations of the aorta in the episternal notch, with some degree of dullness over the manubrium sterni, the larger volume of the pulse and the fact that the second aortic sound is invariably accentuated, unless the valves be incompetent, enables us to recognize the former.

The systolic murmur sometimes heard in sacculated aneurism of the arch can hardly be attributed to aortic stenosis, if the pressure signs of aneurism be not overlooked. Attention to the character of the pulse and to the state of the left ventricle will generally prevent a wrong interpretation being put on the systolic basic murmur of anæmia.

Disease of the Mitral Valve.—III. Mitral Incompetence.—*Pathology.*—Incompetence of the mitral valve—one of the commonest of all valvular lesions—is, in most instances, the result of contraction of the free edges of the curtains or of shortening of the chordæ tendineæ.

Rupture of the chordæ or cusps, adhesion of the valves to each other or to the cardiac walls, perforation of the curtains, and a growth of vegetations may also produce the same effect. Contractile lesions of the mitral valve may be said to be invariably due to chronic endocarditis. Atheromatous patches are frequently met with, especially in the large anterior flap, but it is doubtful whether atheroma is ever a direct cause of derangement of the mitral valve. Relative incompetence is frequently brought about by dilatation of the left ventricle and relaxation of the papillary muscles and of the muscular fibers surrounding the mitral orifice. The fibrous structure of the valve cur-

tains does not admit of the same degree of distention, and in consequence the flaps no longer fit accurately together.

Effects upon heart and circulation.—The function of the mitral valve is to shut off the left auricle from the left ventricle during the systole of the latter. When the efficiency of the valve is unaffected the curtains are gradually floated up during the latter part of diastole, and are brought into contact at the commencement of the ventricular systole. The blood contained in the ventricle is then driven in the direction of least resistance—viz., into the aorta.

Closure of the mitral valves is assisted by simultaneous contraction of the papillary muscles and of the muscular fibers, which partially encircle the mitral orifice, so that the diameter of the opening is greatly reduced during systole. At the same time the systolic shortening of the papillary muscles prevents the flaps from being forced backward into the auricle by the increased pressure in the ventricle.

The sudden tension to which the mitral valves are subjected by their closure gives rise to audible vibrations, which constitute one factor of the first sound of the heart. When the accurate approximation of the mitral segments is interfered with by any of the morbid changes just enumerated, some of the blood which ought to be pumped from the ventricle into the aorta escapes backward against the current of the circulation into the auricle.

The regurgitant stream, flowing through the narrow slit separating the imperfectly closed valves into the wider space of the left auricle, comes into collision with the onward current entering from the lungs. A fluid vein is produced, and a murmur is heard during the systole of the ventricle. Owing to the regurgitation of blood from the ventricle, the left auricle at the end of diastole contains the normal volume of blood received from the lungs plus the amount that has leaked backward from the ventricle. This increase in the contents of the auricle involves dilatation, and, as the mass of blood to be discharged at each auricular systole is augmented, hypertrophy is superadded. As the result of the increased capacity of the auricle, a larger quantity of blood than usual is now thrown into the left ventricle during diastole. Dilatation of the ventricle ensues, and, in consequence

of the extra work thrown on this chamber by the increase in the volume of blood that has to be propelled at each systole, hypertrophy is also developed.

Simultaneously with these changes in the left heart, dilatation and hypertrophy of the right ventricle and auricle are induced by the engorgement of these cavities necessitated by the derangement of the mitral valve. The pulmonary artery and veins undergo dilatation, the capillaries become distended and varicose, and a condition known as "brown induration of the lung" results.

The effects of mitral incompetence can only be compensated by hypertrophy on the part of the right and left ventricles. The walls of the auricles are so thin that hypertrophy in their case plays an unimportant rôle.

Turning now to the *effects of the valvular lesion on the peripheral circulation* we can see that so long as the hypertrophy of the two ventricles is sufficient to neutralize the leakage at the mitral orifice, the volume of blood discharged into the aorta at each systole does not appreciably decline, and the circulation is therefore not interfered with. The conditions necessary for the development of hypertrophy, and the circumstances that determine the duration of compensation, have been described in speaking of aortic disease and need not be repeated. This state of things may last for years, but in most cases compensation is less perfect, and the volume of blood discharged from the ventricle at each systole, and the pressure in the aortic circulation undergo some diminution. As a result the pulmonary circulation and right heart become overfilled. This backward congestion may remain limited to the lesser circulation and right ventricle for a considerable time, and beyond a tendency to dyspnoea on extra exertion, dependent upon the high tension in the pulmonary vessels, the patient may present no symptoms of circulatory disorder. This stage passed, engorgement of the veins of the portal and systemic circulation is established, frequently culminating in dropsical effusions.

This period is commonly associated with relative incompetence of the tricuspid valve, which has its origin in the increasing distention of the right ventricle. Rupture of compensation may be the direct result of progressive incompetence

of the mitral valve, or of debility and dilatation of the right ventricle, in which case it is generally a very gradual process. On the other hand, failure of the heart may be precipitated acutely by the various causes mentioned in aortic incompetence.

In most cases the valvular disorder and compensatory changes go hand in hand, the development of the former being gradual.

When incompetence is abruptly induced, or when it undergoes a sudden increase in consequence of rupture of some portion of the valvular apparatus, as in certain cases of malignant endocarditis, derangement of the circulation is developed acutely, and less time is given for the heart to accommodate itself to the altered conditions under which its work has to be carried on.

Symptoms and course.—During the stage of compensation there may be no symptom and the patient quite unaware of disease. More often slight degrees of dyspnœa are evoked by any unwonted exertion even in compensated cases. This tendency is more marked in mitral than in aortic disease, owing to the inevitable rise of pressure in the pulmonary capillaries entailed by lesions of the former valve. The overfilled condition of the lesser circulation and of the bronchial veins predisposes to bronchitis, and attacks of this kind are very commonly the determining cause of rupture of compensation. The onset of cardiac failure is evidenced by the symptoms of myocardial debility which have so often been described: dyspnœa, palpitation, a sense of oppression, cyanosis, and congestion of the viscera.

The subjects of mitral disease often present a dusky-red or bluish color about the cheeks, lips, nose, ears, and tips of the fingers and toes. Venous stigmata are also frequently present on the face. The conjunctiva are anæmic, and not unfrequently somewhat yellowish, the same icteric tint being observed in the skin. In other cases the complexion has a pale, ashy hue, suggesting imperfect aëration of the blood. Purpuric skin eruptions, mainly involving the lower extremities, may arise during the later stages of the disease.

The presence of fully developed signs of failing compensation does not preclude recovery. Patients with great cardiac dilatation, cyanosis, visceral congestion, and dropsy may be restored to compara-

tive health by timely and suitable treatment. As a rule the danger increases with each successive attack of cardiac failure, and recovery is wont to become gradually less perfect. The fatal termination is usually reached by a process of slow asphyxia, depending on the progressive dilatation and enfeeblement of the heart, more particularly of the right ventricle. The development of Cheyne-Stokes' respiration is at times the precursor of the end. Sudden death is uncommon.

The effects of venous stasis are commonly so pronounced in mitral disease that some mention may be made of them again at this point.

Pulmonary.—Dyspnœa, the cardinal symptom of pulmonary engorgement, is often associated with a troublesome cough and a profuse watery secretion. Hemoptysis may occur as the result of rupture of small vessels or of embolic infarction, secondary to thrombosis of the right heart. Signs of bronchitis or of œdema confined to, or most marked at, the bases of the lungs, and an accentuated pulmonary second sound, are also significant of pulmonary engorgement.

Portal.—Tenderness and enlargement of the liver with persistent dyspepsia, evidenced by irregular action of the bowels (constipation and diarrhea alternating), nausea, flatulence, and epigastric pain, are sometimes very early signs of disturbed compensation.

Renal.—Quantitative as well as qualitative changes in the urine often furnish most valuable information concerning the vigor of the circulation. A reduction in the amount of urine in a case of cardiac disease, whether accompanied or not by albuminuria, shows that the circulation in the glomeruli is at a low ebb, and that the waste products of metabolism are being excreted in diminished quantity.

In some it may be difficult to determine whether albuminuria and dropsy are primarily cardiac or renal. The presence of granular casts and of a large amount of albumen in the urine, together with a waxy, anæmic tint of the skin, point to the kidney as the organ mainly concerned. In certain instances, however, a decision may be impossible. The gradual ascent of the dropsical effusion from the lower extremities to the upper parts of the body, and conversely, the earlier appearance of œdema of the eyelids and face, may help

us to a correct conclusion. Unfortunately, the statements of patients as to the order in which different symptoms have occurred, are not always reliable. It should also be remembered that renal and cardiac disease may coexist. These difficulties are less likely to occur in the case of mitral than aortic affections, the latter being more frequently associated with cirrhosis of the kidney and arterial degeneration.

Uterine engorgement often leads to disorders of menstruation. Sterility is by no means rare.

The *complications* that are apt to occur in mitral disease do not differ from those to which aortic cases are liable, with the exception of angina pectoris, but the tendency to engorgement of the viscera and to dropsical effusions is far more pronounced in lesions of the mitral valve.

Physical examination of the heart.

—*Inspection*.—The apex beat is displaced outward, and bulging of the præcordia may be observed in young persons with elastic chest walls.

Palpation.—Diffused forcible pulsation is felt, sometimes more marked toward the sternum and in the epigastrium—*i. e.*, over the right ventricle. A systolic thrill is occasionally perceptible at the apex.

Percussion.—The area of cardiac dullness is increased outward and somewhat upward at first, and when the enlargement of the right ventricle is considerable, the dullness may extend across to the right border of the sternum, or even farther in this direction.

Auscultation.—At the apex a systolic murmur is heard, wholly or partially obscuring the first sound. The second sound in this region may be clear, weak, or inaudible, and when stenosis coexists, a diastolic or præ systolic murmur may be superadded. The heart sounds in the aortic area are unaltered. The pulmonary second sound is accentuated, and at times reduplicated. The systolic murmur is sometimes very loud, and may be heard all over the præcordia. In exceptional cases the point of maximum intensity of the murmur may be situated as high as the third rib or second intercostal space, close to the sternum. The murmur is generally conveyed outward toward the axilla, and is often heard at the angle of the left scapula. When it is very loud it may be audible over both scapulæ, or even over the whole thorax.

The displacement of the apex beat to the left is partly the result of the hypertrophy and dilatation of the left ventricle, but it is also indirectly due to the enlarged condition of the right ventricle, which by its increased weight causes the heart to assume a more horizontal position, and tilts the apex outward. When the degree of regurgitation is considerable, and more especially when the vigor of the left ventricle is preserved, the systolic apex murmur is generally well conveyed to the angle of the left scapula—*i. e.*, in the axis of the blood-stream regurgitating into the left auricle. In those cases where the murmur is heard louder over the position of the mitral valve itself—*viz.*, at the third left costo-sternal articulation—than at the apex, it is probable that the cause is to be found in great dilatation of the left auricle and in retraction of the edge of the left lung, allowing the dilated auricle to approach closer than usual to the front of the chest. In the terminal stages the development of relative incompetence of the tricuspid valve is often revealed by the appearance of an independent systolic murmur over the ensiform cartilage, and by systolic pulsation of the distended jugular veins. The characteristic murmur is occasionally absent in cases of mitral incompetence, where great debility of the left ventricle exists.

Pulse.—The pulse shows no abnormality during the stage of compensation, but when failure commences the pulse-wave becomes smaller, the tension is lowered, and various degrees of arrhythmia appear. Inequality of volume of the individual beats is of more serious import than mere intermission, where some beats are dropped at intervals. Sphygmographic tracings do not show any characteristic features.

Diagnosis.—A systolic apex murmur, enlargement of the right ventricle, and accentuation of the pulmonary second sound are the characteristic signs of mitral incompetence.

In attempting to estimate the extent of the valvular lesion, more importance is to be attached to the evidence of its secondary effects on the heart and circulation than to the character of the murmur.

IV. Mitral Stenosis.—*Pathology*.—Obstructive disease of the mitral valve is nearly always a chronic process depending upon fibrous thickening and contraction of the valvular ring, and

adhesion of the curtains to one another, whereby the orifice is often reduced to a mere chink or fissure, "the buttonhole type"; or again, stenosis may be due to thickening and shortening of the chordæ tendineæ, which draw down the margins of the thickened and adherent valves toward the floor of the ventricle, "the funnel-shaped variety." Combinations of the two forms are frequently met with. These changes are the effects of a gradual fibrous thickening, or chronic endocarditis. Luxuriant vegetations may occasionally produce obstruction, but, as a rule, they are not associated with fibrous lesions. Mitral stenosis is specially common in women, and a definite history of rheumatism is often wanting. Some regard the lesion as congenital in such cases, but it is, at least, equally probable that the valvular disease represents the remains of slight rheumatic attacks which have been forgotten.

Effects upon heart and circulation.

—In the main the same as those of incompetence as far as the peripheral circulation is concerned. The obstruction at the mitral opening leads to backward engorgement of the left auricle, pulmonary circulation and right heart, and to imperfect filling of the left ventricle and aortic system. The left auricle, being unable to empty itself completely, becomes dilated and hypertrophied, and the degree of enlargement of the right ventricle that is produced is even greater than in the case of incompetence. Similar changes are induced in the pulmonary vessels, and in the lungs in both forms of mitral disease.

The left ventricle, receiving a smaller quantity of blood than usual, has less work to do, and is commonly found in a state of atrophy after death. When the left ventricle is hypertrophied in mitral stenosis, it is probable that incompetence was the initial lesion, or that increased peripheral resistance in the arterial system (renal disease, or arterio-sclerosis), has been in operation. As the lesion of mitral stenosis almost always involves some degree of rigidity, the valves are commonly unable to meet accurately during the ventricular systole, and stenosis is complicated by incompetence. Where obstruction is the predominant condition, however, the term mitral stenosis may be employed. It is obvious that the narrowing of the

orifice must hinder the passage of blood from the auricle into the ventricle during the ventricular diastole, and the blood escaping from the auricle has to pass through a narrow opening into the wide ventricle beyond. A fluid vein is produced, and a murmur is heard during the diastolic period of the cardiac cycle.

Compensation depends only to a slight degree on the amount of hypertrophy of the thin-walled left auricle, but is determined by the condition of the right ventricle on which the stress of the intracardiac circulation mainly falls. The pulmonary engorgement is greater in stenosis than in incompetence, and rupture of vessels and profuse hemoptysis are far more often observed in the former affection. When the mitral constriction is slight, and hypertrophy of the right ventricle is adequately developed, the amount of blood thrown out into the aorta at each systole does not fall much below the average, and the circulation is unaffected. If the lesion be severe the pulse is smaller than in health. Where stenosis has existed from an early period the aorta and its branches are narrow and undeveloped. This condition increases the mechanical difficulties which the heart has to overcome, and is an unfavorable element. Rupture of compensation from pulmonary causes is even more common in stenosis than incompetence of the mitral valve.

The *symptoms, course, and complications* of mitral disease are the same, whether the affection be obstructive or regurgitant.

Physical examination of the heart.

—*Inspection.*—Slight bulging of the præcordia may sometimes be detected, and the apex beat is slightly displaced outward.

Palpation discovers diffused forcible pulsation over the right ventricle, and a præ systolic thrill is frequently felt at the apex.

Percussion.—The area of cardiac dullness is increased upward to the right, and in a less degree to the left also.

Auscultation.—At the apex a præ systolic murmur is heard running up to the first sound, which is short and abrupt, resembling the normal second sound. The second sound at the apex may be audible, and is not unfrequently reduplicated at this point, as well as over the right ventricle and the pulmonary artery.

The pulmonary second sound is accentuated. At times the murmur may be prolonged almost throughout the whole diastole, commencing directly after the second sound, and becoming rougher and louder during the latter part of the diastolic period. The early diastolic and the præsystolic portions of this murmur are occasionally separated by a brief interval. In rare cases a murmur may be heard during the commencement of the diastole alone, as in the case of aortic regurgitation. The præsystolic murmur is frequently confined to the immediate neighborhood of the apex, though at times it may be diffused widely over the præcordia. Except in cases of this description, where the murmur is generally very loud, it is rarely heard at the angle of the left scapula, and, unlike the systolic mitral murmur, it is not conveyed toward the left axilla. The præsystolic murmur is generally low-pitched, rough, and churning, but it is subject to great variations of pitch and quality.

In order to understand the method of production of this murmur, remember that the long pause of the cardiac cycle comprises not merely the active dilatation of the ventricle, but also the short period of auricular contraction which immediately precedes the systole of the ventricle. The occurrence of the murmur just before the first sound is explained by the sudden acceleration of the blood current through the narrowed mitral orifice caused by the contraction of the left auricle, the flow during the earlier portion of the diastole being comparatively noiseless, owing to the low pressure at which the blood pours into the left ventricle. The presence of an early diastolic murmur is probably due partly to the suction action of the actively dilating ventricle, and partly to the high tension existing in the pulmonary circulation.

The degree of hypertrophy of the left auricle, the pressure in the pulmonary veins, and the activity with which the left ventricle dilates during diastole, mainly determine the existence or loudness of the murmur of mitral stenosis. The second sound at the apex usually disappears when narrowing reaches a certain point; the præsystolic murmur and abrupt short first sound persisting. Absence of the second sound is explained as by the overlapping of the left apex by the enlarged right ventricle, and by the weak-

ening of the aortic second sound consequent upon the low pressure in the systemic arteries. In the later stages the præsystolic murmur frequently vanishes, a short, sharp sound or a systolic murmur alone being audible. At the same time the accentuation of the pulmonary second sound commonly disappears, owing to the development of tricuspid incompetence, which involves a reduction of blood-pressure in the vessels of the lungs.

In many cases of mitral stenosis no præsystolic or diastolic murmur can be detected, and a systolic apex murmur or a short, sharp first sound or a slight "prefix" to the first sound may be the only auscultatory evidence of mitral disease. The systolic murmur is frequently accompanied or preceded by a short thump, which some regard as the last portion of a præsystolic murmur, but which is more probably the modified first sound of mitral stenosis. When, in cases of this sort, the second sound is reduplicated, and the systolic murmur is not well conveyed toward the axilla and back, the existence of mitral stenosis is very probable, and the degree of incompetence is slight. Reduplication of the second sound is more common in mitral stenosis than in any other condition, but this sign cannot be regarded as pathognomonic of mitral narrowing. A cantering rhythm, in which three indistinct heart sounds are audible, is commonly observed, but a similar rhythm may be developed in other diseases. It is easy to see why a systolic murmur should occur in mitral stenosis, owing to the incompetence which almost invariably coexists, but it is not so easy to account for the numerous cases of combined stenosis and incompetence in which no systolic murmur is heard. The high tension in the pulmonary circulation and left auricle, as contrasted with the low pressure in the aorta, may explain the absence of a systolic murmur; for the blood in the left ventricle, flowing in the direction of least resistance, pours freely into the aorta, whereas the amount that escapes backward into the distended auricle is comparatively trifling. The reduplication of the second sound is believed to be due to a synchronous closure of the aortic and pulmonary valves, in consequence of the different degrees of tension existing in these vessels. The peculiar short, sharp first sound has been explained by

the supposition that, the pressure in the left ventricle during diastole being very slight, the mitral valves are brought together with greater suddenness than in the normal condition, where the amount of blood entering the ventricle is larger, and the curtains are floated up more gradually.

The præ systolic murmur may only be audible when the patient is in the recumbent position, and the examination of all doubtful cases in various postures is even more necessary in mitral stenosis than in any other form of valvular disease.

Pulse.—During the period of compensation there may be no appreciable change beyond perhaps a slight reduction in volume. In advanced stages it becomes small, and the tension usually falls. Occasionally the arterial pressure may be increased, possibly from the occurrence of vasomotor contraction in response to the imperfectly oxygenized state of the blood. When compensation fails the pulse frequently exhibits even more extreme degrees of arrhythmia than in mitral incompetence. Irregularity has been considered by many writers to be specially characteristic of mitral stenosis, and in the later stages this is no doubt perfectly true. But while compensation is preserved it is by no means common to find arrhythmia in this disease.

Derangement of the heart's rhythm in organic disease is largely the result of debility of the cardiac muscle, and secondarily of disordered innervation. Here the development of arrhythmia often conveys a timely warning. The frequency of the pulse is generally increased even in compensated cases, and, when failure commences, the heart's action is almost always considerably accelerated. The sphygmograph does not usually supply any information that cannot be obtained by other means.

Diagnosis.—A præ systolic murmur at the apex of the heart is the pathognomonic sign of mitral stenosis, but the severity of mitral obstruction is to be gauged mainly by the degree of enlargement of the right ventricle, by the amount of visceral engorgement, and by the volume of the pulse. Stenosis may be regarded as being less extensive when the two sounds of the heart are heard at the apex, in addition to the præ systolic murmur, than when the second sound is obscured at this point. The quality of the

murmur does not possess much significance, and it may be said that loudness of murmur in this, as in all valvular disease, points to hypertrophy, and therefore to compensatory changes.

Valvular disease of the right side of the heart.—Primary affections of the valves of the right heart, except as the result of congenital disease, are almost unknown. Secondary lesions are less uncommon, especially in the case of the tricuspid valve.

V. Pulmonary Incompetence.—*Pathology.*—This, the rarest of valvular diseases may depend on congenital abnormalities—*e. g.*, where there are only two semilunar valves, or in cases of acquired disease, it may develop in consequence of similar changes to those which occasion aortic incompetence. The small vegetations, which not unfrequently develop on the pulmonary cusps in old-standing endocarditis of the left heart, rarely give rise to functional derangement of the valve. Malignant endocarditis occasionally leads to pulmonary incompetence.

Effects upon heart and circulation.—The effects are seen in dilatation and hypertrophy of the right ventricle and to a less extent of the right auricle, and in distention of the systemic and portal veins. A patent foramen ovale and imperfect closure of the ventricular septum have been noted in some congenital cases. Communication between the two sides of the heart appears to be favorable on the whole, as the engorgement of the venous system is thereby diminished, and the left ventricle receives a better supply of blood.

The *symptoms* are little known; emphysema, bronchitis, and other pulmonary complications generally coexist. The *course* and termination same as in severe disease of the lungs or of the mitral valve.

Physical examination.—The physical signs are: Dilatation and hypertrophy of the right ventricle, and a diastolic murmur in the pulmonary area, conducted down the left edge of the sternum to the ensiform cartilage. The *pulse* is small and may be irregular.

Diagnosis.—The absence of signs of dilatation and hypertrophy of the left ventricle, and of a typical collapsing pulse, and the presence of the second sound in the carotid arteries, are the chief points that may be relied upon to

distinguish pulmonary regurgitation from incompetence of the aortic valves.

VI. Pulmonary Stenosis.—*Pathology.*—Stenosis may very occasionally be the result of chronic endocarditis or a growth of vegetations, but, with the rarest exceptions, it owns a congenital origin. It may then be the result either of fetal endocarditis involving the valve segments, or of a ring-shaped fibrous thickening and contraction of the portion of the ventricle immediately below the valves, or it may be a consequence of developmental malformation. The trunk of the pulmonary artery may be narrowed for a considerable distance beyond the valves, especially in congenital cases. A patent foramen ovale, incomplete ventricular septum, and persistent ductus arteriosus are very commonly associated with pulmonary stenosis. It is impossible to enter into the details of these conditions here, as the interest and importance which they possess are rather anatomical than clinical.

Effects upon heart and circulation.—Practically the same as in the case of incompetence of the pulmonary valves. When stenosis is extreme, and when atresia or actual occlusion exists, the right ventricle may be small and undeveloped. Death generally occurs soon after birth.

Symptoms and course.—The symptoms of pulmonary constriction are mainly dyspnœa and varying degrees of cyanosis. When the lesion is congenital the disposition to cyanosis, particularly on exertion, is usually very marked, and the fingers and toes are often extremely clubbed. The patients rarely live more than twelve years. The growth of the body is always more or less interfered with, and the subcutaneous fat and muscles are imperfectly developed. In severe cases dyspnœa and cyanosis appear directly after birth, but occasionally these symptoms do not develop till about the period of puberty. The course is nearly always progressive; subjects are very liable to contract chronic pulmonary tuberculosis.

Physical examination reveals signs of enlargement of the right ventricle and a systolic murmur in the pulmonary area. The murmur is often harsh and audible over the whole præcordia, but at times it may be very faint. The point of maximum intensity is situated close to the left

margin of the sternum, in the second intercostal space, or at the level of the third rib. The murmur is not conveyed along the aorta into the carotids, but is generally propagated upward toward the left clavicle, and may sometimes be heard over the back. The pulmonary second sound is weak, and when incompetence exists there may be a diastolic murmur. A systolic thrill in the pulmonary area is commonly present. In some no systolic murmur can be heard. The *pulse* is weak, small, and may be irregular.

VII. Tricuspid Incompetence.—*Pathology.*—May be the result of endocarditis, or of dilatation of the right ventricle and tricuspid orifice. In the former the valvular derangement is produced by similar changes to those that have been described under the head of *Mitral Incompetence*, and the tricuspid lesion is almost invariably secondary to endocarditis of the left heart. Relative incompetence is far more common, and may supervene not only on affection of the mitral and aortic valves, but also on dilatation and debility of the left or right ventricle from whatever cause.

Effects upon heart and circulation.—Tricuspid incompetence leads to dilatation and hypertrophy of the right ventricle and auricle, distention of the systemic and portal veins, and ultimately to cyanosis and dropsy. This valvular defect can only be very imperfectly counterbalanced by hypertrophy and dilatation of the right ventricle and auricle; hence, compensation is never adequate, and a condition of venous engorgement and arterial anæmia are rapidly induced. The development of tricuspid insufficiency, therefore, greatly aggravates the effects of any existing valvular disease, and is always a matter of considerable gravity.

Symptoms and course.—The symptoms of the tricuspid affection are almost always merged in those of the primary disease, and are represented by an increased tendency to venous stasis, cyanosis, and dropsy. Where incompetence is relative, recovery may take place if the obstruction to the intracardiac circulation in front can be removed or diminished. Regurgitation, due to structural changes in the valve, is a most serious condition, and generally proves fatal at an early date, the mode of termination resembling that of mitral disease.

Physical examination.—Signs are: a systolic murmur heard loudest over the ensiform cartilage or at the lower end of the sternum, signs of enlargement of the right ventricle and weakening of the pulmonary second sound. The jugular veins are overfilled, and often exhibit systolic pulsation.

When the veins become stretched beyond a certain point their valves give way, and the regurgitant wave, entering the right auricle from the ventricle, passes into the jugulars, which, therefore, pulsate synchronously with the ventricular systole. If the degree of regurgitation be small, or the ventricle contract feebly, venous pulsation may be absent. Incompetence of the jugular valves may be detected by compressing the vein high up in the neck, and observing that it fills from below. The enlarged jugular veins may also show slight oscillations when their valves are intact, and when no tricuspid incompetence exists, owing to the contractions of the auricle or ventricle being transmitted to the column of blood in the distended veins. The oscillations may, therefore, be either præ systolic or systolic. It is believed that the systolic expansion of the aorta may be communicated to the vena cava superior, and from thence to the innominate and jugular veins. If the veins pulsate strongly, and if their valves be incompetent, tricuspid insufficiency probably exists, but systolic jugular pulsation is not pathognomonic of this valvular lesion. The regurgitant stream, entering the right auricle, is also transmitted through the vena cava inferior to the hepatic veins, which have no valves, and the liver sometimes can be felt to undergo systolic expansile pulsation, which is not to be confounded with the communicated pulsation which is so common in this region. The pulse is small, weak, and frequently irregular.

VIII. Tricuspid Stenosis.—*Pathology.*—Far more rare than incompetence, and, except in a few instances when it is congenital and associated with other malformations of the heart, it is always secondary to valvular disease of the left side, and almost invariably to mitral stenosis.

The *effects of the lesion, symptoms, and course* are very similar to those of tricuspid incompetence; compensation is impossible.

Physical examination.—A præ systolic murmur, heard best over the ensiform

cartilage, or somewhat to the left or right of this point, is the characteristic physical sign. A thrill, præ systolic in time, may occasionally be felt in the same position.

IX. Combined Valvular Disease.—The frequent association of stenosis and incompetence has been emphasized more than once, though, for convenience, the individual affections have been considered separately. The presence of these combined lesions is indicated by the *physical signs* proper to each.

The *diagnosis* of combined valvular disease turns not merely on the presence of the different characteristic murmurs, but also upon the secondary effects of the individual lesions on the heart and circulation generally. Thus, a small pulse in a case presenting the typical signs of aortic regurgitation should always suggest the possibility of concomitant mitral disease, even when the auscultatory evidence of the latter is equivocal or wanting. But though two or more lesions may be present, it should be stated that one frequently preponderates to such an extent as to claim almost exclusive attention.

It is worthy of note that the more chronic contractile forms of endocarditis, as a rule, lead ultimately to narrowing in the case of the mitral valve, and to incompetence when the aortic valves are concerned. The combination of these opposite conditions of the two sets of valves is by no means rare. The frequency with which relative mitral incompetence develops in cases of aortic regurgitation has been already alluded to.

The *prognosis* is more favorable in aortic stenosis than in other varieties, owing to the marked preponderance of hypertrophy over dilatation in this affection. Incompetence of the aortic valves is a much more serious lesion, by reason of the great degree of ventricular dilatation which it occasions, together with its tendency to sudden death. Compensation is often preserved for years in both forms of aortic disease, but failure is less readily recovered from than in affections of the mitral valve. The relative prognosis in mitral stenosis and incompetence is a matter of dispute. For practical purposes the prognosis is determined by the features of each individual case, and must be based on considerations common to all forms of valvular disease, which may be thus briefly summarized:

State of the heart's wall.—The degree

of enlargement, and the relative proportions of hypertrophy and dilatation supply information as to the severity of the lesion and the capabilities of the cardiac muscle. Persistent arrhythmia is significant of myocardial degeneration. A history of repeated rupture of compensation suggests the probability that the cardiac muscle is becoming exhausted.

Extent and nature of the valvular lesion.—The data required for estimating these points have already been mentioned in speaking of the several affections of the valves. When the lesion is extensive, and especially where it is presumably due to atheromatous changes, the prospects are serious. Degenerative vascular disease is, necessarily, progressive, and there is more danger of coronary obstruction, and, therefore, of myocardial degeneration.

Effects of lesion on circulation.—The condition of the pulse, the presence or absence of cyanosis and visceral stasis on the one hand, and of definite cardiac symptoms on the other, are the points that require special attention.

Condition of the arteries and viscera.—Arterial degeneration adds to the gravity of the case, not only on account of the danger of cerebral hemorrhage, but also by reason of the increased work which it throws on the left ventricle. Persistent signs of hepatic and gastro-intestinal derangement, albuminuria, and passive bronchial catarrh, furnish evidence of serious disorder of the circulation, and are bad omens, owing to the prejudicial effect on the general health which these conditions involve.

State of general nutrition.—Anæmia and malnutrition are very apt to develop in all serious cardiac disease, owing to the baneful results of imperfect aëration of the blood and of the visceral derangements just alluded to. Preservation of a good standard of general nutrition is a favorable prognostic sign.

Social condition and habits.—Laborious occupations, insufficient food, anxiety, worry, or mental overwork, sexual excesses, the abuse of alcohol, tobacco, tea, or coffee, have a most injurious effect. If these unfavorable influences can be excluded, the patient's prospects are immensely improved.

Age.—The prognosis is always serious in children before the age of puberty, owing to the strain thrown on the heart

during the active growth of the body. In old people the natural tendency to degenerative changes is apt to intensify the effects of valvular disease.

Complications.—Their presence or absence is a matter of importance, but even in the most favorable and uncomplicated cases serious accidents, such as cerebral embolism, may occur at any moment, and disarrange all previous calculations.

Treatment.—Salicylic acid and its salts generally have little influence in hindering the occurrence of endocarditis, but nevertheless subacute relapses of rheumatism ensuing in the course of established valvular disease should always be promptly and carefully treated by rest and suitable drugs, as such outbursts are very apt to be associated with the development of a fresh crop of vegetations. In the case of valvular affections secondary to arterial disease we may hope for more results from prophylactic measures, considering the close relationship that subsists between atheroma and such influences as overexertion, alcoholism, gout, and syphilis.

Stage of compensation.—During this period drugs are seldom required, and treatment should be mainly prophylactic and hygienic. Patients should avoid excesses, whether physical, mental, emotional, or sexual. Diet moderate, nutritious, and digestible. Wine or beer in small quantities may be allowed, unless the tension of the pulse be high. Tobacco, from its weakening action on the heart, must be used, if at all, with great moderation. Warm clothing, and especially flannel next the skin, should be worn. Prolonged immersion in cold or hot water must be forbidden. Regular gentle exercise, gradually increased, is of great service on account of its beneficial effect on general nutrition and on the coronary circulation. As long as the patient experiences no dyspnoea, walking, riding, and shooting may be indulged in with advantage. In persons of sedentary habits still greater caution is required, and physical exertion must be more carefully undertaken.

The intelligent co-operation of the patient is especially needed during the stage of compensation. On the one hand, he should be informed, as far as it is thought advisable, as to the general nature of his complaint; but on the other, it is quite as important to avoid unneces-

sary plainness of speech, as the moral effect of being told that he is the subject of "heart disease" often takes all heart out of the patient. He should be encouraged to believe that his future is to a large extent in his own hands, and his rule of life should be "moderation in all things." Regular daily evacuation of the bowels must be secured, and in plethoric patients an occasional course of saline aperients or some corresponding mineral water may be ordered. A tendency to anæmia is an indication for iron or some chalybeate water. Functional disorders must be treated in the usual way. Sea air and health resorts at moderate elevations as a rule suit more cardiac cases.

The question of marriage is important. Women should, if possible, be prevented from marrying on account of the great risks attendant on pregnancy and parturition. In the case of men marriage may be sanctioned if compensation be satisfactory, and when there is reason to believe that the cardiac affection is likely to be stationary. At the same time, the probability that the ordinary expectation of life will not be realized must be taken into consideration.

Stage of failing compensation.—When dilatation and cardiac weakness begin to predominate, a careful combination of specific cardiac remedies, with other measures both general and local, is called for. Complete rest in bed must be insisted upon. Light nutritious food should be given in small quantities and at short intervals, and a regular action of the bowels secured.

Among cardiac drugs none can compare with digitalis; its *effects* are exerted both on the general circulation and heart. It raises the tension in the arteries, and slows the action of the heart, and increases the force of the individual contractions. Failure of the heart's contractile power, with signs of dilatation, low arterial pressure, and a small and rapid pulse, are therefore the special indications for the use of digitalis. The good results of this medicine are more conspicuous in mitral than aortic cases, and objections have been raised to its use in aortic incompetence, on the ground that the lengthening of the diastole leads to still further distention of the left ventricle, and the increased force of the cardiac contractions, coupled with heightened arterial tension, adds to the risk of

cerebral hemorrhage. Against this view it must be stated that during the period of cardiac dilatation an increase in the force of the ventricular systole, and a rise of arterial pressure, are of great advantage, inasmuch as the arteries are always more or less empty between the beats—*i.e.*, the mean pressure is low, even in fairly well compensated cases of aortic regurgitation, and when the left ventricle begins to fail the arteries are of course even less adequately filled. And it must be remembered that a steady and continuous flow of blood through the capillaries, which is the end and object of the circulation, is determined, not by the initial, but by the mean pressure in the arteries.

If the use of digitalis be strictly limited to the stage of progressive dilatation, its results are often most satisfactory; at the same time it should be administered with great caution, and in small doses to begin with, in aortic disease, and as soon as its tonic effects on the heart are obtained it should be discontinued. The beneficial action of the drug is also manifested in the relief of visceral congestions and their consequences—dyspnoea, bronchitis, deficient secretion of urine, and dropsical effusions.

In mitral cases, where dilatation is pronounced, the infusion in doses of 2 to 6 drams, or an equivalent amount of the tincture or powder, may be ordered every three or four hours for a few days until the effects of the drug appear, medicinal treatment being then suspended for a time altogether. Owing to the so-called cumulative action of digitalis, symptoms of poisoning sometimes develop with very little warning. When, therefore, a patient complains of nausea or vomiting, and the pulse becomes weak, small, and irregular, and the quantity of urine declines, the drug must be at once stopped, and if collapse be threatened, brandy, ether, and ammonia should be exhibited till the heart's power is restored. In some cases the maximum effects of digitalis are not obtained for twenty-four hours or more after its administration has been suspended. Diuresis and removal of œdematous swellings are among the most striking and tangible results of its successful action. The increased flow of urine is to be attributed to stimulation of the heart's contractions, and to a rise of pressure in the renal artery.

The use of digitalis in smaller doses, continued for a longer time, is to be preferred in other cases, but here also the physician must be on the watch for nausea and other toxic symptoms. At times gastric symptoms are so persistently produced that the remedy has to be abandoned. Occasionally a change to another preparation obviates the difficulty. It may here be repeated that rest is of the first importance, and in many instances of cardiac failure, especially among the poor, a few days in bed, with suitable food, suffice to restore a considerable degree of compensation.

It is very common to meet with patients who are, so to speak, on the borderland between compensation and failure, to whom digitalis in tonic doses of 10 minims of the tincture twice a day may be administered continuously for months with the greatest advantage.

Iron may be combined with digitalis if anæmia be a prominent feature; otherwise the latter drug is better given alone, owing to the liability of iron to cause constipation. When the action of digitalis begins to fail, it may generally be inferred that the limits of compensatory hypertrophy have been reached, this result depending on the progressive nature of the valvular lesion, or on the supervention of myocardial degeneration.

Strophanthus closely resembles digitalis in its action, and though less generally useful, sometimes proves an efficient substitute when the action of the latter remedy is becoming exhausted. *Convallaria*, *adonis vernalis*, and various other drugs have been recommended as possessing similar virtues, but experience has scarcely confirmed these expectations.

Strychnine, ether, and ammonia are also valuable remedies, and may be employed in all valvular affections to stimulate the action of the heart.

Belladonna is sometimes serviceable in aortic cases, and in combination with digitalis it may be advantageously prescribed in mitral disease, especially when arrhythmia is a prominent feature.

Treatment of special symptoms.—*Dyspnœa*, when it depends upon engorgement of the pulmonary circulation, can only be relieved by improving the force of the heart (digitalis, strychnia, etc.). When it is due to bronchitis, expectorants may be combined with digitalis. The dyspnœa which occurs in connection with high

arterial pressure may often be relieved by nitrite of amyl and nitro-glycerine. The last named remedy is occasionally useful in those exceptional cases of mitral stenosis where the tension of the pulse is raised. Small hypodermic injections of morphia sometimes give great relief when all other measures fail.

Palpitation in cases of failing compensation is usually symptomatic of cardiac weakness, and here the administration of small quantities of brandy, frequently repeated, is sometimes successful. A belladonna plaster, or an icebag applied to the præcordia, and bromide of ammonium, may also be tried.

Cardiac pain is often benefited by arsenic, iodides, or nitro-glycerine. Local applications of belladonna and aconite are also useful.

Dropsy may be treated by diuretics, such as digitalis, caffeine, convallaria, sparteine and squill, but of these digitalis is by far the most effectual. The combination of digitalis, squill, and blue pill is sometimes of great service. Calomel in repeated doses has lately been found to act well as a diuretic in cardiac cases.

Hydragogue cathartics are often used for the same purpose, though they have a less decided effect than diuretics. Jalap, scammony, elaterium, acid tartrate of potash, and mercurial preparations are the drugs that are mostly employed. Œdema of the skin may be relieved by puncture with Southey's trocars, but great cleanliness and antiseptic precautions are needed to prevent the development of erysipelas and other inflammatory affections.

Deficient secretion of urine must be treated by remedies, like digitalis, that act on the renal circulation.

Insomnia, which is often a most distressing symptom, may at times yield to paraldehyde, urethane, sulphonal, and bromides, but in troublesome cases a small hypodermic injection of morphia is the only means by which sleep can be obtained. A course of belladonna has occasionally been found to give good results.

Dyspepsia, being commonly the consequence of portal congestion, is usually benefited by mild purgatives, in combination with bitter infusions, acids, or alkalis, in different cases.

Hemoptysis is most common in mitral stenosis, and though it alarms the patient its effect is often salutary, and no special treatment is required.

Syncopal attacks are prone to occur in aortic cases as the result of cerebral anæmia. Brandy, ether, and ammonia may be administered, and the patient should be placed flat on the back.

The treatment of complications such as embolism, effusions into serous cavities, etc., must be carried out on general principles. The preceding remarks refer more especially to disease of the aortic and mitral valves, but affections of the right side of the heart must be treated on the same principles as those recommended in the case of mitral disease. In combined valvular affections treatment must be directed to the predominant lesion.

PERCY KIDD.

Symptomatic Indications.—The most generally useful remedy is *digitalis*, which is called for in all conditions where the heart is failing in power, the contractions are not powerful enough and are too rapid, and the arteries are not properly filled. Next in value is *convallaria*, in conditions due to incompleteness or absence of compensation, when there is deficient arterial blood supply and venous stagnation. *Convallaria* acts with striking benefit upon the dyspnœa due to pulmonary congestion, palpitation from least exertion, great nervous irritability, hysteria. *Adonis vernalis* is valuable in endocarditis, with valvitis to tone the muscular fibers and overcome dilatation from weakening of muscular walls, for which the principal symptom is found in the diminished force of the heart's action, with lowered blood pressure. *Squilla* will sometimes prove useful when the heart's action is feeble, irregular, and weak, with much dyspnœa, and constant hawking, loose or dry cough, scanty urine, cold skin. *Cactus grandiflorus* may be called for when the action of the heart is much excited, with sensation as if the heart was grasped or constricted. For the dropsy attending valvular disease the principal remedy is *arsenicum*. *Apocynum* may be useful.

HEARTBURN is a prominent symptom of chronic gastritis, and consists of a burning sensation generally referred to the cardiac end of the stomach, but sometimes felt all over the abdomen. Acid eructations are usually present. Careful dieting is of the first importance in the treatment. Fat, sugar, starch, and beer should be prohibited, very weak brandy

and water being the only stimulant allowed. Alkalies may be administered with benefit. See FEVER, HECTIC.

Symptomatic Indications.—The principal remedy is *nux vomica*, which will relieve the majority of cases, particularly when associated with acidity. *Pulsatilla* is useful when with diarrhea and acidity, and during pregnancy.

HEMERALOPIA.—A disease in which the eyes possess the faculty of seeing while the sun is above the horizon, but are incapable of seeing by the aid of artificial light. Its causes are not determined. The eye, when carefully examined, presents no alteration, either in its membranes or humors.

HEMIPLEGIA.—Paralysis of one-half of the body, the result of a lesion existing in the *opposite* half of the brain.

May be caused by: (1) extensive disease of the motor part of the cortex; (2) lesions of the motor fibers of the corona radiata, passing down from the cortex; (3) disease about the corpus striatum, involving the fibers of the internal capsule contiguous to it; (4) a lesion of the pyramidal tract in the crus cerebri and pons Varolii.

The most common cause of hemiplegia is hemorrhage or softening about the internal capsule and corpus striatum, but although the corpus striatum has been usually described as the seat of hemiplegia, it seems probable that lesions of this body alone do not cause hemiplegia unless the internal capsule itself be involved. The portion of the internal capsule, destruction of which causes hemiplegia, comprises a small part of the anterior limb just in front of the genu and the anterior two-thirds of the posterior limb. Hemiplegia with gradual onset is also caused by tumors occurring in the above mentioned parts of the motor tract.

Symptoms.—When, after an attack of apoplexy, the patient attempts to move the limbs, he is frequently found to be paralyzed in one-half of the body. In the early stage the patient may have conjugate deviation of the eyes, and the head may be turned toward the sound side (by the overaction of the non-paralyzed muscles), and there may be some difficulty in turning the head and eyes toward the paralyzed side.

The naso-labial fold is less marked, and the angle of the mouth is lower, on the paralyzed side, and there is difficulty in showing the teeth on that side; the upper part of the face is usually unaffected, though in some cases there may be rather more difficulty in wrinkling the brow and in closing the eye on the paralyzed side, but never to the extent observed in paralysis of the trunk of the facial nerve. The tongue, when protruded, deviates toward the paralyzed side, the speech is sometimes thick and indistinct, and with right hemiplegia aphasia may be present. Slight difficulty of swallowing may exist.

The upper and lower limbs of the affected side are completely or partially paralyzed, and at first are relaxed or may present the phenomenon of "early rigidity"—a condition supposed to be due to "irritation" by the lesion of the neighboring parts of the brain.

The muscles of the paralyzed limbs react well to both faradic and galvanic currents, and there is no loss or change of reaction such as is seen after lesions of the anterior cornua of the spinal cord or of the peripheral nerves. There is no marked wasting of the limbs and no anæsthesia, unless the sensory fibers in the posterior third of the hinder limb of the internal capsule be involved. The tendon reflexes are increased on the paralyzed side, the knee-jerk (patellar tendon reflex) being increased, and ankle clonus being present, while the superficial reflexes (plantar, etc.) are usually diminished. The sphincters are not involved as a rule, unless there be some mental defect owing to the highest cerebral centers being involved, or in cases of double hemiplegia. The thoracic muscles and abdominal muscles escape paralysis, but at times the abdominal muscles are weak on the paralyzed side.

After a few days, or even months, a gradual return of power takes place in the paralyzed limbs, and in most cases the leg begins to recover before the arm, and the proximal joints of the limbs (shoulder, hip) before the distal ones (hand, foot). If the attack have been a slight one, the patient may completely recover the use of his limbs, but in a great many cases a certain amount of power returns in the shoulder and elbow, but not in the hand or wrist. After a few weeks, the joints which fail to recover power are affected with "late rigidity,"

and become stiff and contracted, while at the same time the tendon reflexes are much increased. The rigidity is due to sclerosis descending from the fibers which have been destroyed in the internal capsule down the pyramidal tract and lateral columns of the spinal cord.

In some cases the face and the upper limb are affected, and the lower limb escapes, while in others, the lower limb is affected more than the upper, and here often the face is very little paralyzed, and recovers very soon, while the arm recovers power before the leg. These cases are probably due to the lesion occurring in different parts of the internal capsule or the cortex, the anterior region of the motor part of the capsule being affected in the former case, and the posterior part in the latter.

In lesions about the upper part of the pons Varolii the third nerve on the *same* side as the lesion is liable to be paralyzed, producing external strabismus of the eye, with ptosis—along with hemiplegia of the side *opposite* to the lesion; and in lesions of the lower part of the pons the facial nucleus of the *same* side as the lesion may be affected—causing paralysis of the whole of the face of that side, with paralysis of the arm and leg of the opposite side; this is called "cross paralysis."

With hemiplegia there is frequently hemianæsthesia of the paralyzed limbs, the loss of sensibility being sharply limited by the median line. In such cases there is sometimes hemianopsia of the same side—*i. e.*, with right hemianæsthesia, the right half of the field of vision for both eyes is abolished, with loss of hearing, taste, and (?) smell on the same side as the hemianæsthesia.

Diagnosis.—See CEREBRAL HEMORRHAGE. With regard to the position of the lesion producing the hemiplegia it may be said that lesions of the cortex are usually associated with epileptiform convulsions of one side, occurring during the course of the hemiplegia, and affecting the paralyzed limbs (*see* BRAIN). In such cases the paralysis is often partial and affects the face alone, or one limb only.

The most common site of the lesion is in the internal capsule. It is difficult to diagnose this from disease of the corona radiata, but to produce the same amount of paralysis a much larger lesion would

be required there, owing to the spreading out of the motor fibers. Hemianæsthesia usually means that the posterior part of the internal capsule is involved, but it may be also caused by lesions of the pons Varolii.

Prognosis is bad if there be no return of power in the paralyzed parts at the end of a month. Early rigidity is an unfavorable sign, especially so if it persist. When, after several weeks, there is no return of power in a limb, such as the arm, and it becomes stiff from late rigidity, with great increase of the tendon reflexes, it is almost hopeless to expect any improvement. Hemiplegia, with a gradual onset, especially in old people, is unfavorable, as it is frequently due to softening from thrombosis. In cases in which the onset is gradual, and signs of an intracranial growth subsequently develop, the prognosis is very grave.

Treatment.—In the early stages of hemiplegia the patient should be kept completely at rest in bed, and the bowels attended to. The diet should be light and nourishing, and stimulants are best avoided. Later on the paralyzed limbs may be rubbed, and passive movements employed, and the patient encouraged to try and move them. To prevent wasting the muscles should be faradized, but not at the outset of the case. Tonics, as quinine and iron, are useful, and nervine tonics, as strychnine and hypophosphite of soda, may be given with advantage. A history of syphilis will suggest the use of iodide of potassium and mercury. As soon as the patient is well enough he should be got into a couch or wheeled chair, and encouraged to walk when sufficient power has been regained in the leg.

C. E. BEEVOR.

Symptomatic Indications.—*Causticum* is the first and principal remedy for paralysis after apoplexy, shifting rheumatic pains. *Rhus tox.* is useful in rheumatic paralysis, creeping numbness, particularly on left side. *Nux vomica* with disturbance of digestion, paralysis from abuse of alcohol. See PARALYSIS.

HEPATITIS. — See LIVER, CIRRHOSIS OF.

HERNIA.—The protrusion of a viscus, or a part of a viscus, from the cavity within which it is contained. Commonly considered to apply to the viscera of the

abdomen, and to be synonymous with “rupture.”

As generally accepted, the term implies that the protruded part is covered by integument, and the expression is not usually applied to the escape of viscera through a recent penetrating wound of the abdomen. “Hernia cerebri” and “hernia testis” are applied to the escape of disorganized brain matter or testicular tissue through an opening respectively in the skull or in the scrotum.

The essential parts of a hernia may be considered under three heads.

1. *The sac.*—The sac of a rupture is composed of peritoneum, and forms the sac or bag in which the protruded parts are contained. Hernial sacs are divided into two kinds, the congenital and the acquired. In the former instance the sac depends upon a congenital defect in the peritoneum; it exists, as it were, ready made: and such sacs are met with only in the inguinal region and at the umbilicus. In the former situation they depend upon an imperfect closure of the tubular process of peritoneum that normally accompanies the testis in its descent into the scrotum. In the latter locality they depend upon imperfect closure of the ventral walls, and lead to a rare form of rupture known as the congenital umbilical.

The formation of the acquired hernial sac merits attention. The peritoneum lines evenly the anterior parietes of the abdomen. There are certain weak points in the abdominal wall, as in the vicinity of the inguinal canal in the male. Along this canal the testis has passed out of the belly; the spermatic cord occupies its tract, and prevents that tract from being obliterated. Some other organ besides the testis may, if proper force be applied, be made to follow its line of escape, and so constitute a rupture. The peritoneum, moreover, about the inner opening of the inguinal canal, is not so firmly adherent as elsewhere, and under a certain degree of intra-abdominal pressure the little patch of serous membrane that covers the so-called “internal ring” may be made to bulge into the inguinal canal. If that pressure be frequently repeated, the bulging will be increased until a funnel-like depression is seen in the peritoneum at this spot.

By a further step the funnel is elongated into a glove-finger-like bag occupying

the inguinal canal; and as soon as the protruded membrane has escaped beyond the narrow limits of the canal into the loose scrotal tissue, it may expand into a bag of pyriform shape, since beyond the canal it meets with less resistance to its progress. To the pyriform bag may be applied the term, a fully developed hernial sac. The main part of the sac is called the body; the wide extremity, the fundus; the narrow extremity (the stalk of the pear), the neck; and the opening of the sac into the abdominal cavity, the mouth.

The interior lining of the sac is smooth, its outer wall rough; so that when once a sac has been formed it nearly always contracts adhesions to the parts around and becomes permanent. The contents of the sac may be pushed back into the abdomen, but the sac itself generally remains permanently irreducible. About the neck of the sac the peritoneum is thrown into pleats or folds. In time these pleats become matted together, and then the neck becomes a tough and permanent structure; so that, if all other parts outside the sac were to be cut away, that structure would still retain its peculiar outline. Before such matting together takes place, the neck of the sac has no independent existence, but is due to the narrowness of the passage it occupies; and when the parts around it are cut away it ceases to exist. Thus it happens that the contents of a sac cannot be strangulated or nipped by its neck until that neck has taken the permanent form (by agglutination of the pleated peritoneum) of a definite and rigid ring. In process of time the neck tends to become very dense and firm.

The neck always occupies the narrowest part of the tract along which the protrusion has passed. The body may undergo little change, or may become much thickened, or may send off a diverticulum or secondary sac. In a hernia of the cæcum or of the bladder there is usually either no sac at all, or only a partial one.

2. *The contents of the sac* vary mainly according to the position of the hernia. Usually the small intestine (and especially the ileum) is the part involved in the rupture. All the abdominal viscera, however, with the exception of the pancreas, have been the subjects of protrusion. Next in frequency to the small intestine comes the colon, and after the

colon the stomach. The great omentum is very frequently involved in a rupture, especially in those occupying the left side of the body, the epiploön being placed more to the left than to the right of the middle line.

A rupture containing intestine only is called an *enterocele*; one containing omentum only an *epiplocele*. To the hernia occupied by both omentum and gut, the term *entero-epiplocele* is applied. By the term *cystocele* is understood a rupture containing a part of the urinary bladder.

3. *The parts that cover the sac* will vary according to the situation of the hernia. In general terms, it may be said that the layers of fascia covering the protrusion become fused together, that muscular tissues waste, that the subcutaneous fat is apt to disappear, and that the skin shows a tendency to atrophy. Such changes are best seen where there is no redundant skin to accommodate the protrusion as in femoral hernia, and are usually absent when the opposite condition exists, as in the case of small scrotal herniæ.

Ætiology of hernia.—1. *Sex.*—Hernia is more common in males than in females in the proportion of two to one for all ages and for varieties of rupture. 2. *Age.*—It is met with at all periods of life, but the majority of cases develop before the age of thirty-five years. In many instances the rupture is congenital. 3. *Heredity.*—A disposition to hernia may be inherited. Mr. Kingdon has estimated that thirty-four per cent. of all cases show the effects of hereditary influence. The great majority of these cases are met with in infants who are the subjects of congenital inguinal hernia.

4. All forms of congenital hernia depend upon certain definite *structural defects*.

5. *Long mesentery.*—It has been suggested that an abnormally long mesentery may dispose to hernia, and may be a congenital condition. In a normal subject no loop of small gut can be drawn out of the abdomen below the level of the pubic spine, and therefore, when intestine occupies the scrotum, it must present a much lengthened mesentery.

6. *Occupation* influences the production of hernia, rupture being most common among the laboring classes. It would appear to be encouraged by muscular exertion undertaken when the thighs are bent

at the hip, as in lifting weights. In this position the structures about the inguinal and femoral "orifices" are relaxed, and a vigorous contraction of the abdominal muscles must bring much pressure to bear upon those points. Many times a hernia has become protruded while straining at stool, the structures about the groin being relaxed by the posture assumed. Severe, abrupt, and intermittent exertions especially dispose to hernia.

7. *Certain diseased conditions* encourage rupture. Thus hernia is apt to occur after a weakening of any part of the abdominal wall by wound, rupture of muscle, or abscess. It is encouraged by the relaxed parietes left after parturition, or ascites or abdominal tumor, and is not infrequent in those who have lost their muscular tone, and exhibit a relaxed condition of their tissues. A rapid loss of fat in the subjects of great obesity would appear to favor certain herniæ. Diseases involving frequent vigorous use of the abdominal muscles, as chronic bronchitis, straining at stool, straining to empty the bladder, etc., encourage the production of rupture.

Seat of hernia.—It may be said that out of every 100 cases of rupture, 84 will be inguinal, 10 femoral, and 5 umbilical.

The clinical forms of hernia.—1. Reducible. 2. Irreducible. 3. Obstructed or incarcerated. 4. Inflamed. 5. Strangulated.

1. **Reducible hernia.**—*Diagnosis.*—The most common form, in which most recent ruptures are met with, the contents can without difficulty be reduced into the abdomen. The patient presents, at one of the sites for hernia, an elongated or rounded tumor, broader below than above, and often narrowed into a species of neck near its point of connection with the abdominal parietes. It is smooth and regular. When the contents of the sac are intestine the swelling feels elastic. It becomes tense and enlarged when the patient strains or exerts himself. It is probably larger when he is standing up than when he is lying down. It presents a distinct impulse on coughing. It is tympanitic on percussion. If reduced it returns into the abdomen with a slip and with a peculiar gurgling noise.

When the sac contains omentum alone the tumor is compressible, and often feels flabby and uneven. It is dull on percussion. It is less readily affected by position and straining. It presents a fainter

impulse on coughing. If reduced it returns gradually and without gurgle. In entero-epiploceles the signs of the two forms of hernia may be combined, but except in very simple and typical cases the diagnosis of the contents of the sac is by no means certain.

The subjects of reducible hernia usually complain of a distressing sense of weakness about the regions of the tumor, and of pain there during exertion. At the same time they are apt to be troubled with some discomforts within the abdomen, and to be the subjects of an uncertain kind of dyspepsia.

The *prognosis* is favorable so long as the rupture is of moderate size, can be kept well reduced by a proper truss, and the patient is not exposed to violent exertion.

Treatment.—A. *Palliative* consists simply in the use of a proper truss whereby the hernia is retained within the abdomen. If the rupture be a small enterocele, it may be prevented from descending for months or years by means of a truss. The larger the tumor, the more difficult is it to prevent the intestine from descending, and the greatest difficulty is experienced when the orifice of the hernial sac is disproportionately large. Obesity offers as a rule a serious obstacle to proper adjustment. A small inguinal hernia is more easily kept up than is a femoral rupture of corresponding size. The least difficulty is experienced in retaining ventral and umbilical ruptures when they do not exceed moderate dimensions. If some irreducible omentum be left in the sac, it seriously interferes with the efficacy of a truss, and under such circumstances much difficulty may be experienced in preventing the descent of a knuckle of reducible intestine. Congenital inguinal herniæ are more easily retained than are acquired inguinal ruptures of similar proportions.

In many the use of a truss has led to a permanent cure of the slighter degrees of hernia, especially in instances where improvement has taken place in the state of the muscular system. The continuous and careful use of a truss has led to cure in cases of congenital inguinal hernia, the patent tube of peritoneum having been induced to close under the long maintained compression.

Trusses.—The essential parts of a truss are the pad, which is placed over the hernial orifice, and the spring or belt, which

keeps the pad in position. A good truss should be light, firm, and elastic, and should keep up the rupture in all positions of the body, and under all ordinary circumstances of exertion. If the pad press too firmly, it may produce atrophy of the parietes, and even enlargement of the hernial opening, or may cause any irreducible contents to inflame. The truss should be worn all day, and at night may be replaced by a lighter one. The patient should also be provided with a "bathing truss," *i.e.*, a truss so made as to be unaffected by immersion in water.

The pad is made of various materials. It must vary in size according to the dimensions of the hernial aperture, and should overlap the aperture for at least half an inch all round. A still greater margin should be allowed in large herniæ. With regard to the precise direction of the pad, in any case the rule must be observed that the pressure be exerted in a direction at right angles to the plane of the hernial passage. Thus, in a thin subject, with inguinal hernia, the pad should press directly backward, while in patients with pendulous abdomens the line of pressure would be upward, backward, and inward. Too convex a pad is objectionable, since it tends to enlarge the aperture instead of protecting it.

The ordinary *truss* presents a spring of an intermediate character. The pad is affixed to one end of the spring at an angle that varies with the nature of the rupture. On the pad are two studs: the upper to take the strap that passes from the free end of the spring; the lower to take a strap that passes along the perineum between the thighs. The spring must pass round the body just below the iliac crest. If it is above the crest, it will be displaced by the action of the abdominal muscles; if it is much below the crest, it comes under the influence of the gluteal muscles; and if it be on the crest, it is apt to chafe the skin.

To measure for an inguinal or femoral truss the tape should be made to start from the lower part of the hernial orifice, pass up to the anterior superior spine of the same side, then round the body one inch below the iliac crest, to the other anterior spine, and thence to the upper part of the hernial orifice. In oblique inguinal hernia the pad should be placed over the internal ring and canal, in direct inguinal over the external ring. In fem-

oral rupture the pad should press as directly as possible upon the femoral ring at the level of Gimbernat's ligament.

To test the value of a truss the patient should strain and cough in such positions as will most relax the parietes about the hernial orifice, and encourage any tendency of the truss to shift its position. Thus, in the case of herniæ about the groin, he should be made to strain while sitting with the body flexed at the hip joints, and with the legs wide apart, so as to prevent the abdominal walls from deriving support from contact with the thighs.

For irreducible femoral herniæ a truss with a hollowed pad is used, so as to support and protect the parts. A like pad may be used for small irreducible inguinal ruptures.

For large irreducible scrotal herniæ a "bag truss" is used, the apparatus being merely a well-adjusted "suspensory bandage."

B. Methods for radical cure.—(a) *Wutzer's operation* consists in invaginating a part of the scrotum, and with it the fundus of the sac, into the inguinal canal, and in fixing it there by exciting adhesive inflammation in the neck of the sac. The scrotal tissues are invaginated by means of a hollow boxwood cylinder, the end of which is passed up as far as the internal ring. This cylinder conceals a needle, which is made to traverse the invaginated scrotum, the sac, and the anterior abdominal wall. The needle and the cylinder are then fixed in place by means of a concave boxwood case, which is screwed to the cylinder. The apparatus is retained for six to eight days, when adhesion will have occurred at the fundus of the invaginated portion. The operation has been practically abandoned, as the cures obtained have not been permanent, and a truss cannot be dispensed with.

(b) *Wood's operations*, known as the subcutaneous wire operations, are varied, according to the nature of the herniæ dealt with.

The general principles (which have been applied to inguinal, femoral, and umbilical ruptures) may be illustrated by a reference to the procedure in the first-named hernia. In this form, the hernia having been reduced, an incision is made into the scrotum, the fundus of the sac is invaginated upon itself, and pushed up into

the inguinal canal. It is now secured in this position by a wire suture, which, in addition to securing the sac, is so passed from one side to the other of the canal that it is made to practically close the inguinal canal. The wire suture, secured over a pad, is retained from eight to twelve days, and excites a varying degree of plastic inflammation about the parts. The effect of this operation is to unite in one cicatrix the sides of the inguinal canal as far up as the deep ring, together with the pillars of the superficial ring; this ring supports the invaginated, twisted, and obliterated sac, with its intimate coverings of external and internal spermatic and cremasteric fasciæ. All these are blended together in the fibrinous effusion consequent upon the pressure of the wires. The risks amount to only one per cent. In favorable cases successes attain to eighty per cent., and in less favorable cases to sixty per cent. Many patients have never required to wear a truss again; others have been able to wear a lighter truss; and even unsuccessful cases have never been rendered worse by the operation.

(c) *By injection.*—By this procedure an irritating fluid is introduced into the tissues about the neck of the sac. Some inflammatory action results, and, by a species of cicatrization, the neck of the sac is closed. The operation was first introduced by Dr. Heaton, who used, as his injection material, an extract of oak bark. Dr. Warren of Boston has perfected Dr. Heaton's method, which he has extensively adopted with, he states, very excellent results. This method of treating reducible herniæ has lately been again advocated by Dr. Schwalbe, whose plan is as follows: The rupture is reduced and retained by the forefinger. A syringe is then thrust through the skin at a point from one to two cm. from the neck of the hernia, and is then cautiously pushed deeper until its point reaches the vicinity of the hernial orifice. This must be done, however, without wounding the sac. When the canula is in this position, the contents of the syringe are slowly injected into the tissues about the hernial aperture. The material employed is a twenty, fifty, or seventy per cent. solution of alcohol. The pain caused by the operation is dulled by slight chloroform narcosis, or by local anæsthesia. The injection has to be repeated, on an average, twenty

times in each case, and confinement in bed for the first few weeks of cure is essential. The cure of an umbilical hernia will probably require two to three months; a femoral hernia, three to six months; while an inguinal hernia may require treatment for one year before it is wholly cured. These operations, however, have met with little support. The results appear to be uncertain; the treatment is painful, very tedious, and protracted, and in unskilled hands there must be a risk of piercing the sac and injecting the irritant into the peritoneal cavity.

(d) *Obliteration of the sac.*—This operation may be described as it is applied to a scrotal hernia. An incision is made along the center of the tumor in its long axis, and is so planned that the center of the incision corresponds to the external ring. The sac is exposed, and is entirely separated from the surrounding parts. The contents are reduced, and the neck of the sac having been defined, that part is surrounded by a ligature of catgut. This is very tightly tied, cut short, and left. The sac below the ligature is then excised. One or two sutures of catgut or wire are next introduced, so as to close the external abdominal ring; these are cut short and are permanently retained, a drain is introduced, and the wound closed. The whole proceeding should be conducted under Listerian precautions. If the hernia be very large, an elliptical piece of skin may be removed before the wound is closed. If in whole or in part not reducible, the sac must be opened, adhesions divided, and portions of adherent omentum ligatured and removed.

Some ligature the neck alone, and leave the sac undisturbed. By this means the extensive raw surface that results from the excision of the sac is avoided, and it is maintained that the shrunken sac acts as an efficient plug. In such a case, however, the sac may suppurate, and trouble therefrom may arise.

Ball dissects the sac from its attachments, grasps the neck high up with a pair of clamp forceps, and then twists it, executing, as a rule, three complete revolutions. He claims three advantages for this measure. 1. The sac is closed at a higher point in the inguinal canal than could be reached by any ligature. 2. The peritoneum about the abdominal orifice is disturbed, is tightened, and thrown into

folds, which probably in time adhere. 3. The sac is well and completely closed.

This operation should not be employed in small or moderate herniæ that can be easily kept up by a truss. It may be adopted (1) in herniæ of large size that cannot be supported; (2) in herniæ formed in whole or in part of adherent omentum, as in ruptures where a piece of adherent omentum occupies the sac, and prevents the proper retention of reducible bowel; (3) in strangulated herniæ.

The procedure, when applied to umbilical or ventral ruptures, differs in no essential respect from the operation already described. In femoral hernia a great difficulty attends the closure of the hernial orifice. A needle can be well passed through Gimbernat's ligament, but on the other side of the ring there is hardly enough tissue to the inner side of the femoral vein to hold a tight suture. In these ruptures the process of torsion of the sac would appear to be indicated.

This operation is not a radical cure. In many instances it has been complete. The best that can be said is that it will render almost any hernia tolerable and capable of being comfortably supported by a slight truss. It has also advantages in connection with the treatment of strangulated herniæ. In 188 examples of the operation performed for strangulated rupture, the mortality was seventeen per cent., with some recurrence of the hernia in one-third.

In small inguinal herniæ, and in ordinary femoral herniæ, the whole sac may be removed; but in large inguinal herniæ, especially in those of the congenital form, the total extirpation of the sac is unnecessary, and it may prove difficult to dissect it away without injuring some of the constituents of the spermatic cord, thus giving rise to considerable hemorrhage, difficult to check and prone to recurrence. It is sufficient in such cases to dissect a ring-like portion of serous membrane away from the neck of the sac. This leaves a broad, raw surface, which afterward firmly unites in a cicatricial mass, leaving the testicle shut off below in normal and practically undisturbed connections.

It is desirable to suture or ligature the neck as high up as possible, so as to leave no pouch of serous membrane in which a hernia may again form. In some only were the pillars of the ring sutured in addition. I have not been able to observe

that the final result was much affected by this. Suturing may, however, be of immediate advantage in cases complicated by cough, and it probably increases the amount of plastic material thrown out, and consequently the strength of the subsequent cicatrix. As a rule, if the ring be wide it is better to close it in this way. One effect must follow on this innovation, namely, that early operation, so important in all cases of strangulation, will tend to become yet more early, since it is justifiable to operate for the radical cure of hernia by this method in the absence of symptoms of strangulation.

In nearly all strangulated herniæ, after the division of the stricture, a partial or complete abscission of the sac should prove an ordinary part of the operation. Where the aperture is large, its margins should be drawn together by suture. Chromicized or green catgut suffices for the purpose; or a silver suture may be used. In many cases the operation may be extra-peritoneal from the beginning, and the ligature applied around the neck of the sac before it is opened or removed. In non-strangulated herniæ the operation may be performed without serious risk, if the patient be in good general health, and with the result of permanently freeing the individual from the consequences of a debilitating infirmity. In young children up to the age of nine operation is not advised, because of the great difficulty of maintaining the wound aseptic; and because the effort to procure a permanent cure by a carefully adjusted truss is so often successful.

2. Irreducible hernia.—In this form of rupture the contents cannot be returned into the abdomen; but the tumor presents an impulse on coughing, and exhibits the ordinary physical signs. Such herniæ are usually of old standing, and often of large size. As a rule, herniæ of the cæcum or of the bladder are irreducible. The principal causes of irreducibility are the following: (1) The great bulk of the tumor, as seen in very large, pendulous, scrotal, and umbilical herniæ. (2) Adhesions between the sac and its contents, matting together the loops of protruded bowel, or between one part of the sac and another, and so forming bars which impede reduction. (3) A great development of fat in prolapsed omentum may lead to a reducible rupture becoming permanently irreducible. In many in-

stances some part of the hernial contents is reducible, while the remaining portion is fixed in the sac. The commonest examples are large scrotal herniæ, and femoral epiploceles.

An irreducible hernia produces a sense of weakness in the part, and is attended by more or less abdominal pain, by intestinal irregularities, and by dyspepsia. It is apt to increase in size, and liable to become obstructed, inflamed, or strangulated. It is peculiarly exposed to injury.

Treatment.—If large the hernia should be supported by a bag truss. If small, it must be protected and supported by a truss or a hollow pad. Avoid exertion, adopt a simple diet, and take care that the bowels act regularly. In instances where the irreducibility has depended upon a development of fat in the hernial contents, the rupture has been rendered reducible by keeping the patient in bed for several weeks, with an icebag applied to the tumor, and upon a very low diet.

In the majority of instances, a more or less complete cure results from opening up the sac, dividing such adhesions as require division, then reducing the contents, and treating the sac and the hernial orifice in the manner described in the "radical cure." This procedure in large scrotal herniæ affords great relief, and enables the patient to retain the rupture comfortably with a light truss. In cases where very extensive adhesions involve the bowel, active interference will in most cases be contra-indicated.

Cæcal herniæ and cystocele are considered here, since they are most usually irreducible.

Cæcal herniæ are met with only on the right side (inguinal) and at the umbilicus in certain forms of congenital herniæ, attended by malformation of the colon. In the former situation there will be either no sac, or, in most instances, but a partial one. A large irregular tumor is produced, which is more or less irreducible, which has no great disposition to become strangulated, but is very apt to present the phenomena of an "obstructed hernia." When the cæcum takes part in a congenital umbilical hernia, it is provided with a perfect sac, and may be easily reduced.

Cystocele is very rare. The sac is partial and the rupture irreducible. The protrusion is attended by difficulty in urinating and pelvic pain. The tumor varies in size, and, by squeezing it when

full urine may be forced along the urethra. It is dull on percussion, and presents distinct evidence of fluctuation. A cystocele may be combined with some protrusion of intestine.

3. Obstructed or incarcerated hernia.—In this form, the bowel occupying the tumor becomes obstructed by fecal matter, and probably by portions of undigested food. Symptoms of intestinal obstruction are produced. The condition is usually met with in herniæ containing colon, and particularly in such as are in whole or in part irreducible. It is most common in umbilical ruptures and in individuals who are liable to constipation. When obstruction takes place in a hernia, the tumor is found to be larger than usual, a little painful, and possibly tender. It is dull on percussion, feels doughy to the touch, can often be lessened in size by pressure, is irreducible, but presents an impulse on coughing. It will be attended with some colicky pains, with a dragging sensation about the umbilicus, with defective appetite and coated tongue. There will be some flatulent distention of the abdomen, nausea that may pass on to vomiting, and more or less constipation. Unlike a strangulated hernia, there are no evidences of constitutional depression; vomiting is trifling, constipation not complete, and the tumor neither so tense nor so painful as in strangulation. An impulse on coughing is retained.

Treatment.—Rest in bed with the body so placed as to relax the fascial structures about the hernia. An icebag should be applied, and if much colic exists, give a little opium. Nothing but iced water should be given by the mouth. In twenty-four hours the more marked symptoms will probably pass off, when an enema may be administered, followed in a few hours by a dose of castor oil. The less the tumor is manipulated the better.

4. Inflamed hernia.—Usually the result of some injury inflicted upon a small irreducible rupture; often due to a badly fitting truss. Most frequently met with in connection with small irreducible femoral epiploceles. Is essentially a form of well-localized peritonitis, involving the sac and its contents.

The *symptoms* are: The tumor becomes hot, tender, and painful. If purely omental it is apt to feel hard and nodulated; if an enterocele, much fluid usually collects in the sac. The swelling is

irreducible, but retains an impulse on coughing. There will be some fever, vomiting, and possibly constipation. The vomiting will be, however, slight, inconstant, and the ejected matters will be composed only of the contents of the stomach. The constipation likewise is not invariable, is not complete, and flatus is usually freely passed. It differs from strangulated hernia mainly in the circumstance that there is little or no constitutional disturbance, while the chief symptoms are purely local. It is, on the other hand, not infrequent to meet with patients suffering from a severely strangulated hernia who are not even aware that they are ruptured.

Treatment.—Absolute rest in bed, with the knees bent over a pillow, a low diet, and an icebag applied to the part. An enema may be given, and when the inflammatory symptoms have subsided, a mild aperient, such as castor oil. If there be much pain, use opium. In certain cases the inflammation may pass on to suppuration of the sac, and the treatment of such complication resolves itself simply into the ordinary treatment of an abscess.

5. Strangulated hernia.—This term is applied to a rupture in which there is (1) an obstruction to the passage of the gut back into the abdomen; (2) an obstruction to the passage of the intestinal contents in the gut involved; and (3) an obstruction to the passage of blood in the herniated tissue.

The condition is met with in all forms of hernia, and may occur in any case. It is more common in old than in recent ruptures, most often met with in women, and in active adult life, in inguinal than in femoral ruptures, and is by comparison uncommon in the umbilical form. In inguinal herniæ it more often involves the congenital than the acquired forms.

Mechanism.—Strangulation is usually due to a sudden descent into the sac of more than its usual amount of contents. This is often brought about by some abrupt unwonted exertion, though increased peristaltic movement in the bowel may lead to the condition. It is often preceded by some "bowel complaint" or intestinal disturbance. Sometimes the swelling of the contents of the sac plays a primary part. The gut has become engorged by the nature of its contents, or by the alteration in the circula-

tion produced by some enteritis. It has swollen slowly until at last the swelling has reached a degree that enables the phenomena of strangulation to be produced. There are thus instances where the peculiar symptoms have developed during sleep. In any case the hernial contents are increased in volume. The narrow strait, through which those contents have passed, is occupied to the utmost. The veins are compressed, and the parts rendered still more swollen, and when these circulatory changes are produced, the phenomena of strangulation are not far distant. The constriction may be at the neck of the sac produced either by the structures immediately outside, or by the tissues of the neck itself; it may be at some narrowed point in the body of the sac as seen in "hour-glass hernia;" it may be caused by adhesions within the sac, between which bowel or omentum has been thrust. In the majority of instances the constricting agent is the ring of tissue outside the neck of the sac. There is no evidence to show that strangulation can be produced by spasmodic contraction of the tissues outside the neck of the sac. These tissues are usually hard and dense, and play a passive part in the condition induced.

The strangulated parts will not return into the abdomen, because the mechanical relation between their size and shape and that of the hernial ring will not permit them to alter their position. The mechanical obstacle to reduction is akin to the mechanical obstacle that prevents a button from being drawn through a buttonhole by mere traction. It will be seen from this that enteroceles, are very much more liable to strangulation than epiploceles, and also that an irreducible, hernia may be the seat of strangulation either on account, as is most usual, of the descent of more gut, or on account of a swelling of the parts already in the sac.

Local effects.—The loop of gut involved becomes swollen and its walls thickened. At the seat of constriction a deep furrow is formed in the intestine. It must be remembered that in the great majority of cases a knuckle or loop of gut is implicated, and consequently two tubes of intestine fall within the constricting line. Since the gut above the constriction will be distended by its retarded contents, and will subsequently

become hyperæmic, and since the gut below the stricture will be empty and collapsed, it usually happens that the upper limb of the knuckle will show more conspicuous changes at the line of constriction than will the lower. So when the strangulated gut gives way at the stricture line as a result of long-continued imprisonment, it is usually the upper portion of the loop, *i. e.*, the part nearer to the pylorus, that exhibits the breach. The loop in the sac soon becomes of a deep red color from interference with the venous circulation, becomes œdematous, and often exhibits patches of extravasated blood. In time the tint deepens into a claret, and then a purplish-brown color. In time all circulation is arrested, and the bowel becomes almost black, or greenish-black, or a blackish chocolate-brown, and shows the aspect of gangrene. The changes are not as a rule such as involve any question of inflammation. Inflammatory phenomena demand a condition of the vessels other than that of complete arrest of the circulation. But it is common to find slight evidences of inflammation in the less acute cases, or at the outset of the strangulation, and then flakes of lymph may be found upon the surface of the strangled loop. At first the bowel is smooth, glistening, and perfectly tense and elastic. As changes progress these features are lost. It becomes dull, and its surface is a little harsh or even sticky from death of the peritoneal epithelium. It subsequently loses its elasticity and yields under the finger. Death of the gut is not to be solely judged by its color. Test the state of the peritoneum that covers it, and the condition of its elasticity. The serous coat, being farther from the blood vessels than the muscular coat, is usually the first of the two to perish.

If the involved loop be opened, it will be found to be occupied by bloody mucus or by much dark blood. The mucous membrane soon perishes, and is sometimes found shed in large part. With regard to the sac itself, it commonly exhibits the phenomena of peritonitis; and when much lymph is found in the sac cavity, it is usually produced by the inflammation of that membrane. An accumulation of fluid within the sac is the product of peritonitis. At first this is clear and serous, but it soon becomes bloodstained, although still clear. This

bloody fluid later becomes turbid, and may assume a browner tint. If the gut be gangrenous, it will probably be quite turbid or opaque, and present a feculent odor.

The changes in strangulated omentum are identical with those met with in the bowel, if allowance be made for the differences in structure.

The gut, when gangrenous, may become ruptured, often from unnecessarily severe taxis, and fecal matter may be found in the sac. Sometimes there is merely a small perforation at the fundus of the loop, or in other instances the loop has not given way, but fecal extravasation is found to have occurred at the line of stricture, usually from the upper limb of the involved loop. Gangrene of the intestine is more common in femoral than in inguinal hernia. As a rule, when the gut gives way in strangulated hernia, no fecal extravasation takes place into the abdominal cavity. It is found in such cases that adhesions have formed about the hernial orifice, so that the ruptured bowel is held in place, and all communication between the sac and the peritoneal cavity is shut off. In neglected strangulated herniæ, the sac, or rather the tissues immediately outside it, may suppurate, and an abscess may form. When such an abscess is opened, it is not uncommon to find that the sac has sloughed *en masse*. If the patient recover, a fecal fistula results.

Symptoms.—The symptoms usually commence with pain at the seat of the hernia. The rupture will increase in size, become more tense, be dull on percussion, tender, especially near the neck, and lose all impulse on coughing. It will be irreducible. If much serum collects in the sac the tumor may undergo increase in size after the occurrence of the strangulation. The patient will be attacked with some colicky pain in the abdomen, and a sense of constriction and pain in the epigastrium; he will probably feel faint, and will be seized with vomiting. This symptom is one of the earliest, and one of the most constant and pronounced. The vomited matter consists at first of the contents of the stomach, then of bilious matters of a greenish color. In time the ejected material becomes brown, and presents at first an intestinal and subsequently a feculent odor. The vomiting is very frequent, persistent, and distressing. It occurs after the swallowing of any food as well as at other times.

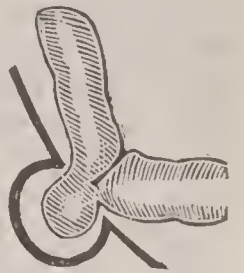
There is absolute constipation, not even flatus being passed. At the commencement of the attack, however, the bowel below the obstruction may empty itself, and there may even be a little quasi-diarrhea with tenesmus. The abdominal pain increases; it is of a colicky character, is paroxysmal, is a little relieved by the vomiting, and is most severe about the umbilicus. There is often a fixed pain about the neck of the sac. If relief be not given, the patient loses strength rapidly, the eyes become sunken, the nose pinched, the skin cold and clammy, and in severe cases the symptoms of collapse are marked. The pulse is small, rapid, and compressible. The tongue is at first covered with a creamy fur, but soon becomes dry and brown; there is great thirst. The urine is much diminished in amount, and is of high specific gravity. The chlorides are conspicuously diminished in amount, and if the strangulation has existed for some time, albuminuria is present. If unrelieved, the symptoms progress, and the patient dies usually in a state of collapse. In very acute cases death from collapse may supervene before any very gross local changes have taken place. In the majority of cases death follows upon the gangrene of the gut, or upon peritonitis, or upon yielding of the bowel at the stricture line. When gangrene sets in the pain diminishes or ceases, the vomiting is usually replaced by hiccough, the pulse becomes feeble and intermittent, and a low form of delirium is not uncommon. In such a case, also, there may be local evidences of inflammation of the hernial sac.

Modifications of symptoms.—(1) In small herniæ, especially those in the femoral region, the local symptoms may be so little marked that the patient may fail to draw the surgeon's attention to the rupture, or may not be aware that he is ruptured. If there be much omentum in the sac the tumor may still feel soft and lax after strangulation. If a small knuckle of gut in a large rupture be strangulated by adhesions within the sac, the tumor may still present an impulse on coughing after strangulation. (2) The vomiting may in rare cases be slight, or may cease after a while, or be persistent but not feculent. (3) Remember that the principal symptoms can be masked by opium. With the use of the drug the pain disappears, the pulse improves, the signs of

collapse are less marked, the amount of urine is increased, and the vomiting rendered much less frequent. It is unwise, therefore, to administer opium until the diagnosis is clear and a plan of treatment has been determined upon.

Strangulated omental hernia.—This is attended by symptoms, though usually less severe, of the same general character as those first described. The pain is slighter, the vomiting less severe, the constipation often incomplete, and depression less marked. The hernial tumor feels nodular and hard. The case, if left to itself, will probably end in a fatal peritonitis, and such cases require active treatment.

Littre's hernia.—In this form of rupture an entire knuckle of intestine is not implicated, but a portion only of the circumference of the bowel is involved in the hernial ring. The part of the bowel constricted is firmly held by the constricting agent, and although this part becomes strangulated, and will, if unrelieved, become gangrenous, the lumen of the intestine is not entirely occluded (see cut.) This form of strangulated hernia is practically limited to the femoral region. The tumor is often so small as to be overlooked, and the condition is usually observed in small reducible herniæ, for which no truss has been considered necessary. The symptoms are less acute than those attending the ordinary strangulated rupture. The pain is severe, and vomiting appears early, but the vomiting is not so urgent, nor are the ejected matters so apt to become feculent as is the case in the common form. There may be constipation, but usually this is incomplete, and loose motions may be passed throughout the progress of the case. The ensnared part is apt to become rapidly gangrenous, and a Littre's hernia calls for prompt surgical interference.



The *diagnosis* presents in the majority of instances no especial difficulty. The general symptoms to which most importance attaches are the severe and persisting vomiting, the absolute constipation, and the marked constitutional depression. Of the local symptoms, the most important perhaps is the absence of impulse, on coughing, in the tumor. In obstructed or incarcerated hernia the most conspicuous

symptoms are those of obstinate constipation. In inflamed hernia the local manifestations predominate over all others. In strangulated ruptures the constitutional symptoms are the most striking.

The *prognosis* is bad, and, unless relieved, nearly all will end fatally. Instances have been recorded where the gut has become gangrenous and the sac has sloughed, where the skin has in time given way and an artificial anus has developed, and yet the patient, after exhibiting the very gravest symptoms, has recovered. Such instances are rare and exceptional, and can take no part in determining the treatment. In very acute cases, especially when the treatment has been ill advised (as, for example, when purgatives have been given), death may follow in forty-eight hours if the hernia be not reduced. On the other hand, in less urgent cases, and especially in cases where opium has been given, the patient's life may be prolonged for even two weeks before death ensues from the unrelieved strangulation. Taking the average it may be said that an unrelieved strangulated hernia will probably bring about a fatal issue within seven days.

Treatment of strangulated hernia must be prompt and definite. Few maladies are more seriously affected by delay. If a loop of intestine is being strangulated, every hour adds to the seriousness of the case, and will hasten the death of the ensnared bowel. In any instance the patient should be placed at once in the recumbent posture in bed, and if the hernia be in the groin the thighs may be flexed by means of pillows under the knees so as to relax the strictures about the seat of rupture. Some slight relief may be given by warm applications to the abdomen. No food should be administered by the mouth. Thirst may be relieved by sucking small pieces of ice, or, if it excites no intestinal movement, by the use of copious enemata of warm water. When these preliminary measures have been adopted, steps should be taken to reduce the hernia. This may be effected either by manipulation, the procedure known as "the taxis," or by the operation of "herniotomy."

Taxis.—This is an attempt made to reduce the hernia into the abdomen by the pressure of the fingers. The patient is placed in a recumbent posture. If the hernia be umbilical the thighs should be

well flexed upon the belly so as to relax the anterior abdominal parietes. If it be femoral or inguinal the thigh of the affected side should, with the same object, be flexed and a little abducted. The head and shoulders should be low and the pelvis be well raised upon pillows, or the bottom of the bed may be elevated one foot or two. The neck of the hernia should then be steadied between the thumb and forefinger of the left hand. By these digits the hernial orifice is defined, and a kind of funnel-like passage made in front of the hernial ring. The contents of the sac must then be pressed gently toward the abdomen by a combined squeezing and kneading movement. In umbilical and in direct inguinal hernia the pressure must be in a direction horizontally backward, or backward and upward. In oblique inguinal the force must be directed upward, backward, and outward, along the inguinal canal; while in femoral ruptures the force will generally have to be first applied a little downward until the saphenous opening be cleared, and then directly backward toward the spine of the pubes. The amount of force to be employed and its duration and repetition must be dictated by common sense, it being borne in mind that the pressure is exercised upon bowel in a softened congested state, or it may be approaching gangrene. When reduction is successful the bowel slips back with a sudden jerk, and often with a characteristic gurgle. Omentum, on the other hand, returns more slowly, and of course without gurgle. If the taxis properly applied fails, the only alternative is herniotomy.

Under antiseptic precaution, the wound generally heals without complication, and the evil consequences of the opening of the peritoneal cavity are no longer to be dreaded.

The advantages of the taxis, if successful, are these. The gut is reduced, no wound is made, the peritoneal cavity is not opened up. The disadvantages are: the gut cannot be seen, and most serious damage may be inflicted by undue pressure upon intestine that is either seriously altered in structure or possibly on the verge of gangrene. Taxis is liable to certain special accidents that are difficult to avoid. Taxis affords no opportunity of improving the condition of the hernia after its reduction. At the present time there is no excuse for violent or long-con-

tinued attempts at taxis. Such attempts expose the bowel to the greatest dangers, and involve more serious risks than does the usual cutting operation.

The advantages of the operation, as compared with the taxis, are these: (1) The gut can be inspected, and is not exposed to the evils that may attend much handling. (2) The special accidents that attend taxis are not possible. (3) Adhesions and conditions likely to perpetuate the hernia can be dealt with. (4) By the excision and ligature of the sac the rupture may be cured, or at least placed in a more favorable condition. (5) There is no risk of reducing gangrenous or perforated bowel.

When taxis is not to be employed.—(1) In very acute cases, where the symptoms are of great severity, and of rapid development, the use of the taxis adds to the risk by possible damage to the gut, and by causing delay. This especially applies to the acute strangulation of congenital inguinal herniæ. (2) The longer a rupture has been strangulated, the less likely is taxis to be of any avail. Every day lessens the probability of reduction, and increases the possibility of gangrene. If, therefore, marked symptoms of strangulation have existed for three days, it would be unwise to delay an operation in order to give an extended trial to taxis. (3) If there be evidence that the rupture was previously irreducible, taxis should not be attempted. (4) Taxis is inadmissible when there is evidence of gangrene of the gut, or of inflammation or sloughing of the sac.

When taxis may be employed.—(1) If the patient be seen within a few hours of the occurrence of strangulation, taxis is very likely to prove of avail. (2) In cases where the symptoms are less pronounced than usual, taxis may effect a reduction after the lapse of twenty-four or forty-eight hours. (3) In the majority of cases the use of taxis may be directed as follows: the patient having been placed in bed, and there being no indications to the contrary, gentle taxis is applied. If it fails, and if the symptoms be urgent, opium may be given, and in half an hour, the patient being anæsthetized, another gentle attempt at taxis is made, and if it fail again the operation is at once performed. If the symptoms are in no way acute an opiate may be given and an icebag applied to the swelling for an

hour or two. At the end of this time taxis may be again attempted, and if it fail an anæsthetic should be at once administered. It is undesirable to administer an anæsthetic for the sole purpose of attempting taxis, and then, in the event of failure, allowing the patient to recover and then necessitating a second administration of chloroform before any further step can be taken. Before the anæsthetic is given the patient should be told that taxis will once more be tried, but that if it fail, after a reasonable trial, an operation will be forthwith performed.

Accidents incident to taxis.—The bowel may be apparently reduced by taxis, and the symptoms of strangulation continue. This persistence may be due among other causes, to the following:

1. *Reduction en masse.*—In this form the entire sac, together with its contents, is pushed *en bloc* into the abdomen, and if the bowel has been strangulated by the neck of the sac, it is obvious that the symptoms will persist after the apparent reduction. The accident is very rarely met with, except in connection with small femoral herniæ. It is almost unknown in acquired inguinal ruptures, and is impossible in the congenital forms. The accident may be diagnosed by noting that the reducing has been effected very slowly and with difficulty, considerable force having been employed, that the contents have not slipped back, and that there has been no characteristic gurgle. There are, however, no means of at once diagnosing a reduction *en masse* from the reduction of a large piece of omentum. When it is recognized by the symptoms persisting; the hernial orifice must be at once cut down upon, the sac secured and drawn down, then opened in the usual way, and the contents reduced or treated.

2. The peritoneum lining the abdominal parietes around the hernial orifice may become detached. When taxis is applied the neck of the sac is thrust back into the abdomen, a movement permitted by the peritoneum. The sac itself is not reduced, but the hernial contents are thrust into the space provided between the detached peritoneum and the parietes from which that membrane has been separated. This accident is rare, and is limited to inguinal ruptures.

3. *Reduction en bissac.*—In congenital inguinal herniæ it has been noted that in rare instances a diverticulum extends from

the original sac. This diverticulum, or second sac, will come off on the distal side of the neck of the original sac, and will be found to extend upward between the muscles of the anterior abdominal parietes, or to lie between those muscles and the transversalis fascia, or between that fascia and the peritoneum. Or it may be placed in the iliac fossa between the muscle and its fascia, or between that fascia and the peritoneum. In any instance the strangulated bowel is reduced from the original sac and forced into the diverticulum, still continuing strangulated by the neck that is common to the two sacs. The phenomena and treatment attending such reduction are identical with those associated with reduction *en masse*.

4. *Reduction through a rupture in the neck of the sac.*—As an effect of forcible and long sustained compression of the hernial tumor, the delicate serous membrane of the sac may be rent, or torn, and the hernia makes its escape through the aperture into the subserous connective tissue; its course outside the peritoneal sac is advanced by continued pressure, and detaching the connections of the neighboring peritoneum it forms for itself a pouch between that serous membrane and the internal abdominal fascia. This accident is met with in inguinal herniæ, and especially in the congenital form; the rupture is usually at the posterior part of the neck, and the artificial sac takes a direction downward and outward. The indications of the accident are the same as those of reduction *en masse*. The tumor becomes flaccid, and smaller; the bulk of the tumor slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt; but the surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia from the gripe of the mouth of the sac as it enters the abdominal cavity. Treatment same as that already indicated.

The persistence of strangulation and symptoms, after complete reduction by taxis or by operation, may depend upon these conditions: (1) The gut is hopelessly damaged; it maintains the condition of intestinal obstruction, and does not recover from its state of paralysis. (2) The gut has been reduced, still strangled by some old adhesions that existed within the sac, but not connected with it. This condition cannot well occur after an opera-

tion in which the sac has been opened. In certain instances a small piece of gut has been strangulated through a hole in some omentum occupying the sac. On reduction the gut and omentum have been returned together, the former still strangulated. (3) Symptoms of acute peritonitis supervene, which, up to a certain point, may imitate the symptoms of strangulation.

Treatment.—In the first-named condition the abdomen may be opened about the site of the hernial orifice, and, the damaged gut having been drawn out of the wound, an artificial anus may be established. In some cases it is advisable to resect the damaged loop before establishing the artificial opening. In condition 2 the abdomen should be opened near the hernial orifice, and the strangulation relieved by dividing the constricting band. To condition 3 is applicable the usual measures adopted for acute peritonitis.

After successful reduction by taxis, the hernia must be prevented from returning by means of a properly applied pad and bandage. No food should be administered until all sickness has ceased, and then the patient should be placed for three or four days upon a slender diet of iced milk and beef tea. The bowels should be kept at rest by means of opium for a week at least. If no untoward symptoms develop, a little solid food may be given on the third day; and, if the bowels are not opened by the seventh day, an enema, followed, if necessary, by a dose of castor oil, may be employed. On no account should any attempt be made to excite the bowels so long as any abdominal pain, colic, or disposition to vomit continues. If all things go well, the patient may get up on the seventh day if he be provided with a proper truss. In the majority of instances the bowels act spontaneously within forty-eight hours of the reduction. Sometimes diarrhea, with abdominal pain and nausea, sets in. These symptoms, as a rule, depend from some enteritis, starting from the damaged loop of intestine. The symptoms are best met by absolute rest, a milk diet, warm applications to the abdomen, and the free use of opium.

Herniotomy.—In cases of strangulated hernia, when taxis has failed, or is considered inadmissible, herniotomy should be performed without delay. When the

symptoms of strangulation are pronounced, and their character beyond question, there can be no excuse for temporizing.

While the anæsthetic is being administered, the skin about the hernia, if it be inguinal, may be shaved and the parts thoroughly cleaned. The whole procedure should be carried out under strict antiseptic precautions. The incision varies according to the site of the rupture. In *inguinal hernia*, an incision, from one and a half to two inches in length, is made over the external abdominal ring in the long axis of the swelling. The center of the incision should correspond to the center of the ring. In dividing the subcutaneous tissues the superior external pubic artery will be cut, and may bleed freely. The various layers of tissue that cover the sac must be then carefully divided. The cremaster is the only structure, however, that is likely to be recognized. It is always easy to recognize the sac. It is usually of a bluish aspect, and presents arborescent vessels; it varies greatly in thickness and density. When the sac has been reached, the finger is carried along it into the inguinal canal to search for the constriction. When this has been found, the hernia director, guided by the finger, is passed beneath the constriction, which is then divided by the hernia knife by cutting directly upward.

In *femoral hernia* the incision is made along the inner side of the tumor, is vertical, about one and a half inches in length, and so planned that the center of the incision will correspond to the saphenous opening. The sac is reached in the usual way, and the constriction will usually be found at the femoral ring, and will be caused mainly by Gimbernat's ligament. The stricture is divided by cutting upward and inward.

In *umbilical hernia* the incision is vertical, is made in the middle line, is about two inches in length, and is so arranged that the center of the incision will correspond to the highest point of the hernial orifice. The stricture cannot be divided without opening the sac.

It has been already pointed out that the gut may be strangulated, not by a constriction outside the sac, but by the neck of the sac itself. In such a case division of the external stricture will not liberate the ensnared intestine, and it will be necessary to open the sac itself. Independently of

these cases, there remains the question as to whether the sac should be opened in ordinary instances. Against the opening it was formerly urged that the peritoneum would be opened, that the gut would be exposed, and that if bleeding occurred after the closure of the wound, it would take place into the abdominal cavity. Since the introduction of Listerism and the operations for the final closure of the sac, these objections have ceased to have much weight. The advantages of opening the sac are these: the gut can be inspected, the risk of returning gangrenous bowel, or bowel strangulated by bands independent of the sac, is removed, and the operation for the final closure of the sac is more readily effected. The sac need not be opened as a matter of routine. In quite recent cases where no taxis has been tried, and where there is no reason to expect a serious condition of the bowel, it is not necessary that the sac be opened, if the stricture that holds the bowel be entirely without the sac. In the majority of instances, it is well that the sac should be opened.

Management of the intestine.—(a) If the bowel be still smooth and glistening and of purple color, and if it feel firm and elastic to the touch, it should be returned into the abdomen as soon as the stricture has been divided. (b) If, on opening the sac, it is found that only a very minute piece of intestine is strangulated, the loop so involved should be gently held while the stricture is being divided. If this precaution be not adopted, the loop may slip suddenly back into the abdomen on being set free by the knife. (c) In any instance the gut must be handled with the greatest care. (d) Before the loop is reduced a little more bowel may be drawn down, so as to expose the line of strangulation. It is possible that the loop itself may appear fit for reduction, while ulceration exists at the stricture line. (e) If the gut be black, dull, and sticky on the surface, and has quite lost its resilience, it must be regarded as beyond recovery.

Treatment of gangrenous bowel.—When the gut is damaged beyond recovery, one of two courses may be adopted: either to leave the damaged bowel to slough off in the sac and await the formation of a fecal fistula, or at once to excise the gangrenous loop of intestine, and unite by suture the cut extremities of the gut.

A patient, in whose case strangulation has existed long enough to produce gangrene of the bowel, is generally so exhausted as to be but little fitted to bear the shock of the further operation necessary to remove and suture the portion of affected bowel. If the individual survive, the condition of the parts operated upon are often most unfavorable for sound and rapid union. Beyond the area of the gangrened portion there will be a zone of inflammatory infiltration. In some cases it will be difficult to determine exactly at what point it is safe to divide the intestine, so as to be quite clear of the damaged parts. The contents of the sac will be in a septic condition, and it may be afterward difficult to insure purity of the wound. The intestine also is generally distended by fluid fæces, and not in the empty flaccid condition to be met with in a patient who has been previously prepared for the operation. This adds much to the difficulties of the operation. In many instances the general condition of the patient will be such as to forbid any severe operation. In these the sac had best be laid freely open, a charcoal poultice applied, or the part sprinkled with iodoform. If the prolapsed loop be much distended, an opening may be made into it with the knife or scissors. As to whether the neck of the sac should be incised and the stricture divided, it is objected that it may separate the adhesions which shut off the general cavity of the abdomen. But if carefully done there need be little risk, as the adhesions usually extend inside considerably beyond the seat of the stricture. The advantage of freeing the stricture consists in allowing the natural circulation to be restored in the prolapsed portion, and whatever may not be hopelessly damaged recovers its vitality.

As a general rule, therefore, in cases of gangrenous bowel, the stricture should be carefully liberated, and the prolapse left otherwise undisturbed, in the open sac.

But if a limited portion only of bowel is affected by gangrene, or if perforated merely at one point, and strength has been well maintained, it may be better at once to excise the affected portion of the gut and unite the divided edges by a double row of sutures. The first row should merely include the edges of the serous membranes, and the second a portion of the peritoneal surface and subjacent tissue, excluding

the mucous membrane. The needle, armed with a fine silk thread, is first introduced a little more than half an inch from the margin of the bowel, then passed for a quarter of an inch beneath the surface, and made to emerge about an eighth of an inch from the free margin. The needle is then passed in a similar manner, but in a reverse direction, through the opposite side of the bowel. This second row is inserted in such a way that, when drawn together, a surface of at least a quarter of an inch of the upper and lower end of the bowel will be brought into close contact all round, and the first sutured margin of the bowel will be inverted toward the lumen of the tube.

When the portion removed exceeds half an inch it will be necessary to move a V-shaped portion of mesentery as well. The cut edges of this should first be sutured. It is of moment to take care that the part next the intestine be very accurately and closely brought together, as here is the weak point in the chain of sutures. All bleeding must first be carefully arrested and the wound purified. The ends of the divided intestine may be held between the fingers and thumbs of an assistant to prevent any escape of their contents, or secured by clamps whose blades are protected by india rubber.

When the operation is completed, the parts are to be returned to the abdominal cavity, the wound closed, and a drainage-tube inserted. The prospects of recovery are good, if the patient survive the shock and peritonitis do not occur. Even a slight fecal discharge, which may occur some days later, does not exclude the prospect of a final complete recovery. The parts are surrounded by adhesions, and the opening caused by premature yielding of some of the sutures may after a time close.

If it be decided for any reason to leave the hernia unreduced, the time must be awaited when a fecal fistula has been established, and health and strength are sufficiently restored. In some cases, where the fistula has been the result of a small perforation, and there is no loss of bowel substance, or only a trifling one, the fistula may spontaneously close. This is an unusual result; generally a considerable portion of the bowel wall has perished. By degrees the posterior surface projects toward the fistulous open-

ing, there being no resistance in that direction. This projection gradually assumes a valvular form, and has been called by Dupuytren the *éperon*. This will more or less completely shut off the lower opening of the intestine, and direct the contents toward the fistula, while the bowel below becomes collapsed and contracted in caliber.

In certain favorable cases the valve-like process may be cut through by the application of Dupuytren's clamp. The continuity of the bowel may be thus restored. The fæces have no longer the same tendency to escape, and the fistulous opening gradually closes, or a plastic operation to close it may be performed. The application of the clamp is not free from risk of setting up peritonitis, and is uncertain in its results. Where it has failed, or where inapplicable, a more radical method consists in carefully detaching the margins of the fistula and portion of the intestine adherent to the abdominal wall, drawing the ends out of the wound, cutting a portion off each extremity, and then suturing the divided ends together in the manner already described. As the lower end is usually much contracted it may be well to cut it off obliquely, to render the margin longer and better fitted to adjust exactly to the upper end. When thus performed, this operation is much less dangerous to life than when undertaken at the time of the strangulation. The patient must be carefully prepared beforehand by emptying the intestine, and giving as little food as possible for the twenty-four hours. The region of the fistula itself must be thoroughly purified, and the bowel repeatedly washed out from the opening. The after-treatment consists in keeping the patient under the influence of opium to maintain the intestine quiescent.

Treatment of wounded intestine.—The bowel may be wounded during an operation for hernia, either by mistaking the sac, by reason of adhesions of the bowel to the sac, or more frequently during the division of the stricture. If only the peritoneal investment be divided, the bowel may be returned. It is not necessary to introduce sutures. If the wound be complete, however, it must be closed by the introduction of a sufficient number of sutures of fine silk or catgut, and then replaced. It can seldom be necessary to establish an artificial anus

by attaching the margins of the divided bowel to the skin wound.

Wound of the arteries.—The obturator or epigastric arteries, lying as they do close to the neck of the sac, are sometimes wounded during the incision of the stricture. The accident is rare, and is impossible if proper care be taken. The bleeding may take place internally or externally. In the former case the diagnosis may not be made until signs of loss of blood show themselves. The best procedure is to enlarge the existing wound sufficiently to expose the vessel at the point injured, and apply a ligature above and below the wound. Compression is not to be recommended. Secondary hemorrhage, often repeated, has been observed from these vessels. The same treatment will apply. But in this case, as the bleeding will have been determined by some general cause, the result is less likely to be satisfactory.

Management of omentum.—(a) If the omentum be healthy it should be returned into the abdomen. If seriously changed by previous attacks of inflammation, by which its folds have become adherent, better remove it. (b) If it be very acutely strangulated excise the involved part. A clamp having been applied, the mass is removed with scissors, and the divided vessels having been separately secured by catgut ligatures, the stump is reduced into the abdomen; or the portion to be removed, having been firmly tied with two or more silken ligatures, may be cut off, and the stump reduced. (c) If the omentum be adherent it should not be allowed to remain in the sac, but should be excised in the manner first named. (a) If the omentum be left in the sac it is apt to become inflamed and to suppurate, besides insuring the positive recurrence of the hernia.

Management of adhesions.—Recent adhesions may be broken down with the finger. This requires care, for when such adhesions are attached to the bowel they sometimes cover small perforating ulcers. Older adhesions may be simply cut, and any bleeding point secured; but old adhesions, that are large and vascular, may require to be ligatured in two places before they are divided.

Management of the sac.—After the complete emptying of its contents the sac should be treated as described in the section on radical cure. It should be excised in whole or in part, its neck secured

as high up as possible by a catgut ligature, and the hernial orifice closed by two or more points of suture. If the sac is acutely inflamed this procedure should not be attempted; and the same applies to instances where the parts have sloughed or have undergone suppuration.

After-treatment.—The patient should be kept in the recumbent position, with his knees flexed over a pillow. As soon as he has recovered from the effects of the anæsthetic an injection of morphia should be given. No food should be administered by the mouth for at least thirty-six hours. The patient may have a little ice to suck to relieve his thirst, and, if there be much prostration, the strength may be supported by enemata of peptonized beef-tea with a little brandy.

Abdominal pain should be met by hypodermic injections of morphia. The bowels should be kept quiet until the seventh day, and if they have not spontaneously acted by that time, and all the symptoms are favorable, an enema may be administered. No harm will arise, however, from a further delay up to ten or twelve days from the date of operation, when the bowels will probably act spontaneously. The drain, if one be used, may be removed from the wound at the end of forty-eight hours, and the sutures taken out next day. The antiseptic dressings may be discontinued on the tenth day, and the wound then treated with iodoform or boracic lint. Firm pressure should be maintained over the part till the wound is quite sound. The patient should be kept in bed for at least three weeks, and at the end of a month the parts may be sufficiently recovered to allow a truss to be applied, if such be required. The patient must not rise without a truss, or a properly applied pad and spica bandage.

Accidents after operation.—1. The reduced gut may remain *hors de combat*, and being entirely paralyzed, the symptoms of intestinal obstruction may continue. 2. Diffuse peritonitis may supervene. In most instances this is due to the giving way of the bowel after its reduction into the abdomen. The perforation is usually small, fecal extravasation occurs, and a fatal peritonitis follows. 3. Some amount of local peritonitis may supervene, and need not occasion any alarm as to the final issue of the case. 4. Acute enteritis may be induced. This in-

flammation spreads from the strangulated loop, and tends to attack the hyperæmic bowel above the seat of strangulation. The symptoms are: severe intermittent colicky pains in the abdomen, which are often lessened by pressure; diarrhea, with the passage of stools that are usually dark-colored, and often mixed with blood. Some vomiting, which is never severe and never stercoraceous. The abdomen is sunken, and there is an absence of any tympanitic distention. The condition is best met by absolute rest, by a diet of iced milk only, by the free use of opium, and the application of warm fomentations to the abdomen. 5. The intestine, reduced by taxis, or operation, has in certain instances become the seat of stricture, and the adhesions that sometimes form about the hernial opening have been the cause of fatal intestinal obstruction.

Omentum that is flexed in a hernia may form an omental ligament that may produce a strangulation.

Anatomical Forms of Hernia.—**Inguinal.**—The most common form. It occurs with greatest frequency between the ages of twenty and forty, and after that between the ages of one and twenty. Is most common in men, comparatively rare in female adults, more frequent in young girls. It is almost the only form of rupture that is met with in female children under the age of five years. In such cases it is of congenital origin, and depends upon imperfect closure of the canal of Nuck.

Inguinal herniæ may be divided into two classes: 1. *The acquired form.* 2. The varieties that depend upon imperfect closure of the vaginal process of peritoneum. Taken collectively, commonly spoken of as *congenital*.

1. Acquired inguinal hernia.—May appear under one or two aspects. (a) The oblique or indirect rupture is the most common of all herniæ. The protrusion in this form descends along the inguinal canal, the neck of the sac being to the outer side of the deep epigastric artery. As the hernia increases it escapes from the external abdominal ring, and descends into the scrotum or labium major (scrotal or labial hernia). Any form of inguinal rupture in which the protrusion has not extended beyond the external abdominal rings is called a *bubonocoele*. The coverings of this hernia are the following: the skin, the superficial

fascia, the intercolumnar fascia, the cremaster muscle, the infundibuliform fascia, the subserous tissue, and the peritoneum. When strangulation occurs the constriction is usually at the neck of the sac, or it may be caused by the pillars of the external abdominal ring. The rupture lies in front of the spermatic cord, and when it has descended into the scrotum is separate from the testicle by the tunica vaginalis.

In its early stages the hernia may present a long and narrow neck, formed by that part of the sac which lies between the two abdominal rings. As the rupture becomes pendulous, the two rings are approximated by the constant dragging upon the internal orifice, the neck becomes, considerably shortened, and in old scrotal herniæ, after reduction, the finger can be passed almost directly into the abdomen, and the inguinal canal, as a long and oblique passage, has ceased to exist.

(b) In the direct inguinal hernia the gut makes its escape through Hesselbach's triangle to the inner side of the deep epigastric artery. It enters the inguinal canal at a lower point than the oblique form. It usually passes to the outer side of the conjoined tendon, and may be a little deflected outward when that structure is very rigid. The coverings of the sac are: the skin, the superficial and intercolumnar fasciæ, the cremasteric fascia (except in instances where the gut has forced its way *through* the conjoined tendon), the transversalis fascia, and the subserous tissue.

When strangulation occurs the agent is usually the conjoined tendon, though the obstruction may be brought about by the neck of the sac. Direct herniæ differ, moreover, from indirect in the following points: they are never congenital; they are usually smaller and more globular; they are more liable to strangulation. On reduction they pass back in a more direct manner, and, if the finger be placed in the hernial orifice, it may be possible to detect the pulsations of the epigastric artery on the outer side of opening.

2. Herniæ depending upon congenital defects in the processus vaginalis.—The testicle, in its descent from the abdomen into the scrotum, is accompanied by a process of tube of peritoneum. This diverticulum at, before, or soon after birth, becomes shut off from the general peritoneal cavity, and persists at the tunica vaginalis. It would appear that, in the

process of closing, the processus becomes occluded at two points, one being at the internal ring, and the other at the top of the epididymis. The part of the tube that remains between these two points occupies the whole of the inguinal canal. It soon shrinks, and is represented in a few months by a simple fibrous cord. Should any portion of this segment of the tube not be obliterated, then it may at some time be the seat of an accumulation of fluid, and constitute an "encysted hydrocele of the cord."

Three circumstances may occur in connection with the vaginal process. (1) It may remain patent throughout, unclosed at any point. (2) It may be occluded at the lower point only; *i. e.*, just above the epididymis. (3) It may be occluded at the upper point only; *i. e.*, at the internal ring. When a hernia develops in connection with the first-named defect it is called *congenital*; when one develops in connection with the second-named defect, it is called a *hernia into the funicular process*; and when with the third defect, *an infantile or encysted hernia*.

The *congenital hernia* appears at birth or within a few months of birth. It may appear for the first time when the child begins to run about, and in certain cases, under conditions later described, it may make its descent for the first time in adult life. The gut descends along the patent vaginal process and enters the scrotum. In its progress it follows the inguinal canal lying in front of the cord.

This hernia differs from the acquired oblique rupture in the following points: It appears in infants or children; it develops suddenly, and may descend at once into the scrotum. It envelops and conceals the testicle, whereas in the acquired rupture the testis is felt below the sac, and quite distinct from it. In the congenital form the internal ring is not dragged down; the inguinal canal does not become shortened as it does in the acquired variety; the neck of the sac, therefore, remains long and narrow, and thus it happens that these ruptures, when strangulated, are much more difficult to reduce than are those of slow formation. Lastly, the congenital hernia is more liable to strangulation, and to certain accidents after taxis, *viz.*, reduction *en bissac*, and reduction through a rupture about the neck of the sac.

In some forms of congenital hernia, a constriction exists in the sac about a third of the way down. This constitutes the somewhat rare variety known as *the hour-glass hernia*. It is due to an incomplete closure of the vaginal process.

The congenital rupture may be associated with a retained testis. When this complication exists, no truss should be worn until the child begins to run about, until, indeed, the second year. If at the end of that time the testis has not descended, then both it and the rupture must be maintained by a truss, because the patient will begin to run the risk of strangulation. Many of the milder forms of congenital hernia have been cured by the persistent use of a good truss.

The hernia into the funicular process appears at the same periods of life, and under the same circumstances, as the variety just named. Indeed, it resembles the congenital form in *all* respects, save that, instead of enveloping the testis, that body can be felt below the rupture, and quite distinct from it. The gut descends along the open vaginal process as far as the epididymis, where it is arrested. This form is as common as the congenital.

In the infantile hernia a septum exists at the internal ring, between the peritoneal cavity above and the tunica vaginalis below, which extends as high as the internal ring. If this septum is pressed upon, it may yield in the direction of the testis. By further yielding it forms a sac for the rupture, and this sac projects into the tunica vaginalis as the "knock-up" of a wine bottle projects into the bottle cavity. Thus a hernia is formed, which appears to have two sacs. It is rare, and cannot be diagnosed until the parts are cut down upon. The hernia forms slowly, is met with in infants, in young children, and in young adults. The testis is found below the swelling, and quite distinct from it.

The *diagnosis* of an inguinal hernia generally presents no difficulty. There is the history of the case, the fact that the swelling occupies the inguinal opening, and that its upper limit cannot be defined. The rupture is, moreover, commonly tympanitic, reducible, and with an impulse on coughing. It is opaque, whereas hydrocele of the part will be translucent. An encysted hydrocele of the cord, moreover, can be moved by dragging upon the cord, and its upper limits can generally

be made out. The term diffused hydrocele of the cord is applied to a collection of peritoneal fluid in the open processus vaginalis. This collection is translucent, returns gradually on lifting the scrotum, and if, after it has disappeared, the patient stands up, the tumor will fill from the bottom, and not from the top as a hernia does. Sometimes a hydrocele extends into the inguinal canal, but its characters otherwise serve to distinguish it from hernia. A search for the testicles in the scrotum should prevent a retained testicle in the canal from being mistaken for a hernia.

Femoral or crural hernia is rare before twenty, and is most common between ages of twenty and forty. It is never congenital, and more common in women. The rupture descends along the femoral canal, and has the following coverings: the skin, the superficial and cribriform fasciæ, the crural sheath, the septum crurale, the subserous tissue, and peritoneum. The neck of the sac will be at the femoral ring, and the strangulating agent is very usually Gimbernat's ligament. The relations of the deep epigastric and obturator arteries to the neck of this hernia must be borne in mind. Femoral herniæ are, as a rule, of comparatively small size, when large the tumor usually mounts up over Poupart's ligament. In this position it may imitate an inguinal hernia. The matter can be readily settled by noting that a femoral rupture will always lie to the outer side of the pubic spine, while an inguinal rupture will lie to the inner side. The pubic spine can be felt in the male by invaginating the scrotum, and in the female by abducting the thigh so as to render distinct the sharp tendon of the adductor longus. The finger passed along this tendon will be guided to the point of bone.

Differential diagnosis of a femoral hernia.—A psoas abscess has an impulse on coughing, enlarges on coughing and on standing up, and may be more or less reducible. Unlike the hernia, however, it is always dull on percussion; it descends as a rule to the outer side of the femoral vessels, and is attended by the other manifestations of spinal abscess. A limited varix of the femoral or internal saphenous veins may imitate rupture to some extent. But when the patient is erect, pressure upon the crural ring will prevent the descent of a rupture, while it

will increase the size of a varicose swelling. An enlarged gland cannot well be mistaken for a hernia, unless it be for a small irreducible epiplocele.

Umbilical hernia is met with in three forms: 1. The congenital; very rare. It depends upon imperfect closure of the ventral plates, and in some monsters all the viscera may be contained in the protrusion. In most cases a small tumor is produced at the root of the umbilical cord. The sac extends into the cord and is covered by its tissues. In securing the funis after birth both the sac and intestines have been inadvertently inclosed in the ligature. The sac may give way and the contents protrude. The hernia may become strangulated.

2. The infantile form is the most common, and is due to a yielding of the umbilical cicatrix after the separation of the cord. It is usually quite small, has little tendency to increase, and if left to itself has a great disposition to undergo spontaneous cure. It is exceedingly rare to meet in an adult with an umbilical hernia that has existed since infancy. These herniæ are most readily treated by reducing the rupture and approximating the margins of the hernial aperture by strapping, applied in the same manner as it is used in harelip operations. The hernia is often caused to persist by the use of bandages carrying buttons. These so-called trusses merely prevent the hernia aperture from closing.

3. The umbilical hernia of adults has rarely any relation to the infantile form. It usually develops *de novo* in individuals about or past middle life. It is more common in women than in men, and is most frequent in the obese, and in females who have borne many children. The tumor may attain great size, and may reach to the groin. It usually contains a part of the transverse colon and a large quantity of the omentum. It may contain the stomach. These herniæ are apt to become irreducible or incarcerated. In many cases where the tumor is irreducible little can be done but to support the hernia with a suitable belt, unless some form of so-called radical cure is undertaken.

Ventral hernia.—This term is applied to protrusions at other parts of the anterior abdominal parietes than the umbilicus. Such ruptures are most common in the linea alba, and follow laparotomy

wounds; they may also follow upon accidental wounds or incisions made for the ligature of the iliac arteries; upon destructive suppuration in the parietes, and upon ascites. These herniæ may attain great size, but usually give little trouble. The aperture is large, and they have little disposition to become incarcerated or strangulated. The only treatment required in most cases is a well-applied abdominal belt.

Obturator hernia.—In this form the hernia passes through the obturator fascia or the obturator canal. In any case the neck will be at the thyroid foramen, usually at its upper margin. The sac may be covered by the obturator fascia. The sac, when fully formed, lies below the horizontal ramus of the pubes, above the adductor brevis, to the outer side of the adductor longus, and under cover of the pectineus. It is placed to the inner side of the hip-joint and usually to the inner side of the femoral vessels. The hernia is rare. It is met with mostly between the ages of forty and forty-five, and is almost limited to women. The hernia can hardly be diagnosed unless it become strangulated. In such a case there will be the absence of local signs of strangulated hernia elsewhere, while a slight and possibly tender swelling is felt under the pectineus. The neck of the sac may possibly be reached by the finger in the vagina. There is pain on moving the hip, especially in rotation outward, and pain along the course of the obturator nerve. The hernia has been reduced by taxis with success.

Lumbar hernia is rare. The protrusion occurs either through the quadratus lumborum or the fascia lumborum at the outer edge of that muscle. The internal oblique muscle is then penetrated, and the sac appears on the surface at Petit's triangle, the little space beneath the borders of the external oblique and latissimus dorsi muscles and the crest of the ilium.

Sciatic hernia.—Here the sac passes through the great sacro-sciatic notch, above or below the pyriformis muscle. It then causes a projection beneath the gluteus maximus, or may even escape below the margin of that muscle. It is one of the least common varieties.

Perineal hernia.—The protrusion occurs between the prostate and rectum or the vagina and rectum. The sac escapes between the fibers of the levator ani and

forms a projection in the perineum. These herniæ are mostly met with in females, and may contain the bladder.

Pudendal hernia.—The protrusion is found at the posterior and inferior part of the labium, and the neck of the sac lies between the pubic ramus and the vagina. The hernia has been mistaken for vulvar cyst. It is usually quite reducible, and gives little or no trouble.

Diaphragmatic hernia is of little practical importance. In the great majority of the recorded cases the condition was never recognized during life. Even if diagnosed the hernia is not capable of being treated. Three varieties: 1. The congenital is the most common. It depends upon an imperfect closure of the diaphragmatic septum in the fetus, and is nearly always met with on the left side. When such a congenital gap exists, some of the abdominal viscera may find their way into the thorax. The stomach is the organ most usually herniated, and next in frequency is the colon, and then the small intestines. In some cases this hernia has caused comparatively little trouble. 2. The hernial orifice is produced by an enlargement, congenitally acquired, of one of the normal openings in the diaphragm. 3. The traumatic form. This variety, which is not uncommon, depends upon rupture of the diaphragm by violence, usually due to extensive fractures of the ribs. Some of the abdominal viscera are displaced into the thorax through the rent. The condition is practically limited to the left side, and in the majority of cases the injury is soon followed by death.

WILLIAM MACCORMAC.

Symptomatic Indications.—*Nux vomica* is the most important remedy in the treatment of hernia; will sometimes cure recent cases, and those occurring in infants. In strangulated hernia it frequently brings about spontaneous reduction. *Belladonna* may be useful in relieving the pain of strangulated hernia; *aconite* in inflammatory cases. *Plumbum* has proved effective in strangulated femoral hernia. *Chamomilia* in inguinal hernia of children, especially if caused by violent crying.

HERPES is an acute inflammatory affection, characterized by the development of groups of vesicles on a patch of inflamed skin or mucous membrane. Two forms are recognized, which,

although similar in their anatomical characters, differ as regards their clinical phenomena and pathological relations.

I. Herpes Catarrhalis frequently follows a rigor, and may be its sole sequela. In children a pyrexia of two or three days' duration and of considerable intensity (103°–104° F.) may rapidly subside on the appearance of a crop of herpes. "Herpetic fever" is sometimes a prominent feature of "catheter fever," and often accompanies the onset or crisis of acute febrile diseases, especially pneumonia, bronchitis, ague, and enteric fever. It is commonest in spring and autumn, and may affect so many persons simultaneously as almost to merit the epithet epidemic. The lesions do not exhibit the "nerve distribution" and unilateral distribution of those of zoster. It is accompanied by little or no pain, seldom leaves scars, and is very prone to recur.

Herpes facialis is the commonest form. It occurs in order of frequency upon the lipæ, alæ nasi, ears, chin, and cheeks, and often spreads to the mucous membrane of the cheek; more rarely the tongue, soft palate, uvula, and tonsils are attacked, especially in connection with digestive derangements ("dyspeptic ulcers"). The vesicles on the skin are small, contain clear or turbid fluid, do not rupture unless interfered with, cause no subjective symptoms except slight burning sensations, and usually dry up, with the formation of yellowish crusts, in about a week. On the mucous membranes, however, minute excoriations result from the maceration of the epidermic covering of the vesicles by the saliva, and may lead to a mistaken diagnosis of aphthæ, diphtheria, or even syphilis.

Herpes progenitalis is common in the male sex, affecting chiefly the prepuce and glans penis, but is rare in the female sex, with the notable exception of "puellæ publicæ," in whom it is common, and situated generally upon the labia majora and minora. In both sexes antecedent syphilis or gonorrhea predisposes to its occurrence; it is very liable to recur, and in some individuals every act of coitus is followed by an outbreak. It seldom occurs in persons above forty years of age. The vesicles are rarely numerous and, if left alone, heal in a few days; but they are often scratched, when the resulting excoriations

may discharge freely, and the diagnosis from chancroids become extremely difficult. Sometimes severe neuralgic pain is present, allying the disease with zoster.

Treatment.—Dusting powders or soothing ointments are usually all that is required, but lead lotions may be used if there be much burning or pain.

II. Herpes Zoster (Zoster, Zona, Shingles) is the result of neuritis, most commonly of the intercostal and lumbar nerves, and follows their peripheral distribution.

The two upper divisions of the fifth nerve are also frequently affected, when the cutaneous manifestations may be accompanied by conjunctivitis, keratitis, iritis, or even papillitis. It may, however, follow the course of any cutaneous nerve, various names being attached to it indicative of the nerve or region affected. The nerves most frequently involved are the sciatic, anterior crural, ilio-inguinal, musculo-spiral, occipitals, and the branches of the superficial cervical plexus. It is almost invariably unilateral, and, if bilateral, the same nerve is never affected on the two sides. A symmetrical herpetiform rash effecting the distribution of both fifth nerves has, however, been observed in some syphilitic cases.

The appearance of the rash is generally preceded by severe neuralgic pain, lasting twenty-four hours or more, and frequently by considerable febrile disturbance or malaise. Then patches of skin inflame and closely packed clusters of small papules, which rapidly become vesicles containing clear fluid, form upon them. At the end of four days the climax of the disease is usually attained, but successive crops may sometimes appear afterward. The fully developed vesicles are often about the size of a pea, and may coalesce to form large, shallow blebs, the contents of which may be serous, purulent, or hemorrhagic. At the periphery of the patches the lesions frequently abort—*i. e.*, are arrested in an intermediate stage of their development. The eruption after attaining its maximum quickly subsides, yellow scabs being formed, the separation of which often leaves deep, indelible scars. The process is generally complete at the end of three weeks, but sometimes, owing to extrinsic circumstances, the lesions become gangrenous, and healing is protracted.

Pain is a prominent feature of the disease, except in children; it may precede, accompany, or succeed the rash, and bears no proportion to its amount; in old persons it is often of excruciating intensity, and may persist for months after apparent recovery. There may be anæsthesia or numbness of the skin, even where subjective pain is complained of (anæsthesia dolorosa). Persistent pruritus, motor paralysis, and atrophy of skin or subjacent muscle are rare sequelæ.

The *diagnosis* is easy as a rule, but difficulties may arise from the eruption being abortive or becoming irritated by rubbing, scratching, or unsuitable applications. It may be mistaken for pleurodynia or pleurisy at first, afterward for vesicular or pustular syphilodermata, eczema, hydroa, or pemphigus.

Pathology.—Inflammatory changes have been demonstrated in the spinal ganglia and peripheral nerves. Vesication results from the rapid and copious exudation of serum and leucocytes into the loose rete mucosum, raising the epidermic layers; scars are the consequence of the destruction of the papillary layers.

The *ætiology* of most cases is obscure; cold, damp, and malaria are responsible for a certain number, and small epidemics often occur in spring and autumn. Injuries to, pressure upon, and various diseases of, the nerve trunks and centers may cause herpes in certain persons, and it is believed by some, and probably with reason, to occur with special frequency during the administration of arsenic.

Treatment.—The part must be protected from friction and irritation by dusting powders (zinc or bismuth oleate, starch, etc.) and cotton-wool. If pain be severe, morphia and collodion is a useful application. Tonics must be given, especially quinine, iron, and cod-liver oil. Phosphide of zinc ($\frac{1}{8}$ grain every three hours) is said to shorten the disease. For persistent pain, camphor-chloral, belladonna liniment, and galvanism have been warmly recommended, but morphia used hypodermically is the most reliable drug, and one injection occasionally gives permanent relief. The diet ought to be generous, and, in the case of old persons, may include good wine.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *rhus tox.*, which relieves

the pain and itching and shortens the duration of the eruption; *graphites* is sometimes useful when the eruption is attended with burning pains; tendency to ulcerous conditions, also in old persons; *mercurius* when there is much itching, and great tendency to suppuration. *Sepia* is said to be specific in recent cases. *Zincum* is useful for neuralgic pain persisting after the disappearance of the eruption.

HICCOUGH (*Hiccup*; *Singultus*) is a sudden contraction of the diaphragm, unaccompanied by the normal simultaneous opening of the glottis.

Hiccough is a reflex act, but the term is commonly applied to the characteristic noise due to the inrush of air through the narrowed glottic opening, which necessarily attends it, and is its most obvious feature. It is met with in many forms of nervous and gastric disorder, in uræmia, and in abdominal diseases, especially peritonitis, when it is of decidedly unfavorable omen.

Treatment.—Holding the breath is a popular and frequently efficacious method of arresting it. In serious cases the stomach should be emptied by an emetic. If that be inadvisable, a subcutaneous injection of morphia may be given. When due to a nervous affection, chloroform and opium may be tried.

Symptomatic Indications.—*Nux Vomica* is the most generally useful remedy, particularly in persons addicted to alcohol. *Moschus* may be useful when occurring from exhaustion; *acid sulphuric* in obstinate cases.

HIP-DISEASE (*Morbous coxæ*).—Disease of hip-joint.

Causes.—Scrofula and the ages of childhood and early youth are predisposing causes. Exciting are local injuries, often very slight, and exposure to cold. Causes often uncertain. Affections of the generative organs sometimes cause hip-disease, probably in a reflex manner.

Varieties.—Hip-disease has been divided anatomically, according as it affects the femur only or the acetabulum. In many cases both are involved. It may also be acute, subacute, or chronic. Or it may be strumous or purely traumatic or rheumatic in origin. Practically, it is rarely possible to say whether a given case is or is not strumous. Some diseases

of the hip-joint *e.g.*, chronic rheumatic arthritis, never have the term “hip-disease” applied to them.

Symptoms.—Three stages: 1st. Inflammatory stage. Before the symptoms are well marked, the term “incipient” is used. Stiffness of joint. When patient lies on his back his knee is bent upward. If an attempt be made to straighten it, the small of his back becomes hollow, because the pelvis moves with the femur. Wasting of limb, often a very early symptom; flattening of buttock and obliteration of gluteal fold. Pain often referred to inner side of knee. Pain is most severe when disease begins in the bone. Fullness over joint, best marked when disease begins in synovial membrane. Apparent lengthening, sometimes apparent shortening, both due to rocking of pelvis. Very rarely real lengthening, due to effusion into joint. Of course the patient limps. 2d. Stage of abscess. The suppuration is sometimes entirely outside joint. Pus burrows, fluctuation occurs sometimes in one place, sometimes in another; sinuses form. Probe very likely fails to find dead bone. Sayre’s vertebrated probe is useful. Situation of sinuses indicates situation of disease, whether acetabular or femoral. Before abscess opens, the last stage has usually commenced. 3d. Stage of real shortening. This results from the gradual destruction of head and neck of femur by caries and necrosis, usually by caries. Top of trochanter ascends above Nélaton’s line, a line drawn from ant. sup. spine of ilium to tuberosity of ischium. Abscesses or sinuses, lordosis, flexion of thigh on abdomen, wasting of buttock and thigh, and pain continue as in former stages. The disease naturally terminates either in death from exhaustion or amyloid disease, or in recovery with ankylosis. The ankylosis is in the flexed position, and accompanied by a compensatory spinal curve of the kind called lordosis.

Pathology.—Disease may begin either (1) in the bone near the joint, or (2) in the soft tissues, synovial membranes, or ligaments of the joint. In the latter case the disease is sometimes named “arthritic.” It is a generally accepted doctrine now that the only joint disease which begins in the cartilage is chronic rheumatic arthritis. For a description of the general changes which take place in hip-disease see DISEASES OF BONE AND OF JOINTS.

Ligamentum teres soon gives way. Head of femur perishes by caries or by necrosis. If acetabulum is affected, it is apt to perish partially by necrosis, often becoming perforated. Even when head of femur is destroyed remains of neck of femur rarely leave acetabulum. True dislocation on dorsum ilii does occasionally occur, or, acetabulum being perforated, head of femur may slip through into pelvis. The natural tendency is toward a cure by ankylosis. In acetabular disease, sinuses usually form in buttock, or close to the pubes. In femoral disease they usually open lower down the thigh, especially below and in front of great trochanter.

Diagnosis.—Most cases of hip-disease are unmistakable. It is sometimes difficult to distinguish incipient hip-disease from other affections which cause pain about the hip, accompanied by lameness, common rheumatism, for example. In fact, many cases of hip-disease actually begin as rheumatic synovitis. No disease of the parts about the hip causes such stiffness of the joint; that point is important. Pain in the knee may attract the attention to the wrong place. Many affections, *e. g.*, curvature of spine and hysteria, cause rocking of pelvis and apparent shortening or lengthening. In health, the lower extremities are often slightly unsymmetrical. But in such persons if one leg is much shorter than the other, the feet will probably also be disproportioned. Comparative measurements should be taken from anterior superior spine of ilia to upper or lower end of patella or to inner malleoli, Nélaton's line, Bryant's ilio-femoral triangle. Bryant's ilio-femoral triangle is formed by a horizontal line across top of trochanter, a perpendicular line from anterior superior iliac spine downward, and an oblique line from anterior superior iliac spine to top of trochanter. The lines are equal on both sides in normal persons. Enlarged bursa under psoas is very rare; and the pain, if present, is relieved, not aggravated by flexing thigh on abdomen. Hip-joint disease could hardly be accompanied by such marked swelling over the joint without presenting characteristic and marked symptoms. Hysteria must be diagnosed on general principles. In a doubtful case the surgeon will not try to diagnose without taking the patient's clothes off, and manipulating carefully.

Prognosis.—Depends on stage of disease, original constitution of patient, present condition, on parts actually diseased, and on age. In first stage of disease, especially if symptoms point to origin in joint itself, treatment may be expected to result in recovery with or without ankylosis in good position. Scrofulous patients are very likely to become tuberculous elsewhere when the bone is affected. When necrosis or caries has occurred, prognosis is very bad as to life. It is worse in adults with acetabular disease. The only cases in which recovery without ankylosis is to be reasonably looked for, are those in which the cartilage and bone have never been affected.

Treatment.—Rest of the joint is essential. Sayre's splint is said to make rest in bed unnecessary in many cases in which the disease has not too far advanced. Extension by pulleys and weights (3 to 10 lbs., according to age and individual particularity of patient). Long splint (long splint on sound side, weight to diseased limb); Thomas's splint, plaster cases, leather cases, etc. Treatment should be continued so long as there is any tenderness or sign of active disease and for a little longer. Limb should be straightened under chloroform, if weight fails to bring it down gradually and easily. Inflammatory reaction after this manipulation may be treated by ice or hot poultice locally, according to which seems to act best. When there are signs of struma, give cod-liver oil and iron. In suppurative stage, treat abscesses and sinuses on general principles.

Question of excision.—When suppuration continues, exhaustion increases, and there is evidence of bone disease; and especially if the patient's circumstances are so poor that he cannot get proper attention during long rest in bed, the surgeon is justified in operating to remove the dead bone. Still the operation has its dangers, and the resulting limb is likely to be shorter than after the natural cure. Moreover, it is very difficult, sometimes impossible, to thoroughly remove pelvic necrosis. For operation, see EXCISION. C. B. KEETLEY.

HIP, DISLOCATION OF.—See DISLOCATIONS.

HIP-JOINT, EXCISION OF.—See JOINTS, EXCISIONS.

HODGKIN'S DISEASE.—See LYMPHADENOMA.

HOMESICKNESS.—See NOSTALGIA.

HORDEOLUM.—See EYELIDS, DISEASES OF.

HOUSEMAID'S KNEE.—See BURSÆ, ENLARGED.

HYDATID DISEASE.—An hydatid tumor consists of one or more cysts inclosed in a fibrous capsule, and originating from the scolex of the *tænia echinococcus*, a form of tapeworm which infests the lower animals, notably dogs.

The adult worm is very small, measuring about a quarter of an inch in length, and possessing only four segments, of which the terminal one is as long as the rest of the animal, and is alone provided with reproductive organs. The head presents four suckers and a double row of hooklets, varying from thirty to fifty in number. The eggs discharged with the terminal segment find their way into the human stomach, and, their capsules being dissolved, the embryos, armed with six hooklets, are set free, and, having made their way through the coats of the stomach, may wander to any part of the body. As they are far more often met with in the liver than elsewhere, it may be presumed that they get into one of the branches of the portal vein.

Arrived at its destination, the embryo loses its hooklets, increases in size, and becomes converted into a transparent vesicle. The next change is that a granular layer forms around it which is converted into fibrous tissue, ultimately constituting its capsule. Inside this the cyst wall proper consists of two parts, an outer thick homogeneous laminated elastic membrane, and an inner granular layer. From this inner layer there protrude inward many little bud-like cysts, which for a time remain connected to it by a pedicle, but are ultimately set free, and are then known as daughter cysts. Inside these by a similar process other cysts may form (granddaughter cysts). When the pedicles do not disappear, and the buds remain permanently attached to the inner layer, they are known as brood capsules, because they contain the scolices, of which there may be ten or a dozen in each little sac. The scolex is the larval form, and possesses a head exactly resembling that of the parent worm.

The fluid contained in these cysts is clear, non-albuminous, and slightly saline. On microscopical examination, some detached hooklets will often be found in it, as well as the scolices. An *echinococcus* cyst may not develop any scolices, in which case it is spoken of as an *acephalocyst*. Very rarely the cysts are multilocular—*i. e.*, divided by septa into a number of small cavities.

The *symptoms* produced by the presence of an hydatid tumor will depend upon its situation, and will be found on reference to the diseases of the viscera most commonly affected. See LIVER, HYDATID OF; ABDOMINAL TUMORS.

JOHN ABERCROMBIE.

HYDROA.—A group of vesicular and bullous skin affections presenting many points of affinity with the vesicating erythemata on the one hand, with herpes and pemphigus on the other, but with characteristics of its own sufficiently marked to justify separate description. The group includes the diseases described as dermatitis herpetiformis, pemphigus pruriginosus, urticaria vesicans, and herpes gestationis, and is by no means uncommon.

Hydroa occurs in persons of either sex, especially those of neurotic temperament, and often after worry or anxiety; or during pregnancy or in the parturient state. Its course is intermittent and chronic, lasting for months or even years with periodical intermissions or exacerbations, but with a decided tendency toward ultimate recovery.

Symptoms.—Shivering, pyrexia, and malaise may precede its outbreak, and violent itching is almost invariable; then erythematous patches and raised papules or plateaus, often circinate and rapidly vesicating, appear in successive crops on the trunk and limbs, but the face, neck, scalp, and buccal mucous membrane may also be affected. The vesicles, when recent, are small, pin-head-sized, often angular, tense or umbilicated, contain clear or turbid yellowish fluid, and frequently exhibit herpetiform grouping. By their fusion large bullæ may be formed, and these may or may not be surrounded by an inflammatory halo. These various types of lesion usually co-exist, giving the disease its markedly polymorphic character.

Itching is almost always severe through-

out, and pain or burning is often also complained of. The formation of scales and crusts evidences the beginning of subsidence of the eruption, which is followed by deep pigmentation, with or without scarring.

The *diagnosis* is often difficult at first; the disease may be mistaken for variola, pustular syphiloderma, or bullous iodide rash; afterward it must be differentiated from its afore-mentioned congeners.

Treatment is sometimes decidedly beneficial. Arsenic, pushed to the limit of the patient's tolerance, is the drug most generally useful. At other times belladonna, atropine, and quinine appear to be valuable, while cod-liver oil is of marked benefit to debilitated persons. Locally, lotions of liquor carbonis detergens (3 ij ad 3 viij) or of thymol or naphthol (2 to 5 per cent.) are useful in allaying itching, but prolonged tepid bathing may sometimes be necessary to obtain a good night's rest.

J. J. PRINGLE.

Symptomatic Indications.—*Rhus tox.* is the most generally useful remedy, allaying the burning and itching. *Apis mel.* is sometimes useful, when eruption is attended with burning, stinging pains.

HYDROADENITIS.—An inflammation of the sweat glands, or the connective tissue about them. The condition commences by the appearance of small lumpy swellings like blind boils, which do not suppurate, though they remain for some time tender, painful, enlarged, and of a dull red color, like huge acne indurata spots, only that they possess no central pustular point or follicular orifice.

Treatment.—Allay the local inflammation by ordinary measures, such as hot-water bathing and the free use of some calamine lotion, subsequently painting with collodion, or stimulating the places, when indolent, with the application of the acid nitrate of mercury; or, should this not be successful, subcutaneous puncture may be employed. In some cases which occur in strumous subjects, the disease is greatly influenced for the better by a course of cod-liver oil.

HYDROCELE.—An accumulation of serum forming a swelling in connection with the testicle or spermatic cord.

Varieties.—1. Hydrocele of the tunica vaginalis testis (common hydrocele). 2.

Hydrocele of the cord (sometimes called "encysted hydrocele of the cord"). 3. Encysted hydrocele (frequently called "encysted hydrocele of the epididymis," or "of the testicle"). 4. Diffused hydrocele of the cord. 5. Congenital hydrocele, 6. Infantile hydrocele.

Hydrocele of the Tunica Vaginalis Testis.—*Causes.*—Middle age, weak constitutions, and gout predispose. Injury and orchitis excite. In most cases there has been no known exciting cause.

Signs.—A scrotal tumor, smooth, oval, pyriform, or globular (often constricted in the middle); elastic, tense, or fluctuating, transparent or semi-transparent (rarely quite opaque). No connection with abdomen. Cord free near abdominal ring. No impulse on coughing. Penis gets "absorbed" as it were, into tumor.

Diagnosis.—See HEMATOCELE and INGUINAL HERNIA.

Pathology.—A serous dropsy of the tunica vaginalis, probably of chronic inflammatory origin. The cure acts by checking the secretion of the tunica vaginalis, and rarely results in the production of adhesions.

Treatment.—1. Palliative: Tapping with trocar and canula, or mere use of discutient lotions + suspensory bandage. In tapping make out position of testicle by palpation, by assistance of patient's sensations, and by use of candle and stethoscope. Grasp tumor firmly in left palm. Plunge trocar obliquely upward and backward into juncture of middle and lower thirds of hydrocele. The fluid will usually collect again. Lotio ammoniæ hydrochlor. (3 j to 3 vj) used as a discutient. 2. Radical cure: First empty the hydrocele, then inject two drams of port wine or of tinct. iodi. and water, equal parts. Let the injection flow out after a minute or two. Platinum canula should be used for tinct. iodi., or carbolic acid and glycerine, aa 3 ss, instead of iodine, is said to be less painful. Treatment by seton is not to be recommended. Patient should remain in bed for two or three days.

Hydrocele of the Cord.—Its pathology is probably that of a dropsy of a small obliterated part of the tunica vaginalis funiculi. It may sometimes be an independent cyst. Its appearances are quite characteristic. It is transparent, feels like a pigeon's egg, not more elastic, and slips up and down between the fingers

with great mobility. You may fancy that you have reduced it into the inguinal canal, when, suddenly, in a humorous way, it may be discovered half-way down the cord toward the testicle. Occurs in the young.

Diagnosis.—Only in rare cases, when it extends right into inguinal canal, and patient is so fat as to hide transparency, can this affection be mistaken for hernia.

Treatment.—Tap and inject with tinct. iodi. and water, equal parts. Before injecting be sure that the case is not one of “congenital” hydrocele.

Encysted Hydrocele.—*Signs.*—Those of cyst attached to the testicle, usually to the head of the epididymis.

Pathology.—A cyst containing sometimes pure serum, but frequently a mixture of serum and seminal fluid. An opening has often been found between the seminal tubules and the cyst. The cyst may originate from a dilated seminal tubule, or from a dilated cavity in the connective tissue, or, according to Osborne, from enlargement of the “hydatid of Morgagni.” Same treatment as that of ordinary hydrocele.

Diffused Hydrocele of Cord.—Unknown to living surgeons. Described by Pott. But hydrocele of cord sometimes receives this name if it forms a long, rather ill-defined tumor.

Congenital Hydrocele.—Tunica vaginalis funiculi is opened, as in hernia, into tunica vaginalis testis, but the open process contains peritoneal fluid instead of intestine.

Treatment.—Puncture with fine trocar, and then try to close the opening by the pressure of a truss.

Infantile Hydrocele.—Occurs in infants in whom tunica vaginalis has only closed at external abdominal ring.

Treatment.—Discutient lotions. Puncture. If it is certain that there is no communication with peritoneal cavity, iodine injection may be employed in obstinate cases. Many cases disappear with very little treatment.

C. B. KEETLEY.

HYDROCEPHALUS, ACUTE.—See TUBUCULAR MENINGITIS.

Symptomatic Indications.—Iodine has done good service in promoting absorption of the fluid. In severe cases *kali iod.*, causes absorption. *Spongia* is useful in acute form, *calcareo carb.* in children.

HYDROCEPHALUS.—An accumulation or excess of fluid either within the cerebral ventricles (internal) or outside the brain substance (external). Analogous conditions occur about the spinal cord.

Symptoms.—The head grows large and becomes globular; its circumference may be enormously increased, and may measure 30 inches; the rate of growth varies, and sometimes the head remains stationary in size for weeks together. The sclerotic is often exposed above the cornea, chiefly because of the altered plane of the orbital plates, their direction being much more vertical than natural. The unossified sutures readily yield before the hydrostatic pressure, and the bones become very thin, either general or in limited areas (craniotabes, *q. v.*); in the sutures and fontanelles Wormian bones may develop. The sagittal suture and anterior fontanelle are normally later than other parts in closing, and those parts present most widening, and are the last to close in hydrocephalus.

The eyeballs are rendered more prominent and depressed, so that the pupils may be partly covered by the lower lids. A vibratile thrill of fluctuation may be detected. The hair often grows thinly; the skin of the head may be tense and shiny; large veins may cause furrows (simulating sutures) in the skull bones; the face looks abnormally small by contrast with the big cranium. The mental, motor, vasomotor, and trophic functions are very often deranged. Convulsions are not uncommon; the spasms may occur in any part of the body; they may partake of the characters of true epilepsy; twitching sometimes like chorea may be seen. The muscles are always weaker than natural; their mechanical and faradic irritability is almost always increased. The knee-jerks are usually exaggerated, and ankle clonus may be obtained; the superficial reflexes are sometimes increased, sometimes more marked on one side of the body. Sometimes there is great emaciation, and at others remarkable fattening (lipomatosis neurotica).

The mental development is often retarded, though it is striking how intelligent many of these children seem. If hydrocephalus develop after closure of the cranial sutures, mental apathy and other obscure signs may occur, leading to a diagnosis of “tabes nervosa” or

"neurasthenia." Probably any motor symptom and any mental symptom may occur in these cases; strabismus, nystagmus, amblyopia, contractures, laryngismus stridulus, and various paralyses have been observed. The optic nerves may be atrophied and white, from pressure on the optic chiasma by the distended third ventricle.

The *course* is not favorable; most cases die within a few years, generally as the result of convulsions or intercurrent inflammation of the lungs or throat (diphtheria). There is nothing in the nature of the affection which should kill, bearing in mind that the brain tissues are singularly tolerant of slowly increasing pressure. A case is recorded which lived for seventy-eight years.

Diagnosis.—An encephalocele differs from hydrocephalus in being local and more opaque, and in having a doughy, elastic consistence. A fungus of the dura mater, projecting through a bone, is also local and feels doughy. Macrocephalus, or large head, may be due to rickets or syphilis, and perhaps to a "hypertrophy" (probably false) of the brain. In the two former diseases the enlargement is chiefly due to bony overgrowth.

Pathology.—Probably most cases of chronic hydrocephalus are due to the interference with the circulation of cerebro-spinal fluid between the subarachnoid spaces and the cerebral ventricles, and probably also the most frequent cause of this interference is occlusion of the foramen of Magendie (*see* MENINGITIS, POSTERIOR): which is generally the effect of a local meningitis. Hydrocephalus arises also in cases of intracranial tumor, and the mechanism may be the same in all cases. That congenital syphilis may determine a *posterior meningitis* with subsequent hydrocephalus is certain. That rickets alone is capable of producing hydrocephalus is very doubtful.

Anatomy.—The ventricles are distended with a serous fluid, which may be quite clear, turbid, or may contain flakes of lymph, and is in some cases purulent. All the soft parts of the brain are stretched and thinned, and the commissures and septum lucidum are generally torn and macerated (white softening). The sulci tend to be obliterated, and the convolutions to be flattened.

The membranes may be thinned, but are often thickened, and they may present a "shagreen" appearance, granules, looking like fine white sand, studding their surfaces over a varying extent. These granules are composed of small round cells; they appear to be buds composed of granulation tissue. It is possible that these buds are immature morbid choroid plexuses.

Ætiology.—Acute hydrocephalus internus occurs in tubercular and other forms of meningitis. External hydrocephalus is met with in cases of local atrophy of the brain; it is not usual to describe as external hydrocephalus a general excess of fluid in the subarachnoid tissues of the brain such as goes with general cerebral atrophy. External hydrocephalus may accompany any sort of local brain atrophy, whether it be porencephalia—congenital hole in the brain—or the result of hemorrhages, embolism, or thrombosis. Speaking generally, by hydrocephalus is meant a chronic dropsy of the cerebral ventricles, dating from birth or early infancy (congenital or infantile).

Treatment.—Great care is required to prevent the occurrence of accidents, as blows and falls are more apt to develop neuroses than when the brain is healthy. Counter-irritation and internal remedies scarcely ever cause any reduction in the quantity of fluid or affect the size of the head. Uniform pressure by strips of plaster or by bandaging, so as to make methodical compression, has very seldom done any good. Paracentesis is scarcely more hopeful, though in a few cases the head has been lessened in size; if the operation be undertaken, the fluid must be very slowly withdrawn, and even then convulsions may arise. The first spot to puncture is about an inch from the anterior fontanelle near the edge of the coronal suture, so as to avoid the longitudinal sinus and entering veins: only a few ounces of fluid should be withdrawn at one time; the difficulty as a rule is to get much fluid to flow through the fine canula.

In syphilitic infants the inunction of blue ointment into the shorn scalp has removed the hydrocephalus in three of the writer's cases.

ANGEL MONEY.

Symptomatic Indications.—Sulphur is sometimes useful in promoting absorp-

tion of the fluid. *Calcareo carb.* may help. See DROPSY.

HYDROMETRA.—Retention of watery fluid in the uterine cavity from blocking of the cervical canal. It has been found on post-mortem examination as a result of congenital atresia in young infants; but most commonly occurs in women who have ceased to menstruate. It is a result of endometritis, which is either combined with cicatricial closure of the cervical canal, or the canal is blocked by a tumor, or there is flexion of the uterus, flattening the canal at the point of flexion, and so closing it; the atrophied senile uterus being thin and deficient in contractile power. The condition is preceded by leucorrhœa, and sometimes the distention of the uterus is accompanied by pain, but it rarely causes trouble and may be only discovered in post-mortem examination. It may lead to regurgitation of fluid into the tubes and their distention.

Treatment.—Simply reopen the canal and let out the fluid. The opening should then be kept patent with a stem until its margins have healed. In cases of hydrometra due to flexion, the mere passage of a sound or a bougie is often sufficient.

G. E. HERMAN.

HYDROPHOBIA (RABIES).—An acute disease due to the presence of a specific virus which is conveyed by inoculation from animal to animal (all being susceptible to its effects) by subcutaneous or submucous infection through a wound.

The virus is found almost exclusively in the nervous system, especially in the medulla and spinal cord. It is also contained (evidently in the process of excretion) in the secretion of certain glands, notably the salivary glands.

After the virus has been introduced into the system, the period which elapses before the appearance of the symptoms depends upon the following factors:

(a) *Age.*—The incubation is shorter in children than in adults.

(b) *Part infected.*—The rapidity of onset of the symptoms is greatly determined by the part of the body which may happen to have been bitten. Wounds about the face and head are especially dangerous; next in order of decreasing mortality come bites on the hands, then injuries to other parts, dependent upon the fact that

the face, head, and hands are usually naked, while the other parts are clothed; but bites about the head and face are under all circumstances the most dangerous.

(c) *Extent and severity of the wound.*—Punctured wounds are the most dangerous, and lacerations are fatal in proportion to the extent of the surface afforded for absorption of the virus.

(d) *The animal conveying the infection.*—In order of decreasing severity come: (1) Wolf, (2) cat, (3) dog, (4) other animals.

The death-rate among those bitten by wolves appears to be about 40 per cent.; among those bitten by dogs it is about 15 per cent. It is probable that the carnivora, by reason of their general habits and natural ferocity, are only more virulent in that they cause more severe wounds; but it is questionable whether this completely explains why the cat is so notably more dangerous than the dog.

The shortest possible incubation period has been determined by Pasteur to be about seven days; this occurs usually after subdural inoculation, *i. e.*, inoculation beneath the dura mater. The minimum period has been clinically observed in children, but such cases are very rare. It occurs frequently in rodents after subdural inoculation, the virus having been perfected by transmission through several generations of such animals. The usual period of incubation after subdural inoculation is from fourteen to twenty-one days, and this period has often been observed clinically. The commonest incubation period in man, after subcutaneous infection by a bite or a scratch, is from six to eight weeks. The maximum is unfortunately undetermined, although under exceptional circumstances it may be as long as two years.

Symptoms.—(a) *Premonitory.*—The symptoms, especially in man, are hallucinations, a vague sense of fear and malaise, and frequently itching or irritation in the cicatrix. This may be excessive, and may amount to pain.

In this stage a man behaves oddly and suspiciously. In the dog the appetite becomes depraved, and by the time the second stage is reached solid food is refused. This symptom, absent in man, is pathognomonic of the disease in the lower animals. The temperature begins to rise the pulse and respirations are accelerated,

the voice becomes husky, and the bark and howl of the lower animal is characteristic.

(b) *Furious*.—This stage begins with restlessness, causing the lower animal to break bounds and wander. Then follows hyperæsthesia, particularly noticeable in the ungulates and in man. Any afferent stimulus—*i. e.*, a sound, a draught of air, or the mere association of a verbal suggestion—will cause a violent reflex spasm. In man this symptom constitutes the most distressing feature of the malady. The spasms, which affect particularly the muscles of the pharynx and mouth, are exceedingly painful, and are accompanied by an intense sense of dyspnœa, even when the glottis is widely open or tracheotomy has been performed.

The spasm is usually brought on by the attempt to drink, and is then seen to consist in a violent elevation of the larynx and hyoid bone. The terror of re-exciting this painful spasm leads naturally to a dread of water, which has given the name to the disease. Hydrophobia is a regrettable term, and its use is to be deprecated, since it encourages the popular delusion that so long as a dog drinks, or attempts to drink, it cannot be rabid, whereas it will gladly try to do so even in the last or paralytic stage.

The temperature in the "furious" stage reaches its maximum (in some cases 103°). During the paroxysms the pulse and respirations become quickened and irregular.

(c) *Paralytic*.—Before the furious stage has ceased motor paralysis sets in, almost invariably attacking first the hind limbs and ascending to the head, in a manner so exactly similar to that of "Landry's ascending paralysis" as to suggest that that disease may be only the completely paralytic form of rabies in man.

As the paralysis spreads the temperature begins to decline and becomes subnormal, falling in the rabbit sometimes as low as 22° C. The respirations become slower and the pulse gradually weaker. In this connection it is necessary to speak of the mode of death, which, owing to the frequently marked degree of impairment of the medulla, often occurs by sudden syncope.

Morbid anatomy.—The morbid anatomy is simple. Owing to the fact that the virus produces functional changes of great severity, but of short duration, if

the animal dies, or is killed in an early stage, but few lesions are found after death. If the disease runs its full course, the post-mortem appearances are quite characteristic. The lesions are confined almost entirely to the central nervous system, the alimentary canal and the respiratory tract, the serous membranes remaining perfectly healthy; rigor mortis is well marked.

Nervous system.—The whole of the central nervous system is usually the seat of acute though moderate inflammation; sometimes, however, only patches here and there show any changes. The vessels are greatly congested, and, consequent upon the congestion, exudation of leucocytes takes place into the perivascular lymphatics; hemorrhages also occur, but these may obviously be, in part, accounted for by the mode of death.

Alimentary canal.—According as the disease has run a furious or paralytic course, the pharynx will be more or less congested, and either covered with sticky mucus or dry. The gullet is usually normal, but the stomach is, as a rule, markedly congested. In some animals—*e. g.*, rodents—hemorrhages are almost constantly present in the mucus membrane of this viscus. In any case the fluid contents of the stomach are usually coffee-ground in appearance, from the presence of altered blood. Owing to the depravity of the appetite at the onset of the disease, the stomach in the lower animals very frequently contains foreign bodies—*e. g.*, hay, pieces of wood, stone, etc.; but the presence or absence of these things is not alone pathognomonic. To the loss of appetite is due the fact that the rest of the alimentary canal is usually empty.

Respiratory system.—The larynx frequently participates in the congestion of the pharynx. The trachea and bronchi are often markedly congested. The lungs usually show some patches of acute broncho-pneumonia with hemorrhages. More usually the lower lobes are collapsed and œdematous.

Circulatory system.—The heart is always normal; the blood is frequently to a large extent fluid, but contains dark-colored post-mortem clots. In the liver, spleen, and kidneys, changes similar to those seen in the central nervous system have been described, but only rarely, and subdural inoculation from these viscera

has produced no effect, thus showing that they contain practically none of the virus. Finally, the bladder is distended, especially in the paralytic stage.

In cases where the microscopic evidence and clinical history are alike doubtful, subdural inoculation affords a ready and certain test of the existence or absence of the disease.

Treatment.—This terrible disease can be prevented from existing where the following measures are possible: (1) Proper muzzling of all dogs; (2) humane destruction of all ownerless dogs; (3) proper quarantine or other measure against the importation of the malady.

Where such regulations have been in force, the disease has been completely eradicated in a few years.

(a) *Preventive treatment.*—That devised by Pasteur consists in the subcutaneous injection on successive days of several cubic centimeters of an emulsion of the dried spinal cord of rabbits, that have died from the most acute form of rabies. Chemical substances produced during the culture of an organism, and known to be inhibitory to its growth, are introduced into the system. This is unattended by danger or untoward results—*e. g.*, the production of abscess—and its adoption has reduced the mortality among those bitten by indubitably rabid dogs from 15 per cent. to 1.3 per cent.

(b) *Palliative treatment.*—(1) The patient must be placed in a darkened room, kept quiet and warm; all draughts excluded. He must be brought thoroughly under the influence of morphine, or rectal injections of bromide of potassium, and chloral may be given, but, owing to the risk of inducing syncope, chloral is dangerous. The sensitiveness of the pharynx may be conveniently reduced by the local application of a 20 per cent. solution of cocaine.

(2) Nourishment must be given to the patient by means of nutrient enemata and suppositories, to avoid the spasm in the throat caused by attempts to swallow. At the beginning of the paralytic stage the patient can often swallow a little fluid with great relief, and consequently an apparent improvement is thus obtained, unhappily only of a temporary kind.

Hysterical or Pseudo-Hydrophobia.—Cases from time to time occur in which neurotic persons bitten by dogs, whether rabid or not, develop symptoms resem-

bling rabies in some particulars, and such are often recorded as marvelous cures of the real disease by drugs. A differential diagnosis may be arrived at by observing the following salient points:

Furious stage.—In this stage the hysterical patient usually barks like a dog, and attempts to bite everybody, even himself. He can always be deceived by suggestion, and will thus at one moment display reflex excitement and the absence of it the next, although the stimulus be adequate in each case. The patient speaks very much about the animal by which he was attacked, while in genuine cases this is very rare. The state of the temperature is the most valuable test, as hysterical hydrophobia is an apyrexial affection. The pulse and respiration show no marked quickening. Finally, the absence of true mental disturbance, the stationary character of the general symptoms, and the concurrence of hemianæsthesia or other hysteroid symptoms all help to make the diagnosis of spurious rabies obvious.

Treatment.—The confidence of the patient should be gained, and then, by suggestion and moral suasion, a cure can easily be effected.

VICTOR HORSLEY.

Symptomatic Indications.—The remedies which are claimed to have cured in some cases are *belladonna* and *stramonium*; the former being preferred when the throat symptoms predominate, the stramonium when general nervous irritability and delirium are the leading symptoms.

HYDROPERICARDIUM.—See PERICARDIUM, DROPSY OF.

HYDROPHTHALMIA.—*Dropsy of the Eye.*—This affection is at times caused by an increase in the quantity of the aqueous, at others, of the vitreous, humor. In the former the iris is concave anteriorly and pushed backward. In the latter it is convex, and pushed forward. Most commonly the disease seems to depend on both humors at the same time. Hydrophthalmia some times affects both eyes; children are more exposed to it than adults or old persons.

Treatment must vary according to the cause; its longer or shorter duration; greater or less extent, etc. Hence, according to circumstances, a hydragogue

medicine, purgatives, general and local blood-letting, blisters, setons, moxa, cupping glasses, fomentations, collyria, and fumigations of different kinds, have been employed. When all means fail, and the disease continues to make progress, the fluid may be evacuated by a puncture made with a cataract needle at the lower part of the transparent cornea.

HYDRONEPHROSIS. — A distention of the kidney by accumulated fluid, accompanied by atrophy of its substance, the result of some obstruction in the lower urinary passages.

Symptoms.—A hydronephrosis of moderate size causes a tumor to appear in the region of the kidney, which has the usual characters of a renal tumor (*see* KIDNEY, TUMORS OF). The special characters are its softness, the presence of well-marked fluctuation evidencing its cystic nature, occasionally slight mobility, sometimes a lobulated outline, and generally the absence of pain or tenderness. When both kidneys are affected, a tumor may appear on both sides of the abdomen, but is then rarely of large size. In some cases the tumor disappears, or diminishes in size, coincidently with a sudden discharge of urine. This, when present, is a most important diagnostic sign. Further, such an occurrence may take place again and again, constituting an "intermittent" hydronephrosis. Pressure upon neighboring organs by a very large cyst sometimes causes the only symptoms complained of by the patient. Obstruction of the intestines may thereby be produced. If one kidney only be attacked, and the hydronephrosis be too small to cause any intumescence in the abdomen, no symptoms or signs may be observed which can be directly connected with it.

Diagnosis. — The signs of a renal tumor sufficiently indicate how a hydronephrosis is to be distinguished from cysts arising in other parts. Fluctuation, and the absence of hematuria and pain, differentiate it from malignant and other solid tumors of the kidney. Pus in the urine, at one time or other, with rigors and pyrexia, characterize a pyonephrosis, but hydronephrosis may pass into this condition. A history of symptoms of renal colic produced by gravel or the presence of some other causes of obstruction to the urinary pas-

sages, serve to distinguish hydronephrosis from other cysts of the kidney. The discharge of hydatid vesicles in the urine demonstrates the nature of a cyst of parasitic origin. A perinephritic abscess is more diffused than a hydronephrosis, it is not movable, is accompanied by pyrexia and redness of the skin, and is painful and tender. Finally, the intermittent appearance of a hydronephrosis, when this occurs, is a conclusive test of its character.

Pathology and morbid anatomy.—The cause is always an obstruction of the urinary passages. The obstruction may be in the passages themselves, such as a calculus blocking the ureter; it may be a contraction of the ureter from the cicatrization of an ulcer formed during the previous passage of a calculus along the tube; it may result from a growth of tubercle in the mucous membrane of the ureter; or, it may be due to pressure on the ureter by tumors of different organs, peritoneal bands, or inflammatory exudation following injury.

Congenital deformities are sometimes a cause. Among these are absence of the ureter, imperforate ureter or urethra, contraction or twisting of the ureter, compression of the ureter by an abnormal artery, folds in the mucous membrane of the ureter, and the entrance of the ureter into the pelvis of the kidney by an oblique opening which closes in a valve-like manner. The movement downward of a floating kidney may so fold the ureter as to obstruct the flow of urine along the tube, and consequently produce a hydronephrosis.

When obstruction to the free passage of urine from the kidney is established, the secretion accumulates in the pelvis of the kidney. First the pelvis, then the infundibula, becomes distended, and this, provided that no inflammation of the pelvis be set up, constitutes the first stage of hydronephrosis. It has been found, experimentally, that there is at first congestion of the kidney, due to pressure on the veins contained in the pyramidal portion, and that this gives way shortly to anæmia from pressure on the arteries. The papillæ which project into the pelvis become compressed on all sides and soon atrophy; they have even been known to become necrotic, and to be thrown off *en masse* into the pelvis. The increasing pressure of re-

tained urine soon causes atrophy of the whole of the pyramidal portion of the kidney. The cortical portion becomes indurated from an overgrowth of fibrous tissue, and finally, in extreme cases, undergoes pressure-atrophy, and, gradually wasting, may eventually disappear. Yet the fetal lobulation of the kidney is often somewhat evidenced in the diseased structure. Shadowings of the lobulation are seen on the surface; in the interior, fibrous septa, running inward from the periphery, divide the cavity into several loculi, which communicate only through the pelvis.

Such a condition is a fully developed hydronephrosis, a loculated sac, having fibrous walls, in which islets of kidney substance are often imbedded and filled with a watery fluid containing urinary ingredients. But the type is subject to variations. There may be no loculi, but only a single cavity, or the loculi may be few and imperfect.

If the obstruction be situated in one ureter only, the corresponding kidney will be subject to hydronephrosis. But both ureters may be separately blocked, or they may both be involved at their termination in one cancerous tumor, and then both kidneys become hydronephrotic. Moreover, not infrequently, a kidney has two ureters and two pelves; one only of these may be blocked, and, consequently, only that portion of the kidney corresponding to the obstructed ureter becomes distended, the remaining portion carrying on its functions as before. The size of the hydronephrotic sac is variable; it may be enormous, or smaller than a normal kidney.

In the early stages the contents of a sac are ordinary urine. But soon actual secretion becomes abolished, and the fluid is simply a transudation from the blood. It is then more watery than normal urine, but contains urinary salts and extractive matters, together with a little albumen, cholesterin, fat, blood, epithelial elements, and small quantities of inflammatory products.

When hydronephrosis is unilateral the opposite kidney becomes hypertrophied, and for a long period may satisfactorily supply the needs of the body. The heart becomes hypertrophied, especially in its left ventricular portion. Even when both kidneys are disabled, it is sometimes remarkable how much atrophy of both or-

gans may take place before life is destroyed. In most cases the obstruction which causes distention of the kidney is not total, or is so only for limited and broken periods. When total obstruction has taken place the pressure in the kidney will soon rise so high as to stop secretion and transudation, and therefore simple atrophy of the kidney is most likely to be the final result.

Results.—The distention may overcome the obstacle and may not recur, the kidney being left in a more or less disabled condition, according to the length of time the obstruction has existed. Pressure upon surrounding parts in time causes exhaustion, or occasionally more rapid death from intestinal obstruction. Rupture into the peritoneum is rare, but when it occurs is usually fatal. A double hydronephrosis eventually kills by the supervention of uræmia.

Occasionally the cyst suppurates, producing a pyo-nephrosis. It must also be remembered that with one kidney disabled by hydronephrosis the impaction of a calculus or any other obstruction in the opposite ureter will cause fatal suppression of urine.

Prognosis.—The prognosis is always grave, but not so serious as in other renal tumors. If both kidneys are affected the prognosis is more serious than when one only is diseased. Yet life may be prolonged for a considerable period if the obstruction be incomplete.

Treatment.—The obstruction has been overcome by shampooing the swelling. When there is great distention this is inadmissible. If distress be experienced and serious mischief is threatened from pressure or rupture, the sac should be tapped. The best situation for the puncture is just anterior to the last intercostal space, if the tumor be on the left side, or half-way between the last rib and the crest of the ilium, from 2 inches to 2½ inches behind the anterior superior spine of the ilium, if the tumor be on the right side.

Incision is required if the cyst suppurate, or if, after aspiration, the cyst repeatedly refill and dangerous symptoms again arise. The incision is to be made in the lumbar region, and the cyst drained and irrigated antiseptically. Nephrectomy is a last resource when the useless remains of a kidney are causing exhausting suppuration. Rupture of the cyst into the

peritoneum has been successfully treated by laparotomy and drainage.

ROBERT MAGUIRE.

HYDRORRHŒA GRAVIDARUM

is a rare and curious disease, characterized by a discharge of watery fluid from the uterus during pregnancy. It has been thought to be due (1) to discharge of fluid pent up between the decidua vera and reflexa, the fluid being produced by hypertrophied decidual glands; the disease, according to this view, being properly styled *endometritis decidualis catarrhalis*. (2) To rupture of the membranes high above the os uteri, and partial discharge of the liquor amnii. (3) To an excessive secretion by the glands of the cervix, analogous to the excessive salivation which sometimes occurs in pregnancy.

G. E. HERMAN.

HYDROPS ARTICULI.—See JOINTS.

HYDROTHORAX.—See PLEURISY.

HYMEN, IMPERFORATE.—Closure of the vaginal orifice by excessive development of the hymen, usually congenital. The non-appearance of the menstrual flow in connection with the other signs of menstruation usually excites suspicion of the condition, which is confirmed by examination. The prognosis is generally favorable.

Treatment.—The hymen may sometimes seem to entirely close the vagina, when, on examination of the patient on her back, the anterior free edge of the hymen may be found embracing the posterior wall of the urethra. In such cases a slight incision backward will be sufficient to free it; when the hymen is really imperforate much care should be exercised in incising it, as the accumulated menstrual fluid of the evacuation may become decomposed before it has all passed away, and give rise to fatal septicæmia. A free opening should be made, and the thick, viscid fluid allowed to drain away gradually, antiseptic injections being frequently given.

HYOID BONE, FRACTURE OF.—See FRACTURES.

HYPÆSTHESIA.—See ANÆSTHESIA.

HYPERÆMIA OF SKIN.—This is characterized by an undue injection of

blood into the capillaries, small veins, and arterioles of the superficial layer of the skin conveniently divided into (*a*) active, in which the skin has usually a bright red color, accompanied by a feeling of irritation, as of burning or itching, by moderate swelling, and sometimes by slight elevation of temperature; (*b*) passive, in which the hue is more livid, the temperature lowered or only normal, and a feeling is experienced of numbness or anæsthesia. The division is one of convenience, as the active hyperæmia may culminate in the passive (congestion) or they may be present at one time, on the same portion of skin, as in thrombosis or embolism, when the central part is in a state of congestion and the marginal in one of active hyperæmia.

Active hyperæmia may be subdivided into:

1. Traumatic, excited by irritants. 2. Symptomatic, arising in the course of other diseases, usually under the influence of reflex irritation of the nervous system.

The former are usually called erythemata, but as they are characterized chiefly by an increased vascularity, with little or no exudation, they are more suitably called hyperæmia.

a. Hyperæmia (erythema) mechanica arises on portions of skin exposed to undue pressure, rubbing, or scratching. It is generally transient, but if the irritation be repeated the skin is apt to become the seat of congestion or of inflammatory change, and the eruptions of exanthemata appear upon it with special brightness.

b. Hyperæmia calorica arises on parts most exposed to the sun's rays, or to the wind, as a diffuse bright-red discoloration, which in time becomes darker and usually ends in brownish pigmentation and slight desquamation. Fugitive hyperæmia may be excited by transient degrees of heat and either warm or cold baths.

c. Hyperæmia ab acribus seu venenata is produced by chemical irritants, such as the juice of certain plants, mustard, etc., and readily develops into exudation and inflammation if the cause be prolonged.

Symptomatic hyperæmia may be excited by physical causes such as shame or anger, *i. e.*, in the form of a blush or of a more diffuse and slighter injection—or it may arise in the course of dentition or gastric disturbances in infancy, when it is termed erythema, roseola infantilis, strophulus, etc., or vaccinia,

variola, enteric fever, cholera, rheumatism, and other diseases, when it has been variously named erythema or roseola vaccinia.

Passive hyperæmia may be general, under the influence of heart or lung disease, causing mechanical congestion, or local, from pressure on the veins or deficient arterial force. The two latter have been termed *livedo mechanica* and *livedo calorica*, respectively, by Hebra.

Livedo mechanica, arising under the influence of pressure from tight clothes, garters, or varicose veins, appears as a purplish-red, bluish, or grayish-black discoloration of the skin, disappearing under pressure, with slight swelling, if there be no œdema. It gradually subsides when the cause is removed.

Livedo calorica applies to the bluish-red or purplish tint seen on the nose, ears, etc., of persons exposed to the cold, and to the dark lines about half or three-quarters of an inch wide which form serpentine figures on the extremities and trunk. The latter are chiefly visible on the extremities, and, but less obviously, on the trunk, and though fading on pressure, disappear only when the patient is warm. Occasionally, in the midst of the purplish background, vermilion-red patches are observable, varying in size from $\frac{1}{8}$ to $\frac{1}{3}$ of an inch, and sometimes surrounded by a pale zone.

HYPERÆMIA, FOLLICULAR.—See FOLLICULAR HYPERÆMIA.

HYPERÆSTHESIA.—Exalted sensibility. Hyperæsthesia has the same relation to the sensory part of the nervous system as spasms and convulsions hold to the motor, and, in fact, the two conditions are frequently associated. In this condition the various organs of sense are more readily affected than they should be by impressions which are made upon them, or the sensorium is more appreciative than natural of the impressions conveyed to it from the organs of sense. Practically, exalted sensibility is generally united with painful sensibility. Thus the eye cannot bear bright light; the ear is affected painfully by powerful, high, or discordant sounds; the skin shrinks from the slightest pressure, or from mere contact. In this sense hyperæsthesia is of frequent occurrence; it is observed in hysteria, sometimes in the early period of

febrile disorders, occasionally in inflammatory and other affections of the central nervous organs. It is quite common in hemiparaplegia, when the paralyzed side is generally still sensitive, and its sensibility often becomes painfully acute; it is not uncommon, too, in inflammatory affections involving the skin. Under the term, *dyæsthesia*, may be included a large number of abnormal sensations, referable to the ordinary sensory nerves, to the nerves of special sense, and to the sympathetic system, or, to the afferent nerves connected with the visceral organs. Among perverted sensations referable to the skin, may be included sensations spoken of as frequently indicating the advance of anæsthesia, namely, numbness, sense of coldness, tingling, formication, and the like; as also itching, burning, cutting, stabbing, crushing, shooting, aching, constrictive, and other pains, which are so common, and arise under so many various conditions. True neuralgic pains are usually shooting, flashing with momentary intensity along the fibers of the affected nerve, and occur in paroxysms composed of momentary shocks following one another rapidly. Other varieties of perverted sensibility are those which occur in relation to the visceral organs, among which may be included the desire for air which attends asthma and cardiac disease; the agony of angina pectoris; painful thirst or craving for food; gastralgia, enteralgia, and various indescribable sensations referable to different parts of the body, of which nervous and other patients complain, or which constitute many of the varieties of the so-called epileptic aura. Perverted sensibility of the organs of special sense may be manifested by the appearance of subjective phenomena referable to these organs: of the eye, by the appearance of sparks or flames, or other objects; of the ear, by the perception of sounds, such as humming, buzzing, singing, the ringing of bells, violent explosions, and even words and actual conversation; and of the nose, by the perception of odors; of the taste, by the perception of flavors, all of which have no existence.

HYPERMETROPIA.—See REFRACTION.

HYPERIDROSIS.—A condition characterized by excessive sweating, which

may be either general or local. General sweating may occur in the course of acute constitutional diseases, as acute rheumatism, or in debilitated conditions from debility of the exhalants. Local sweats may affect small portions of the body, the hands or feet, or one hand or foot, or rarely one-half of the body; when continued it produces a sudden appearance of the skin such as is seen after prolonged immersion in water. Eczema may result from the constant irritation of the sweat.

Treatment.—Will depend upon the cause: when from a debility, tonic will be required; occurring in the course of a disease, belladonna may relieve. Sponging with vinegar and water is sometimes efficacious in the night-sweats of phthisis. In local sweating the part should be constantly washed with yellow soap and water, and bathed with a lead or tannic acid solution.

Symptomatic Indications.—*Belladonna* is useful when sweating is general on covered parts, coming and going suddenly, and in weakly children who sweat profusely; *atropia* in sweats of phthisis and exhausting diseases. *Jaborandi* is valuable in copious sweats, particularly when one-sided; *cinchona* in exhausting night sweat on the side on which he lies. *Opium* in hot burning sweats over the body, wants to be uncovered; cold sweat on forehead. *Phosphorus*, profuse sweat at night during sleep. *Silicia*, sweating of the feet. *Calcareæ carb.*, sweating of head.

HYPERTROPHY.—The increased use of a part tends to enlarge and strengthen it; when enlargement from this cause is excessive, or results from some unusual condition of the corresponding or correlated organ, it is termed hypertrophy.

Parts are often described as hypertrophied when enlarged from other causes; it is desirable that the various kinds of enlargement be sharply separated from each other. The heart furnishes us with some typical forms.

Functional enlargement of organs, consequent on increased use, is well illustrated by the uterus in pregnancy, the mammæ in lactation, the testes of birds during the bleeding season, the oviducts of fish, birds, frog, and turtles, the muscles of the arms in boatmen and smiths, and the leg muscles in gymnasts.

As examples of hypertrophy, the following may be selected: the thickening of the muscular coats of the urinary bladder in stricture of the urethra, vesical calculus, and occasionally, in prostatic enlargement, but especially when an adenoma of the prostate produces valvular obstruction of the urethra; the walls of the small intestines above congenital stricture of the ileum, due to abnormal coalescence of the vitello-intestinal duct; and the walls of the esophagus above a fibrous stricture.

This marked tendency of plain muscle-fiber to hypertrophy may be turned to advantage in the operation of excision of the anus, for if only a small portion of the external sphincter be preserved, it will rapidly enlarge, and in a few months form an efficient valve giving the individual absolute control over the outlet of the bowel.

The effects and advantages of increase in size and strength from excessive use are well shown in the extra development of an arm or leg after its fellow has been amputated, especially in young and vigorous subjects. After amputation of the hallux at the tarso-metatarsal joint, the second toe will enlarge if the foot be used for walking, until it nearly rivals in size and appearance the lost toe. Probably all the tissues of the body respond in this way to increased use, even in the case of the testes. In cases of undescended testis, the retained organ is always abnormally small, while the descended testis is unusually heavy; this, of course, refers only to adults.

The kidney furnishes some very striking examples of hypertrophy; when one kidney is slowly destroyed, its fellow, if healthy, will gradually increase until it doubles in size and weight. The secreting tissue of such kidneys is perfectly natural.

Under favorable conditions, bone will hypertrophy, although nearly all the specimens described in pathological museums as hypertrophy of bone are spurious examples of the process.

Hypertrophy of organs from increased use is inseparably connected with increased blood supply. The rapidity with which arteries enlarge is often quite marvelous. When amputation is performed at the hip-joint, in cases of large sarcomata connected with the lower end of the femur, the large size of those arteries, which in a normal limb are usually insignificant twigs, is very noticeable. In

man, the temporal arteries will hypertrophy rapidly after ligature of the common carotid artery of the opposite side, and become perceptibly larger in a few days.

It may be useful to enumerate some of the commoner forms of enlargement of organs frequently mistaken for hypertrophy, among which bone takes a leading position. Thickened bones in cases of osteitis deformans, mollities ossium, acromegaly, rickets, and chronic periostitis or ostitis, cirrhotic and fatty livers, enlarged prostate, the brain in hydrocephalus, macroglossia, emphysematous lung, congenital enlargement of fingers, toes, or limbs, the thyroid body in goiter, inflamed testes and ovaries, and many similar conditions. Overgrown toe-nails, elongated beaks of birds, and teeth of rodents are often set forth as examples of hypertrophy; on the contrary, these owe their abnormal length to disuse, not to increased use.

In conclusion, a few remarks may be made on hypertrophy of the senses, for increased or abnormal use has a similar effect upon them as upon the tissues.

When an individual loses an eye by accident in early life, the remaining eye, if healthy, acquires a greater range of movement and quickness, which compensates in no small degree for the loss of its companion. In those born blind, or who lose the sense of vision in early life, the power of hearing becomes wonderfully acute, and not rarely, tactile sensibility becomes so intensified that such persons make themselves acquainted with external surroundings in a marvelous manner.

HYPNOTISM.—A term of neutral color introduced by James Braid, of Manchester, in 1843, to describe some symptoms, in many ways like natural sleep, which he had been able to induce in some men and animals by means, as he thought, of fixed attention. Phenomena, in many respects identical, had been forced on the attention of the world by Mesmer in 1778. Esdaile, a surgeon, in 1845, at Hooghly, before chloroform had been introduced into India, showed most conclusively that by hypnotism such complete anæsthesia could be produced that lithotomy, amputation above the knee, and many other major surgical operations could be performed, without the knowledge of the patients during hypnotic states lasting

some ten or twelve hours. The use of chloroform and ether for a time diverted attention from the anæsthetic conditions of hypnotism, and its abnormal psychical states were not seriously considered.

Azam and Broca pointed out their importance in 1860, and in 1866 Liébeault, of Nancy, published the results of some years of the use of hypnotism in medicine, which were for the time almost universally neglected. Charles Richet, in 1875, demonstrated afresh the physiological facts, and threw new light upon them; many French physicians began to take an interest in them, and a few German physiologists. Charcot, in 1878, began to make experiments, which were confined to the hysterical patients in the Salpêtrière, and, in 1882, Bernheim began a much wider trial of hypnotism on his patients, with all varieties of disease, in the large hospital of Nancy, where Liébeault's long experience had at last given his practice and beliefs great influence, and since then there has been rapid spread of experiment and knowledge through France. There is needed in the hypnotizer self-confidence, determination, and probably some personal quality not yet determinable; in the subject, at least to begin with, a passive acquiescence. The hypnotizable have no exact distinguishing marks; they are to be best found by trial; in greater numbers among the younger subjects and less educated classes; more frequently, probably, among the French and Italians than among the Germans and English; not to any marked extent more among women than men, among sick than healthy, or among hysterical than non-hysterical persons, though some hysterics have been easily trained into more elaborate symptoms.

Hypnotism is occasionally induced for the first time by mere authoritative command or suggestion in those who know little or nothing about the expected state; more often by some description of the sleeping state that is to follow, accompanied either by long gazing at something fixed, best held near to, and above the level of, the eyes, so as to induce an upward convergent squint, or else by directing attention to some monotonous stimulus to eye or skin or ear, such as slow downward passes made by the operator's hands before the subject's eyes, or gentle uniform stroking of the forehead, or holding a ticking watch to the ear.

Occasionally some parts of the body have been found abnormally sensitive—*e. g.*, the eyeballs or vertex—and pressure on them is followed by hypnotism. In all these cases the part played by expectation and suggestion cannot be eliminated or accurately estimated.

The common hypnotic physical results as seen in the healthy subjects are that the eyelids close and he cannot open them, and that his eyeballs roll upward into a position of slight characteristic convergent squint; there is, generally, increased excitability of muscle and peripheral nerve, with a lessening of the time of involuntary and increase of time of voluntary reflex, and some anæsthesia. Among the psychical phenomena there is a loss of spontaneity in his acts, and a ready obedience to commands, however ridiculous, and confident belief in any delusion, however absurd. The patient is, as a rule, alert and most impressionable, and in fact is ready to form the buffoon of the platform experimenter. In such a subject contraction or stiffening of a limb may be induced by light surface-friction and suggestion, and the arm, stiffened in extension, may be held out at right angles to the shoulder without tremor for even seven hours, while the same individual, in a normal state, will find it difficult to resist tremor after extension for some seven minutes, and collapse from exhaustion in a quarter of an hour. There may be also a cataleptic condition, following generally upon some shock of sound or sudden light, but in this the *flexibilitas cerea* is imperfect.

In a subject in such states as these some traces of memory often persist after awakening; a dim recollection, for example, of feeling unable to refuse obedience to an order which was felt to be ridiculous or fancied to be impossible. His tendency, if nothing keep him alert or restore him to his normal condition, is to lapse into a deeper state, for which there is no more accurate border line than can be drawn by his complete absence of memory of what has happened in his deeper state, either on being completely wakened or on being roused so as to re-enter his previous more alert state. But full memory of either alert or deep condition, and of that alone, recurs to him when that condition is reinduced, as in natural somnambulism the somnambulist forgets his ordinary life, but remembers his actions in previous somnambulatory attacks.

Throughout he is obedient to command, and so exceedingly susceptible to suggestion that he will act on it sometimes a year after he has been waked, though, if given when in a deeper stage, he will know nothing of this post-hypnotic suggestion until he enacts it, and then be quite unaware of the reason of his actions. In the deep state there is, as a rule, a tendency toward falling into a heavy sleep, which gradually becomes normal, and from which the subject wakes with little or no discomfort. Under some circumstances of disease, and more especially of psychical abnormality, such as hysteria, different types of conscious or unconscious suggestion from the hypnotist are very delicately appreciated by some hyperæsthetic subjects, and many variations occur.

Turning to the uses of hypnotism in medical treatment, we find that they may be roughly divided into the relief of pain, the obtaining of sleep, and the large group of consequences or concomitants of the change of some functional activity or mental attitude under post-hypnotic suggestion. In such a case, for example, as that of a middle-aged man with severe double pneumonia, high fever, insomnia, and incipient delirium, hypnotism has been induced on first sight for the first time in about ten minutes by Bernheim, and after a vigorous and repeated command to sleep, complete and refreshing sleep has followed for five hours in the middle of the day, with very substantial benefit, and without the drawbacks generally attaching to hypnotic drugs in such a case. The relief of the most severe pain, such as that of acute articular rheumatism, locomotor ataxy, etc., has not been reached, but some subacute cases of articular rheumatism, and a few of chorea, obstinate sciatica, and many lesser inconveniences, have been entirely cured. After experiments on more than 8000 patients at Nancy, and many others at Toulon, at Montpellier, Bordeaux, and elsewhere, the disposition is to continue and extend the treatment. In surgical operations it has been rarely tried of late; still there are several well-recorded recent instances of childbirth being rendered painless, and a few surgical operations also.

The receptiveness to suggestion in the subject gives the main power to the hypnotizer, in the form of a suggestion or

command to be carried out, it may be, a long time after awakening, and is thus applicable to the control of morbid impulses, such as a morphine or alcohol habit, or hysteria. A patient who is susceptible to this extent imagines his new post-hypnotic inclination to be his own self-engendered idea, and readily acts upon it. In many instances it has, after more or less frequent repetition, proved stronger than his original habit, and he has rejected with disgust what was formerly his chief pleasure.

In cases of acute and chronic insanity it has been, as a rule, difficult to gain the quiet acquiescence necessary at first, but it has been found possible, in several of the few cases where it has been tried, to overcome by patient hypnotism destructive and pernicious tendencies entirely for a time, and probably permanently, though the results are too recent to afford complete evidence. The limits of the powers of post-hypnotic suggestion have not as yet been thoroughly investigated; it is possible that by hypnotism power may be put into the wrong hands, and, consequently, it is always desirable that it should be attempted only by the medical advisers or under strict medical supervision.

A. T. MYERS.

HYPOCHONDRIASIS.—The term originated in the ancient belief that the seat of the disease lay in the organs behind the xiphi-sternum and below the diaphragm. Although in the present day an abnormal cerebral condition is considered the source of the affection, the expression, nevertheless, sufficiently marks its most frequent causal relationship. It is very difficult to define with accuracy its exact limitation, for the disease is on the border-land of insanity, and many cases seem to partake of both a melancholic and hypochondriac element. In the present article the term will be restricted to cases of mental depression originating in morbid sensations.

Symptoms.—As a rule, some little derangement, probably of the digestive tract, occurs in an individual unduly anxious concerning his health. He has picked up some scraps of medical knowledge, and ascribes the symptoms to some serious disease. He now eagerly examines his tongue, pulse, urine, and fæces,

and finds in most or all some corroboration of his anticipations. All his thoughts are fixed upon himself, and focused especially upon the particular organ which is the source of his trouble. One doctor after another is consulted, and specifics and nostrums of all descriptions are tried. He may even be persuaded that this cannot possibly exist, and happier days seem dawning, when he becomes aware of vague pains or slight deviations from the normal, which plainly point to some serious but indefinite disease.

This condition is a more difficult one to cope with than the preceding, for it means that in place of presenting a definite object for attack, the patient will carry on a guerrilla warfare, and no sooner be dislodged from one position than he will assume another. Fugitive burning pains and paræsthesiæ are common in the course of certain superficial nerves, and may also be referred to deeper tissues, such as the brain, heart, or lungs. These become the subject of great concern, and naturally develop and multiply under the attention bestowed upon them. The hypochondriac sometimes does not venture upon a diagnosis, but is, nevertheless, firmly convinced that something is very seriously wrong somewhere. The symptoms which have so serious an import to him as a rule depend upon some functional disturbance.

In some cases sexual irregularities, by inducing in the mind of the patient a belief that he is becoming unmanned, cause a similar depression of spirits. In the same way as the hypochondriac, whose troubles are of gastric origin, his entire attention becomes concentrated upon the erring organ. The general condition is sometimes good and he looks in robust health, but frequently emaciation occurs, and his face wears an expression of anxiety and preoccupation.

Diagnosis.—The only difficulty arises in determining if any grounds exist for the doubts and anxieties of the patient, for it must not be forgotten that in some cases actual organic disease is present, underlying the morbid mental depression. Hence an examination of greater care than usual is demanded in place of the superficial one which is often given. An ordinary hypochondriac misinterprets what is presented to his senses, but is not insane unless he develops delusions of unworthiness, etc., or takes an altogether

unreasonable view of the case, as that his stomach is made of glass.

Prognosis.—This is never very hopeful, but is better in cases of recent origin, when there is no marked neurotic predisposition, and the general vital condition of the patient is good.

Ætiology.—The most persistent forms of the affection occur in those who have a marked family history of insanity. In others this may be absent, but some chronic derangement, probably of the stomach, has induced a condition of self-analysis which leads to the belief that the trouble is of serious organic origin. It is essentially a disease of adult life and middle age. Men are most frequently its victims, and it is probable that many of the slighter forms, occurring in women, would be called hysteria.

Treatment.—It is an important element that the physician gain the confidence of his patient by a careful review of his condition, and treat it as a real disease rather than as a product of the imagination. An endeavor should be made to relieve his self-concentration by recommending a course of travel, stimulating any interest he may before have felt in any particular hobby, and suggesting means, which will differ in each case, for his employment and the development of his sympathies and social instincts. Sea-bathing and exercise, especially horse exercise, short of that which causes actual weariness, should be also encouraged.

Derangements of the stomach, which are nearly always present, should be treated with appropriate drugs; flatulence, with creosote or sulpho-carbolate of soda; constipation, as far as possible, with a careful attention to diet, and failing this, with gentle aperients. Iron should be given in anæmia; cod-liver oil or other fats, even in cases in which there is no marked emaciation. The usual nervine tonics are not of much value.

WILLIAM GAY.

Symptomatic Indications.—When dependent upon derangement of the digestive tract the best remedy is *nux vomica*, particularly in persons of sedentary habits, with constipation. When traceable to torpor or irritation of the biliary secretions, flatulence, gloomy thoughts, *asafetida* will prove useful. In old persons, *arsenicum* is frequently useful, particularly when there are present burning pains. *Cimicifuga* is valuable in puerperal hypo-

chondria, and in that accompanying spermatorrhea, *aurum* does good service when a suicidal tendency is manifest.

HYPOTHERMIC TREATMENT.

The subcutaneous injection of a drug is the most speedy method of bringing a person under its influence. There are many reasons which at times render it undesirable or impossible to give a remedy by the mouth, but such contra-indications do not affect its administration hypodermically.

All the alkaloids may be thus used, as well as many other drugs; ergot is frequently used hypodermically to check hemorrhage. It should be remembered that drugs act more powerfully in this way, and a smaller dose must be used than would be given internally. Care should also be taken that the needle is sharp, and the syringe scrupulously clean. The operator should be careful not to puncture a vein. In timid persons the spot to be punctured may be frozen with a mixture of ice and salt, or brushed with a 10 per cent. solution of cocaine, ten minutes before the puncture is made, to obviate any pain.

Some care is necessary before commencing the use of morphine hypodermically in any case where pain is not obviously due to the presence of organic disease, especially in persons of nervous temperament, owing to the risk of inducing the "morphine habit."

HYPOTHOSSAL NERVE, DISEASES OF.—This is the motor nerve for the intrinsic muscles of the tongue, and also for all the extrinsic muscles, except the mylo-hyoid and digastric, but it does *not* supply the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles.

Two affections of the hypoglossal nerve are described—viz., paralysis and spasm. The former only is of importance.

Paralysis.—Like the facial, the hypoglossal nerve may be affected at its nucleus, outside the medulla, or in its course from the inside of the skull to the tongue. The movements of the tongue are also affected in lesions of the so-called motor cortex, and also of the motor fibers passing down from the cortex through the internal capsule and crus cerebri to the opposite hypoglossal nucleus (*see* HEMIPLEGIA). It may be remarked that, whereas in lesions of one nucleus or one

nerve, only the muscles of the corresponding half of the tongue are wasted and paralyzed, in the case of the cortex or internal capsule some of the muscles of both sides of the tongue are paralyzed for certain movements, but the muscles do not waste, and their electrical reactions are not altered, while, at the same time, there is usually some paralysis of the face and limbs of the same side.

Tumors in the substance of the medulla, or atrophy of the cells of the nucleus, as in bulbar paralysis (*q. v.*), will cause paralysis of the tongue. In the former case, the condition is associated with paralysis of the limbs of the opposite side; in the latter, the disease is usually bilateral, and is associated with atrophy and paralysis of the muscles of the lips, pharynx, and larynx.

Outside the medulla, the hypoglossal nerve is liable to be compressed by tumors, syphilitic growths, or meningeal exudations, and it is particularly associated with lesions of the accessory nerve to the vagus, producing paralysis of the tongue, soft palate, and vocal cord of the same side. Caries of the upper cervical vertebræ may produce paralysis of the hypoglossal. Between the exit from the skull and the tongue the nerve is liable to be compressed by tumors in the neck.

In *paralysis of one-half of the tongue* the muscular tissue atrophies, the mucous membrane is thrown into folds, and when protruded the tip goes toward the paralyzed side. When resting in the mouth the tongue cannot be put over toward the paralyzed side, and, if both sides be affected, it cannot be protruded beyond the teeth. In unilateral paralysis, speech and the power of swallowing are not much affected; but in *double paralysis*, pronunciation of the linguals and dentals is impossible, as this condition is most commonly associated with paralysis of the lips; all speech is lost, and, if the larynx be not involved, the patient can only phonate the vowels. Mastication and swallowing are also very difficult if the tongue cannot control the direction of the bolus of food. In bulbar paralysis, fibrillar tremors are observed. The electric reactions are altered when the nerve is involved, those of degeneration being obtained, while in bulbar paralysis, the muscles, as long as they exist, react to the faradic, but at the same time give the

reaction of degeneration with the constant current.

Diagnosis of the seat of the lesion can usually be made by a careful examination of the extent of the paralysis and its association with other muscles. Bulbar paralysis is almost invariably bilateral, or soon becomes so. A unilateral paralysis, not associated with loss of power in the opposite arm and leg, usually signifies a lesion (often syphilitic) situated outside the medulla, and this is the more likely if it be associated with paralysis of the soft palate and vocal cord of the same side.

Prognosis is always unfavorable.

Treatment should be antisyphilitic, on the chance of that disease being the cause of the paralysis. Tonics and local treatment with the constant current, the positive pole being applied to the back of the neck, and the tongue gently stimulated by drawing the negative pole along it, and the administration of tonics, are measures to which a trial may be given. The treatment of bilateral paralysis is most commonly the same as that for bulbar paralysis (*q. v.*).

C. E. BEEVOR.

HYSTERIA AND HYSTERO-EPILEPSY.—

Hysteria, says one of its most patient students, never has been, and never will be, accurately defined; but we may say this much: that it is a state of functional disease of the nervous system with an almost unbounded variety of abnormal physiological symptoms, and with a strong tendency to the imitation of other diseases, and, further, that along with this there is associated some mental abnormality which is never purely intellectual, but at least in large part emotional.

It has a physiological as well as a psychological side, but it has no pathology that is distinctive; *i. e.*, it is associated with no known and constant abnormality of tissue.

In about nineteen cases out of twenty the symptoms are found in women, and are rather more frequent in the decade between the ages of fifteen and twenty-five than in any other. The male cases, as a rule, are somewhat older. In a large minority of cases there is an inheritance of some nervous incapacity from the parents, not always of hysteria itself, but to a less extent of epilepsy, insanity, alcoholism, or of spasmodic neuroses, such as chorea, torticollis, and tic. All mem-

bers, indeed, of the neurotic group of diseases have some relations with the arthritic family, so that we are not surprised now and then to see as close a connection between rheumatism and hysteria as there is between rheumatism and insanity, and sometimes, between tuberculosis and hysteria.

Hysteria does not limit itself to one type of climate, or one family of races, though it is more at home among an educated people and a white-skinned race. The negresses have only had hysteria since emancipation. An excitable nature in exciting surroundings may reach a condition where a fit of hysterical convulsions may be determined by a trifling accident, emotional or physical; and a fright that is no more than a surprise, or a railway accident that is no more than the tremor of an express, may give rise to terrors that seem agonizing, or originate a hysterical hyperæsthesia that makes the skin too tender to be touched. If the results meet with sympathy, and the subject comes across others in whom similar symptoms have been more fully developed, some imitation is not likely to be avoided, and an epidemic may be started by neuromimesis which is practically baseless, but not fraudulent.

The mode of onset is commonly gradual. An impressionable, nervous child may grow up with constantly overwrought emotions—fits of crying, sobs, tremors, palpitations, headache, sickness, a fastidious appetite, and fancies that slowly declare themselves abnormal. In the adult, some discomfort of head or stomach may be gradually magnified till it becomes all-absorbing, and perverts a natural habit of life, though, possibly, in only one or two particulars. Much more rarely the first easily recognizable symptom is a fit of convulsions, which is the outburst of a slowly gathering tendency.

The most radical division of the bodily symptoms is into the paroxysmal symptoms and the non-paroxysmal and inter-paroxysmal.

(a) The *paroxysmal symptoms* do not decidedly present themselves in more than about half the cases where there is some clear evidence of hysteria. Their immediate origin may be in strong emotion or after long fatigue and strain; but if, as is so often the case, successive attacks have broken down the self-control, a trifle may be sufficient

cause, so that to anyone unacquainted with the previous history and tendency of the patient they may seem spontaneous. The patient will often describe the ordinary or minor paroxysm, in the subsequent days when she has recovered a more settled equilibrium, as beginning with a feeling that is essentially anomalous, like many of the forms of aura in epilepsy, something that alters the plane of consciousness, and is, perhaps, accompanied by a sense of constriction at the waist, or weight on the epigastrium, or pain starting from the hypogastric region, and blending itself quickly with the sensation of *globus*, rising like a ball in the throat, and causing an ever-increasing choking, which can only be relieved by screaming and sobbing, and universal convulsions more or less violent, that have some traces of purposive method, and no constant mode of progress.

These are generally attended by an incomplete unconsciousness and some regard to self-preservation, so that the patient, though perhaps tossing herself about violently and falling heavily without an obvious guard, yet by a subconscious wisdom avoids the fire, and does herself no very serious harm. Such a paroxysm ends gradually after the screaming has subdued itself into mutterings and moans, tears and sobs, or else, after a quiet time, as of syncope with an occasional sigh, by a slow return to complete consciousness, and a more or less incomplete memory.

There is a wide range of variety in such scenes, and the individual character and habits of the patient may make themselves felt in many ways. Many are very short and trivial. An impression of the internal predominance of a separate power of evil or good, which overpowers the actions and the will, is one of the more serious interpretations of this sudden loss of self-control, and may lead to the terror or horror of what has been widely known as "possession," with its attendant struggles and hallucinations of a morbidly active imagination. Or, if there be less discomfort and more self-confidence, it may result in a temporary exaltation, or even ecstasy, in which the limits of the possible or the material seem easy to overstep. Again, in the weak and anæmic subject the attack may have more of the character of a fainting fit, especially if there be some undercurrent

of secret emotion that leads to exhaustion. In some of the severer cases a comatose state may supervene, which has to a superficial observer the look of apparent death, but in which some tremor of the eyelids, and remaining sensibility of the conjunctiva and iris, as well as the persistence of the circulation, as shown by the results of deep puncture of the muscles, if not by the heart sounds or pulse, furnish sufficient grounds for a diagnosis.

Hystero-epilepsy.—There is a group of severe and elaborate cases which has become stereotyped, having an ideally complete course of prodromata, aura, and four periods of paroxysm—the epileptiform period, the period of contortion, that of emotional attitude and gesture, and that of delirium. To a long display comprising these or the greater part of these symptoms, the name of *hystero-epilepsy* or *hysteria major* has been given. This is of use as a short term for a complex whole, so long as it is remembered that it is not intended to connote epilepsy in hysterical dress, or epilepsy complicated with hysteria, but only hysteria with some imitation of epileptic symptoms.

The prodromata on the psychical side are marked, as in other hysterical cases, by neglect of the minor duties of life, foolish carelessness, excitable perversity, and perhaps some pleasure in grumbling; and on the physiological side there are likely to be some perversions of taste or sensation, some dyspeptic symptoms of nausea or tympanites, some polyuria or ptyalism, and some muscular tremor or paresis. In such a state there is frequently peculiar sensitiveness of some limited parts of the body, where a light touch may excite convulsions, and in some cases a deeper pressure control them. These “hysterogenic” spots are generally bilateral and symmetrical, and most commonly in the hypogastric, iliac, or submammary regions, but sometimes in the nerve trunks or elsewhere.

The first period of convulsion is the most epileptiform, of less abrupt onset and longer duration than true epilepsy, without the epileptic cry; beginning perhaps with grinding of the teeth, and going on to some tetanus, with cyanosis, marked opisthotonos and spasms of the arms in flexion, and legs in extension, repeated several times, and followed by a more clonic state of oscillating spasm

of arm, or leg, or body, which resolves itself gradually, after some foaming at the mouth, into a condition of relaxed muscle, and possibly stertor. If the complete course be pursued, after three or four minutes of the epileptiform state, a period of miscellaneous contortions follows in which there is probably some beginning of the return of consciousness, and this is succeeded by a series of displays of emotion and plastic poses, and that again by a confused delirium of recollections and illusions, which may last several hours or more, but gradually gives way to an inter-paroxysmal condition, in which the functions may be completely normal, or on which the paroxysm may have left some trace in the form of the acquisition or disappearance of a contraction, a paralysis, or a mental perversity.

The resemblance to epilepsy does not go on to the extent of producing a *status epilepticus* with a high temperature and dangerous to life, though, in a few rare cases, the epileptic symptoms occur of bitten tongue, and, after the convulsion, of pupils almost insensitive to light; and indeed there is nothing to forbid the possibility of epilepsy concurring in the same patient as hysteria. The term hystero-epilepsy was more loosely used in the last generation, and is still sometimes applied to cases in which the symptoms of a simple attack by themselves were inadequate to establish a diagnosis without further knowledge of the antecedents, consequences, and concomitant habits.

(b) *Non-paroxysmal symptoms.*—The symptoms which do not play a part in the paroxysmal attacks are of most Protean variety, and may pervert nearly every function of the body toward excess or defect.

(1) *Motion.*—The group which borders most closely on the paroxysmal is that which includes some involuntary movements.

The *globus hystericus*, which the subject feels as some sudden obstruction rising in the throat, is due to an upward wave of muscular contraction in the esophagus, and a spasm of the constrictor muscles of the larynx, and not unfrequently similar contraction may originate in the stomach, and produce sickness on very trifling or imperceptible irritation, and the impulse of regurgitation may

spread so far down the bowels as to cause vomiting of most unusual matters, possibly even enemata, so as to satisfy the morbid desire of the patient for what may seem unprecedented. In a few cases in which the vomiting immediately follows swallowing, it has been well proved that the esophageal muscles have thrown up the food before it has reached the stomach. Again, there may be many local troubles: the voice may be wholly lost, or more frequently there may be obstinate refusal to raise it above a whisper, or an imitation of the cries of animals may be resolutely adopted instead of human speech. The frequent hiccough, or *asthma uteri* of the ancients, the almost purposeless fits of laughing and crying, the irregular attacks of dyspnœa, the anxious feeling of labored cardiac palpitation, with some irregularities of rhythm, are some of the commoner symptoms which are often adopted as diagnostic, and so, too, is the hard, frequent cough that is a habit, and spasm without catarrh. There is, rarely, urethral spasm leading to some suppression of water, and still more rarely a curious type of chorea, with regular rhythmical spasms for long periods, sometimes flapping of the hands, sometimes bowing of the body.

Of the motor symptoms after the attacks are over, the *contractures* by tonic muscular spasm are not unfrequent, the apparent paralyses commoner and more inconvenient. The contractures generally affect one limb only, and are never accompanied by the organic hemiplegic affections of the facial muscles. There is most often flexion of the elbow or wrist, and extension of the knee or ankle, and many varieties of posture may supervene. The position and pain of disease of the hip-joint may be very closely copied without any fraudulent intent, and examination under an anæsthetic may be often necessary before a satisfactory diagnosis can be made. Pain in such joints rarely prevents sleep, but recurs on waking, and spreads over a wide area, and one less intimately connected with the nerves of the joint than organic disease. The relaxation of the abdominal aorta, with the in-gathering of some of the muscles round it, may produce symptoms somewhat like those of a true abdominal aneurism. But it is very variable, generally abnormally tender to manipulation of

the surface even, and may be best investigated under an anæsthetic.

The condition of hysterical *muscular paralysis* is one that, in varying degrees, is very often seen, and one whose exact limits it is sometimes impossible to define. Its onset may be spontaneous, or it may follow a fit or emotional crisis; as a rule, it is accompanied by anæsthesia, without alteration of the electrical reactions of the muscles, and affecting the limbs from joint to joint rather than over the more elaborate distribution consequent on the initial injury of a nerve center or nerve trunk. There is often aphonia, a condition common for a moment in normal vivid emotion, which may be indefinitely prolonged either absolutely, or as a whisper, for many months possibly. Its rapid onset and rapid cure, combined with the free motion of the vocal cords under the laryngoscope, are its best diagnostics.

(2) *Sensation*.—In sensation there is almost always some change from the normal, either, increase, decrease, or perversion. The partial anæsthesia of the skin is one of the most frequent symptoms, though it may not be noticed by the patient, and may be so variously localized that it is difficult to find, especially if, as is sometimes the case, it be interspersed with hyperæsthetic patches. Its commonest distribution is over one limb or one side of the body. The want of sensitiveness to pain, to heat, to touch, to electrical changes, to contact (alpagesia), do not vary concomitantly. The anæsthesia often extends to the mucous membrane of the pharynx, nostrils, and vagina; less often to the conjunctiva, meatus auditorius, and membrana tympani. Hyperæsthesia of the breasts is common, of the genitalia occasional. In the extreme tenderness generally attributed to the ovaries, it is hard to say whether myalgia plays a part. A joint may be exceedingly sensitive, and at first sight resemble organic disease, but it is characterized by being as tender in the skin as in the deeper parts. Many of the miseries of neuralgia belong to this morbid class.

The *special senses* are also affected. There is sometimes amaurosis after sudden light, sometimes amblyopia; in the more advanced cases some achromatopsia. The experience hitherto has been that the discrimination of violet and green has been lost earliest, and that of

blue and red retained longest. There is often retraction of the field of vision, rarely central scotoma or hemiopia. The sense of taste is more often blunted or lost, of hearing made more acute. In such a condition there is occasionally hallucination, in some cases visual, in more auditory, of a more fanciful nature than the rarer hallucinations of normal mental and physical life. The most complete investigations that have been made at present show very little, if any, greater susceptibility to hypnotism in hysterical cases than in normal subjects of similar age, race, and education.

(3) *Circulation, Secretion.*—The instability of the vasomotor system is a noteworthy point, and leads not only to rapid blushing and pallor, but in a few rare cases to subcutaneous hemorrhage, hemoptysis, and hematemesis, for which no explanation by fraudulent action has been thought adequate, though there can be no doubt there has been persistent deception in many cases. The secretions, too, have been affected. The rapid secretion of almost colorless urine after a paroxysm is one of the most constant symptoms: the long continuance of almost complete suppression of urine is sometimes simulated, and is in rare cases genuine. Vomiting is a very frequent annoyance, and may proceed to such an extent as to become one of the most dangerous accidents, especially when complicated with obstinate constipation. Pyrexia and, occasionally, hyperpyrexia, occur for which no organic or fraudulent origin can be found, and which may the more reasonably be considered to depend possibly on a morbid, nervous condition in proportion as the evidence of hyperpyrexia, dependent on organic cerebral or spinal injury, gathers strength. General nutrition is, as a rule, good in hysteria, compared with the diseases which it simulates, and practiced observers have reported as much as ten days' abstinence from any nutrition without serious injury.

(c) *Psychology.*—The mental condition is one of the most variable and the most obscure of the constituents of hysteria. It is one of the essentials of the malady that the mind is not in all respects normal. There may be at first sight a condition of apparent equilibrium, stability, and good judgment which has some unconscious weak point in it, or which may

be deliberately assumed to cover some morbid deceit, conceived probably from an emotional cause. The desire to attract attention or to gain sympathy is one of the morbid habits of most far-reaching consequences, and may seek to attain its ends by making its victims show themselves martyrs not only in word, but in deed. They may scald themselves, blister themselves, wound themselves, under circumstances when such anæsthesia as they have does not cover the pain, but where the obvious injury may do something toward gaining pity and sympathy. The absolute abandonment of truthfulness in persons of previously high character is striking, and sometimes hard for the friend or lay critic to believe. It is a point of morbid psychology not to be judged by normal standards. In some of the paralytic and lethargic states it has been very truly said of the mental side of their inertia that it is not that they cannot or they will not, but that they cannot will.

(d) *Diagnosis.*—Amid such a mass of functional symptoms, in subjects avowedly imitative, it is not to be wondered at that some cases of confusion with organic disease occur, and the occasional concurrence of hysteria with other diseases makes its exact limits impossible to determine. In the diagnosis from epilepsy in a single attack there may be insufficient evidence; the most important is the absence of the initial sharp cry, the more gradual onset of the paroxysm, its connection with surrounding emotional conditions, the absence of the signs of complete unconsciousness in action, and the absence of the post-epileptic insensibility of the iris. Of positive signs of hysteria we are gaining more confidence in the abnormalities of sensation such as are found by practiced observers in as many as 93 per cent. of cases. The retraction of the visual field, the segmental or patchy anæsthesia, most amenable to test observations when affecting the larynx, are some of the more important points. Among the motor symptoms, a hemiplegia entirely without initial facial paralysis, a monoplegia without ascertainable local origin, a contracture coming on in sleep or in a few hours without antecedent paralysis, and the complete resolution of the contracture or disappearance of the paralysis under hypnotism or chloroform, is strongly confirmatory. At the same time, it is conceivable

that what has begun as functional may go on to be organic ; that a truly hysterical contracture may slowly turn into a sclerosis of the pyramidal tract. That the mental condition of hysteria should have no hard-and-fast line to distinguish it from insanity is in accordance with the boundaries of insanity on all sides, and for the hysterical patient to overstep the conventional line is not at all infrequent.

(e) *Prognosis*.—That anything truly hysterical will not be fatal is practically certain, but the length of duration of the symptoms and their severity depend in part on the individual constitution, and in no small part also on the firmness, tact, and patience with which they are treated.

(f) *Treatment*.—There is something to be done by prophylaxis in the children of neurotic parents ; the nutrition needs attention, and strengthening by an extra amount of fresh air and exercise ; the adverse possibilities of overwork must be avoided, and any chances of the difficulties of overattention, luxury, and unrestrained willfulness duly combated. When the malady has declared itself, the indications for treatment are more definite. If the patient be first seen in a paroxysm, and the disease be uncomplicated, there is perhaps a greater claim for neglect than for attention ; a middle course may be in some ways convenient, but is none the less inappropriate.

If the patient be freed from all restraint, and left alone in a bare room till the fit is over, she will present herself, after a time, naturally recovered, and the probability of the recurrence of such an attack is lessened. But such treatment, to be successful, must be firm, based on a good diagnosis, and well supported by the friends and attendants in taking no notice of the symptoms between the attacks, and affording the patient no sympathy. It is rare that such a treatment can be carried out in family surroundings, and methods of strict isolation have met with much success, especially when malnutrition was part of the malady, and could be met and overcome by massage and a strict regimen of plain but abundant diet. Hypnotism is beginning to claim some attention, for though by no means are all hysterics hypnotizable, yet in a fair proportion a hypnotic state can be induced in which posthypnotic suggestions of the giving up of hysterical fancies, and the real extension of self-control, will be received

and acted upon. If it be decided to give immediate attention to the attack, and treat it by active measures, a sudden and disagreeable shock by a strong electric discharge or bucketful of cold water may be effectual in stopping it, and sometimes violent pressure on the iliac region is found to have special efficacy, possibly as affecting the ovary. Chloroform and amyl nitrite are dangerous.

For the more chronic symptoms the administration of very offensive medicines, such as asafetida, castoreum, etc., has no solid foundation. A treatment by potassium bromide has little or no effect, and is very notably different to its action in epilepsy. Electricity and magnetism have no special virtue except as inducing passive exercise, which is useful in paralysis, and, if necessary, giving a sufficient shock, both mental and physical, to dissipate some paralyses or hallucinations. A careful and firm hand in keeping up a strict regimen and good digestion is very important ; and, while undue attention is avoided, some of the emotional causes may be discovered and rectified.

A. T. MYERS.

Symptomatic Indications.—*Ignatia* is nearly a specific in many forms of hysteria ; when attended with feeling of suffocation, sensation as of a ball rising to the throat, convulsive crying, etc., continued for a considerable period, it modifies the morbid impressionability. *Musk* is sometimes useful in arresting and shortening paroxysms, when there is headache, tendency to faintness, constriction of the chest. *Asafetida* in hysterical convulsive affections, with flatulence and cough, is valuable. It often arrests the paroxysms and removes peculiar sensations in the head, and flatulence. *Cimicifuga* in hysterical chorea, or in hysteria of uterine origin, is rapidly curative. *Nux vomica* is of special value in middle-aged subjects, with constipation, flatulence, flushings, etc. *Gelsemium*, when the disease appears about the time of climateric.

ICHTHYOSIS (Fish-skin disease).—

A congenital condition in which the skin is dry, rough, scaly, and covered with thick plates or wart-like growths.

I. *Ichthyosis simplex* is the commoner form of the disease, to the milder cases of which the term "xeroderma" has been applied. In such cases the skin is merely dirty-looking, dry, harsh, with constant

furfuraceous desquamation and exaggeration of its natural lines and furrows. In severer cases large, thin, pearly, angular squames or thick plates are formed, which are separated by deep fissures or rifts corresponding in direction to the natural lines of the part; they are usually of a dirty gray color, but may acquire a deep brown or greenish tint from decomposition of sebum and the accumulation of dirt upon them. The plates are adherent at the center, detached at the circumference, and can usually be separated from the subjacent skin without causing bleeding. The appearance caused by these conditions somewhat resembles that of the skin of a fish or reptile.

Ichthyosis generally attains its maximum of intensity over the tips of the elbows and knees, above the ankles, and over the backs of the thighs and shoulders; it is seldom well marked on the scalp and face, and least of all in the flexures of the elbows, axillæ, knees, and groins. The palms and soles are generally moderately affected, but in exceptional cases they may be the only parts attacked (*see* CORN and CALLOSITY). The hair is scanty, lusterless, and dry, the nails brittle, the lobes of the ears sometimes badly developed. In many cases there is heaping up of sebum and epithelium round the orifices of the hair follicles, especially upon the extensor surfaces of the arms and legs, producing a condition identical with keratosis pilaris in appearance; in many mild cases this often constitutes the most prominent feature (*I. follicularis*).

Sweating only occurs from the less ichthyotic portions of skin; it may be especially abundant in summer. The sweating softens and removes the scales, and affords great gratification to the patient; but winter always brings about an aggravation of the condition. Beyond slight itching, subjective symptoms are seldom complained of; but the skin being very vulnerable, troublesome dermatitis is of very frequent occurrence, especially upon exposed parts (*e. g.*, the face), and may mask the true nature of the disease.

Pathology.—Ichthyosis is a deformity rather than a disease, the pathological changes consisting in abnormal thickness of the horny layer of the epidermis, and enlargement of the rete mucosum and papillæ, the vessels of which are dilated. The sebaceous glands are deficient in

number and poorly developed, but the sweat glands are normal.

Ætiology.—It is sometimes hereditary, and frequently affects several members of the same family. Although probably always present at birth, it does not generally attract attention before the second or third year of life, as frequent washing is temporarily beneficial; at puberty the disease may either diminish or become intensified to a marked degree. The condition known as "Harlequin fetus" exemplifies the most exaggerated form; it begins during intra-uterine life, and its subjects are always born prematurely, and have no external ears, eyelids, or lips. One case has been known to live nine days.

Ichthyosis has disappeared completely after the exanthemata; it must be differentiated from psoriasis universalis, eczema, dermatitis exfoliativa, and seborrhea tabescentium.

Treatment, if diligently followed, is usually of signal, albeit temporary service. Frequent frictions with soft soap, followed by warm alkaline or bran baths remove the scales. The subsequent inunction of vaselin, oils or greases, glycerin or glycerin of starch, or a five per cent. naphthol ointment tend to keep the skin smooth and supple. Internal remedies are of little or no use, but jaborandi or pilocarpine might receive further trial.

II. Ichthyosis hystrix (*Hystricismus*).—A much rarer disease than the preceding, and by no means closely allied to it, although the two have been said to coexist.

The lesions are warty-looking growths consisting of elongated and hypertrophied papillæ covered by greatly thickened, dark brown, horny epidermis, and forming flat-topped or pointed spinous projections. These are grouped together to form patches, often unilateral, and distributed along the course of cutaneous nerves like zoster—*i. e.*, transversely on the trunk, longitudinally on the limbs. They are seldom present on the face, and if bilateral are never symmetrical. When situated on exposed parts, as the hands—where they are common—the horny caps are liable to be pulled off; in these circumstances only are they the cause of pain or other subjective symptoms. They may be mistaken for warts or nævi.

Treatment.—In mild cases, in which the lesions are strictly localized, scales may be removed by repeated warm alka-

line baths with soft soap; or by soaking with a dilute solution of liquor potassæ. Concentrated solutions of salicylic acid in collodion or alcohol may then be painted on. Sometimes patches are best removed by scraping.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *arsenicum*, which should be perseveringly tried, this failing, resort may be had to *phosphorus* or *iodine*.

IDIOCY.—A defective development of the mental powers, dating from birth or early childhood. Imbecility is a minor degree of mental deficiency.

Symptoms are physical as well as mental. The most important are a general coarseness of the features and a lack of expression, thick and often everted lips, and a large, coarsely papulated tongue. The teeth are irregular, from delayed or abortive dentition and caries; the gums are swollen, and there is constant slaverling, often with an offensive smell. The palatal arch is high, and its development is asymmetrical; mastication is defective and often disgusting. The gait is waddling or staggering, and various paralyses and contractures of the limbs may be present. The powers of nutrition are imperfect, and the extremities cold and livid. One or more of the special senses may be absent or deficient. There is frequently strabismus. Mentally, the lowest class of idiots are organisms more helpless than the mindless plant, and in the best classes there is considerable weakness of the powers of attention, comparison, judgment, memory, foresight, and volition, and either complete absence, or only a slight development of the faculty of speech.

Idiots are prone to learn bad habits, and to become mischievous and destructive, and are subject to attacks of mania or melancholia. Epilepsy, which is one of the chief factors in the production of idiocy, may also develop in an idiot. Masturbation is a common symptom, and difficult to check. When paralyses are present, choreiform movements and double athetosis are common. Stammering is also a common feature.

Varieties.—(1) **Genetous.**—Includes cases in which, although the causation is indefinite, the condition dates from fetal life. Neurotic inheritance is the chief factor in the majority of such cases. The prog-

nosis is fair when the physique is good, when there is some power of attention and some power of speech is shown by the time the child reaches the age of six years.

(2) **Microcephalic.**—The chief point to be noticed is the smallness of the head. It is probable that a circumference less than eighteen inches implies idiocy. In these cases it is more likely that the skull ossifies over a brain which has ceased to develop than that the growth of the brain is arrested by premature ossification of the skull. Microcephalic idiots are active and full of life, and improve greatly under proper training.

(3) **Eclampsic.**—It is said that fourteen per cent. of cases of idiocy are due to infantile convulsions, but in the great majority of cases convulsions in infancy do not end in idiocy. Convulsions probably act as a predisposing cause to idiocy in a brain which is hereditarily weak, and are themselves a symptom of that weakness. Infantile convulsions are extremely common in the offspring of the insane. Idiots of this class do not admit of much improvement by training.

(4) **Epileptic.**—In the eclampsic variety the fits are the starting-point, but soon cease, while in the epileptic class the fits are both the starting-point of the disease and a prominent feature throughout life. Epilepsy in adults has a strong tendency to cause weakmindedness, and on the developing brain of early childhood its influence is most fatal. Epilepsy developing before the seventh year will cause idiocy, but epilepsy may develop at any period when idiocy is established. These cases, like adult epileptics, are most troublesome; they are irritable, impulsive, and pugnacious, but it is generally considered that the prognosis is as favorable as in other classes of idiocy, if not more so, and much may be done for them by proper training. The diet should include but little meat.

(5) **Hydrocephalic.**—May develop before or after birth. Generally it appears before the age of six months. It may terminate in weakmindedness, or have but little effect upon the mental powers. The head is globular, widest in the frontal region, and sometimes flattened in the occipital region. There is usually deficiency of one or more of the special senses, and the limbs are puny. The ætiology of the disease is indefinite, but tubercle, rickets, scrofula, and hydrocephalus seem

to flourish together in degenerating families. As regards prognosis, if the hydrocephalus be stationary and convulsions do not supervene, great improvement may be expected under proper training. Nourishing diet, cod-liver oil, and iron are the main indications in treatment.

(6) **Paralyses** may exist from birth without causing idiocy, but some arrest of mental development is the rule. One or more limbs cease to grow, and become atrophied and contracted. The paralyses are due to brain lesions caused by injury either before or after birth, or the result of inflammation, abnormal growths, or rarely hemorrhage. Some mental power may be developed, but the physical condition admits of little amelioration.

(7) **Cretinism**.—**ENDEMIC** and **SPORADIC** (*q. v.*)

(8) **Traumatic**.—Comprises cases in which the head has been injured during attempts at abortion or in delivery, or during early childhood. There may be distinct damage to the brain, or merely shock, and the degree of mental deficiency varies much, and bears little relation to the amount of apparent injury. Heredity unquestionably renders the brain more liable to suffer in this way.

(9) **Inflammatory**.—Belong usually to No. 8. A few cases are said to result from the inflammation of the internal ear, which is an occasional sequela of the specific fevers, but this is doubtful.

(10) **Idiocy of deprivation**.—As the development of mental power is dependent upon that of the senses which bring the organism into relation with its environment, the deprivation of two or more of these senses must cause mental deficiency. The early training of the existing senses is the only treatment, and the case of Laura Bridgman shows how much can be effected in this direction.

Ætiology.—There are two males to one female idiot, and this is attributed with some reason to the larger size of the male head at birth. The premature closure of the fontanelles, and the small size of the frontal bone, must be regarded as the effect rather than the cause of the cessation of brain development. In this, as in all forms of insanity, heredity is the great factor, fifty per cent. being due to this cause. The inheritance passes most readily to children of the same sex as the affected parent. With heredity must be

considered the other causes of the mental and physical degeneracy of families. Among which the most important is:

The influence of drink. Unquestionably most potent for evil, transmissible, and culminating in neurotic developments, but the statement that a drunken condition of the father at the moment of procreation will result in the idiocy of the offspring is improbable. Idiocy is common among the children of aged parents, and among families in which tubercle and scrofula are present. The consanguinity of parents and the existence of hereditary syphilis have but little influence in the causation of idiocy. In cretinism we have a general condition which has already been discussed, and finally some cases of idiocy are sporadic, and are considered as examples of reversion. Idiocy due to deprivation of the senses has been already described. The connection of chronic criminality and idiocy is probably intimate, but has not been proved.

Treatment.—In idiocy the defect of mind is always associated with a variety of defects of body which can be met by the ordinary resources of the physician. Abundance of good food, warm clothing, healthy surroundings, useful employment, varied amusements, and the attention and supervision of kindly and skilled attendants, are here, as in all varieties of insanity, the main indications in treatment.

Idiots should be treated in separate wards in asylums, or in institutions devoted to their care, and not, as is too often the case, associated with adults, much to the detriment of both. Among the most useful means of treatment, are classes for education in reading and arithmetic, sometimes drawing and music; for the patients of suitable physique, drilling, gymnastics, and outdoor games, the teaching of trades, such as mat or brush making, printing, or carpentry, at which occupations some idiots evince extraordinary mechanical skill. Dancing and theatricals will be appreciated by a large number of cases. But the physician must be contented with moderate improvements, for he is dealing with an organism whose potentialities are limited. The most important question will often be whether the patient should be kept at home after the age of five. For the sake of the other children, removal to a suitable institution is to be

advocated, and the case will benefit by the systematic training, and will not be discouraged by the constant comparison with normal childhood which is unavoidable in home treatment.

GEORGE REVINGTON.

ILLUSIONS.—Illusions are false perceptions of objects actually present to the senses, as distinguished from hallucinations where there is no external stimulation of the senses. The distinction is somewhat artificial, as no place is so still or so dark but that some stimulation of the senses takes place, and so far as this is true, all hallucinations are illusions. Illusions become evidence of insanity when they cannot be corrected by the reason.

IMPETIGO (contagiosa ; Porrigo).—An acute, inflammatory, contagious pustular disease most frequently met with in children.

The term includes two clinically separable pustular disorders, the one belonging to the eczema group and characterized by abundant pustulation without infective characters; the other a specific contagious disorder. It is more accurate to limit the term to the latter disease.

Impetigo is characterized typically by the rapid outbreak of vesicles which quickly become pustules. The pustules are large, flat, occasionally umbilicated, and surrounded by a narrow, deep red areola; they contain sero-purulent infective fluid which, on being conveyed, by the hands or otherwise, to other parts of the body or to other persons, reproduces the eruption. The pustules soon rupture, their fluid contents dry up to form dirty, thick, yellow scabs and crusts; by the coalescence and fusion of individual pustules extensive scabby areas are formed. The neighboring lymphatic glands become enlarged and tender, but seldom suppurate. There is little or no pain, and no itching, unless the condition be secondary to other itching diseases (especially pediculosis and scabies), as is very frequently the case. In the course of two or three weeks the crusts fall off spontaneously, leaving a red, glazed base which rapidly heals without scarring, but considerable pigmentation may persist for some weeks.

The disease is very common on the

scalp, face, hands, feet, and genitalia of children, especially among the dirty and ill-fed children of the poor. It frequently affects several members of the same family, and becomes, in a certain sense, epidemic among school-children. The dermatitis provoked by pediculosis and scabies, by scratching in prurigo and urticaria, or even in simple eczematous eruptions, is liable to become impetiginous, the transition being marked clinically by the development of infective properties in the pus. Impetigo often follows vaccination, the pus which has developed infective properties being inoculated elsewhere by scratching.

Treatment is usually rapidly successful, but relapses are common unless the child be isolated. Crusts and scabs ought to be removed by poultices, or rags soaked in olive oil, and ammoniated mercury ointment applied to the exposed surface, diluted if there be very extensive excoriation or active inflammation. Pediculi must be exterminated, and scabies treated as elsewhere described. Cod-liver oil and iron are often beneficial.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy is *arsenicum*; black pustules, filled with black blood and fetid pus, better from warmth. *Nitric acid*, in pustular eruption on the face, with large red margin and heavy scabs, frequently benefits. *Antimonium tart.* is useful in impetigo erysipelatodes; *antimonium crudum* in chronic form; worse from bathing, with digestive derangement. *Viola tricolor* is effective in recent cases, particularly of the face, in adults. *Conium* is useful in impetigo, sero-purulent eruption, in aged people. *Iris vers.* in impetigo capitis, with gastric complaints.

IMPETIGO CONTAGIOSA.—See PORRIGO.

IMPOTENCE.—An incapacity for sexual intercourse. The difference between this definition and that of sterility should be noted. Impotence occurs in women as well as men.

Causes.—1. Original malformation of copulatory organs; marked epispadias or hypospadias, absence or occlusion of vagina, and double vagina. 2. Accidental deformity of copulatory organs; amputation of whole penis; occlusion or

obliteration of vagina by cicatricial contraction. 3. Organic affections of the less superficial genito-urinary organs; spermatorrhœa; varicocele; castration. 4. Nervous influences. The condition called "irritability with weakness" usually depends on both third and fourth class of causes. When impotence is not the effect of visible malformation, it almost always is the result of masturbation, very rarely of sexual excess. Masturbation usually leads, in the first place, to "irritability with weakness." Here ejaculation takes place before entrance is effected, or else erection is impossible, and, consequently, copulation impossible. This condition is not always the result of masturbation. Disgust for the female, or the fear of sin or of contagious disorders doubtless causes it in some cases.

Signs and prognosis.—Some have just been given. Sometimes the genitals are flabby, cold, and small. If, in such cases, erections never occur, not even in bed in the morning, the prognosis is not very good. But so long as erections occur at all, the prognosis is very hopeful.

Treatment.—1. Strengthen general health; fresh air, sleep, moderation in all things, in exercise, in diet, and in mental work; 2, avoid all unnatural excitement of genital organs; 3, treat any physical defect which can be found. If there is the slightest sign of varicocele or relaxation of scrotum, give patient a suspensory bandage; 4, to complete the cure—at all events, to demonstrate the cure to the patient—requires the moderate and regular practice of sexual intercourse for a short time. Of course, it is right that this should be done in the marriage state. Paget writes: "Some will expect you to prescribe fornication. I would just as soon prescribe theft or lying, or anything else that God had forbidden. Celibacy does no harm to mind or body; its discipline is excellent; marriage can be safely waited for." If the patient is already married, attend to the first three indications, give some mysterious and harmless medicine, and forbid intercourse for three weeks. The nonchalance that he thus acquires during sexual excitement, and inattention to the strength and duration of the erections, render cohabitation possible, and he has the first successful coitus during the time it was forbidden. Lallemand's porte caustique is a solution of argent. nit. (gr. v. to $\frac{3}{4}$ j)

to be applied to prostatic part of urethra every other day. This is a treatment now unjustly neglected. Faradization of inner surface of thigh, of testicles, and lower part of spine is valuable. Constant current to spine. The positive pole over fifth dorsal vertebra, and the negative over sacrum or perineum. Three or four sittings a week, one to three minutes each. Battery, 20 to 30 Daniel's elements of medium size.

C. B. KEETLEY.

Symptomatic Indications.—The most efficient remedy is *phosphorus*, particularly when the result of seminal weakness. *Phosphoric acid* is valuable when the condition results from excessive sexual indulgence; sudden relaxation of penis during coition, debility. *Aurum* is serviceable when discharge of prostatic fluid occurs from relaxed penis, melancholy, with suicidal tendency. *Cantharis* is useful for nocturnal emissions, relaxed organs, consequences of onanisms, pain in spermatic cord. *Agnus castus* in simple impotence, in young persons, has cured. *Conium* in impotence of old persons, atrophy of testicles.

Page's Tonic Tablets (Williams, Stiger & Co.) which contain $\frac{1}{350}$ grain of phosphorus, are excellent for this condition.

INCUBATION is the development of a disease, and the period of incubation is the time which elapses between the exposure to the poison and the first symptoms of the disease. It is sometimes spoken of as the latent period. It varies greatly in the several infectious disorders, and its probable duration will be found under the different diseases.

INFANT FEEDING.—See MARASMUS.

INFANTILE PARALYSIS (Acute Anterior Poliomyelitis; Acute Atrophic Paralysis; Essential Paralysis).—Paralysis of one or more limbs or of groups of muscles coming on suddenly, and followed by rapid wasting of the paralyzed muscles, with abolition of their reaction to the faradic current. The affection is almost peculiar to childhood.

Symptoms.—Some cases begin with appalling suddenness; the child, if old enough to walk, falls down while crossing the room, and cannot get up. It is

then found that one or both legs are paralyzed. Sometimes the discovery is made in the early morning, nothing having occurred during the night to attract attention, or the child may have been restless and feverish. Sometimes it follows one of the exanthemata, or appears to be the consequence of an accident. In some it is preceded by a definite illness of one or more days' duration, in which no symptoms calculated to raise alarm are observed; and just as the child seems to be getting well it is found that one leg or one arm is not being used. In very young children convulsions are often present in this premonitory illness; and in cases where all the limbs have been paralyzed, the symptoms have sometimes resembled those of meningitis.

The paralysis is absolute and complete from the first; that is to say, it never spreads, though it is usual for it to become less marked in the course of a few days. The leg is more often affected than the arm, in the former the tibialis anticus and extensor group of muscles being most commonly picked out; in the latter, the deltoid, the quadriceps adductors, and glutæi are less often attacked, the hamstrings not infrequently escaping. Both legs are more often attacked than an arm and a leg, while it is decidedly rare to see both arms alone affected, but not very uncommon to find the paralysis attacking both legs and one arm. Even when it seems quite general at first, it rarely remains so. It is believed that the muscles of the scalp, eyeballs, ears, pharynx, larynx, and the sphincters of the rectum and bladder always escape, and the cranial nerves are hardly ever the seat of the disease. Sensibility is never impaired, but the superficial and deep reflexes are lost. Some degree of pain and tenderness, especially in the neighborhood of the joints of the paralyzed limb, is common, and may persist, even for a month, in a gradually diminishing degree, but, as a rule, no pain is complained of while the child is undisturbed.

Usually in the course of a couple of weeks it is seen that the muscles are not only very flabby, but also that they are wasting, and that the limb is distinctly thinner than the other. This atrophy proceeds rapidly, and if the paralyzed muscles be tested electrically, it will be

found that they do not react to the induced current, but act normally, or even excessively, to the constant current (the reaction of degeneration). This change is usually present as early as the end of the first week. The blood vessels of the affected part are contracted, and the limb is always colder than its fellow, and has a somewhat livid color, but no nutritive disturbances of the skin occur.

In long standing cases the whole nutrition of the limb will be found to have suffered, and it is smaller in all its dimensions, the arrest of the growth of the bone being sometimes quite out of proportion to the extent of the muscular paralysis. After a time contractions are very apt to occur from the influence of pressure or the weight of the body; of these, talipes equinovarus are the best examples.

There is a tendency to spontaneous recovery, but, it never proceeds very far. It is rare for a limb not to show some sign of improvement in the course of the first few weeks; it is still more rare for anything approaching complete recovery to take place spontaneously. All the fibers are not paralyzed in an affected muscle, and the chances of recovery depend on the possibility of developing the healthy fibers. In too many instances for mere coincidence, it has happened that when the patient has reached adult life, he has become the subject of progressive muscular atrophy, but the cause of this sequence is unknown.

Diagnosis.—Until the paralysis is declared it may be impossible even to surmise the nature of the affection. In the early stages, hip disease, the so-called congenital dislocation of the hip, and syphilitic epiphysitis of the head of the humerus or femur, are the affections which might give rise to similar symptoms. The obvious pain, heat, and swelling in the neighborhood of the joint would show the true nature of the malady, while in regard to congenital dislocation, the amount of wasting would have to be taken into consideration; if this were inconsiderable the probabilities would be in favor of the congenital affection. When rickets especially affects the muscular system, the condition of the legs may present some resemblance to infantile paralysis, but a very slight amount of care will suffice for the recognition of points of difference. If the paralysis be of hemiplegic form, it

is probably of cerebral origin, and this will be confirmed if it be found that the reflexes are present, that the wasting is only slight, and that there is a tendency to rigidity of the muscles. In all cases the reaction of the paralyzed muscles to the induced current should be ascertained, and it may be necessary to resort to the use of chloroform for this purpose.

Pathology.—Changes in the anterior cornua of the gray matter of the spinal cord are the cause of the paralysis and muscular wasting. The ultimate result is shrinking and degeneration of the multipolar cells, with gradual disappearance of their processes, and often of the remains of the cell. The neuroglia also, in the immediate neighborhood, shows an increase of fibrous tissue; wasting, and sometimes fatty degeneration of the nerve tubes is found in the anterior roots. To the naked eye the only change will be a slight paleness, or a dull pink color of the gray matter, and in long-standing cases, of the entire cornu, or possibly the half of the cord will be wasted. These changes are found in the lumbar or cervical enlargement according as the legs or arms are affected. In some cases, fatal at an early period, the damaged area of the cord has been found soft and vascular, pointing to the presence of inflammatory action, but whether the inflammation begins in the motor cells or in the neuroglia has not yet been determined. In others, the appearances have suggested that a small hemorrhage has occurred, a mode of onset that would fit in well with the symptoms sometimes observed. The muscles at first appear simply wasted, they then lose their striation, and finally undergo degeneration. In long-standing cases, atrophy of the paracentral lobule in the opposite cerebral hemisphere has been found.

Ætiology.—The disease may occur at any age, but is most common between the sixth and eighteenth month. Boys and girls seem equally liable. It occurs much more frequently during the summer, perhaps because less care is taken to protect children from the effects of a chill, but little is known about the exciting causes. The disease has sometimes followed an injury, and occasionally has come on during convalescence from one of the exanthemata. Robust children, equally with the weakly, are liable to be attacked, nor does inherited neurotic tendency seem to predispose especially to the

affection. The disease is not more common among the children of the poor than those of the wealthy.

Treatment.—During the acute stage—*i. e.*, for the first week or so after the paralysis is discovered—the child should be kept quiet; and some recommend that it should not be allowed to lie on its back, with a view to diminish any tendency to congestion of the cord. A succession of blisters applied to the spine near the seat of the disease is a form of treatment which has proved to be most efficient. If there be no fever, ordinary diet may be allowed, and internally the liquid extract of ergot in 3-minim doses, tincture of belladonna or liquor strichninæ in 1 or 2-minim doses, or 1-grain doses of iodide of potassium, may be given to an infant twelve months old. At the end of a month no further improvement can be looked for on these lines, and cod-liver oil and iron should be used instead. After the first week the child should be taken out every day, if the weather permit, and as soon as the limb can be freely handled without pain, which will often not be until after the lapse of three or four weeks, systematic massage and the use of electricity should be commenced. By these means we may hope to develop the muscular fibers of which the nervous centers are not destroyed, but are merely inactive from disuse, and to maintain the circulation in the paralyzed muscles. From the first the greatest care must be taken to keep the limb warm. It is never too late to commence this treatment, though of course the earlier it is begun the better the prospect, but even when two or more years have been allowed to elapse, persistent treatment has been successful. A case should not be given up as hopeless until after at least a year of systematic treatment. Every effort should be made to overcome deformities by manipulation, and by the use of instruments; if these measures fail, the aid of the surgeon should be sought.

JOHN ABERCROMBIE.

Hot air baths of a temperature of 250° to 300° F. combined with the hæmo-spastic treatment and arseniate of strychnine, rhus toxicodendron, or belladonna give good results. See VACUUM and HOT AIR TREATMENTS, p. 1558.

INFLAMMATION.—The “succession of changes which occurs in a living

tissue when it is injured; provided that the injury is not of such degree as at once to destroy its structure and vitality.”—*Burdon Sanderson*. Lately, some authorities consider the succession of changes as “the method by which an organism attempts to render inert noxious elements introduced from without or arising within.” Inflammation has always been considered the most important phenomenon in disease. Medical terminology indicates how closely inflammation is associated with nearly all morbid processes, and a correct understanding of the pathology of inflammation is the foundation of all medical and surgical knowledge and the key to the scientific treatment of disease.

The four cardinal symptoms—*calor*, *dolor*, *tumor*, *rubor*—were enunciated by Celsus; to these may be added *functio læsa*. Galen explained the redness by an increased flow of blood to the part, and the swelling he attributed to exudation. The honor of establishing the modern theory of inflammation is due to Cohnheim, who, by a careful series of microscopical observations, elucidated the succession of changes which occur in an inflamed tissue. He used the mesentery, the web of the foot, and the tongue of the frog. For convenience’ sake, the microscopical changes which occur in an inflamed tissue may be considered separately under three main headings, but it must be clearly understood that they occur conjointly, even from the very onset of inflammation.

I. Vascular changes.—All tissues are extra-vascular, the abundance of the blood supply depending upon their functional activity, consequently tissues having a purely mechanical function are supplied with few vessels or derive their nutriment from vessels which are not situated in the tissue itself, but in the immediate neighborhood. These so-called non-vascular structures are the cornea, cartilage, and elastic tissue; they are, however, capable of undergoing inflammation, and the vascular changes can be observed in the circumjacent vessels.

If the mesentery of a brainless, curarized frog, be examined under the microscope, the process of inflammation can be readily studied. After 15 to 20 minutes’ simple exposure to the air induces inflammation, manifested first by *dilatation of the arteries*, then of the veins, and lastly

and to a much less degree, of the capillaries. With the general vascular dilatation occurs also an acceleration of the blood stream, the so-called afflux or determination of blood to an injured part. The acceleration does not last long, and is followed by a very marked slowing or *retardation* of the circulation. The vessels remain dilated, and numbers of capillaries which previously were not seen, now become visible, the small arterioles exhibit *pulsation*, and each individual corpuscle in the smaller vessels can be distinctly recognized.

At the commencement of the observation, it is noticed that the blood in the vessels exhibits a central axial stream containing the corpuscles and a periaxial stream of plasma. It has been proved that when fluids containing particles of different specific weights be forced through tubes, if the rate of flow on the one hand be sufficiently rapid, the solid particles will form an axial stream, and the fluid, the periaxial stream; if the rapidity of flow be diminished, the lighter particles will be thrown out into the periaxial stream. This seems to explain the change which occurs in the periaxial stream of the vessels; for as the circulation gets slower in the inflamed mesentery, so the white corpuscles, which are specifically lighter than the red, are seen collecting in increasing numbers in the periaxial stream of the smaller veins, forming a continuous layer one or two rows deep, like an epithelial lining.

After a time the flow has become so slow in the capillaries that only an occasional *oscillation* is seen synchronous with the pulse, eventually culminating in *capillary stasis*; finally, coagulation of the blood in the vessels leads to thrombosis, although, even after stasis has occurred, the blood may remain fluid for several days.

II. Exudation of fluid and escape of blood corpuscles.—The leucocytes, which in proportion to the slowing of the circulation have been accumulating in the periaxial stream of the veins, commence to *migrate*. The process is termed *diapedesis*.

A white corpuscle, if watched, will be noticed to bulge out the vessel wall laterally; after a short time it will have made its way through the wall, and it will now hang like a little pear-shaped mass with its stalk attached to the vessel wall;

eventually this is sundered and the corpuscle is free to wander in the tissues. Great numbers of white corpuscles escape in this way, usually many more than the red, but the latter escape in great abundance if the injury be severe. Leucocytes migrate from the capillaries as well as the veins.

An escape of fluid from the vessels is always taking place, even in health; but in inflammation not merely is the transudation increased in quantity, but it is changed in quality, it is richer in albumin and capable of coagulation. In fact after a short time a *false membrane* can be removed from the surface of the mesentery.

III. Tissue changes.—Depend upon 1, the direct effects of injury; 2, the pressure exerted upon the tissue elements by the exudation products; 3, disturbance of the circulation and nutrition.

The tissues of an inflamed part are softer, owing to the structural element being separated by the fluid exudation, and the lymph spaces are crowded with leucocytes, and perhaps red corpuscles. The ultimate degree of destruction of tissue elements mostly depends upon the degree of re-establishment of the circulation in an inflamed area. Regenerative processes may occur in the neighboring cells of an inflamed area, by which the tissue may be repaired. This is a process of cell multiplication, but Sinfleben has shown that it occurs independently of inflammation. Moreover, tissue repair by cell multiplication on the one hand, and intensity of inflammation on the other, proceed in an inverse ratio.

Cardinal signs of inflammation.—(1) *Rubor (Redness)*.—This depends upon the increased afflux or determination of blood to the injured part. Frequently, owing to dilatation, numbers of vessels hitherto unseen become visible; this is termed *injection*. If the vessels are not recognizable, as in inflammation of the skin, the redness is *diffuse*. The redness is usually of a dark tint, tending even to purple; this is owing to the blood being contained more in the veins, and also to the slowing of the blood stream, by which the corpuscles contain less oxyhemoglobin.

The redness depends also upon two other conditions, viz., capillary stasis and the escape of red corpuscles. Either of these conditions produces redness, which will not disappear on pressure. Hemor-

rhages frequently give it a *punctiform* appearance. Much transudation will diminish the degree of redness, therefore the sign “*rubor*” is often most marked in the earlier stages of inflammation.

(2) *Tumor (Swelling)*.—This is caused by two factors, *vascular turgescence* and *exudation*, the latter being much the more important.

There is a great increase of exudation from the vessels in inflammation, and this leads to an increase of the lymph stream. Swelling of the part occurs if the ratio of absorption by the lymph channels be not proportional to the increased exudation, and the degree of swelling depends upon the relation of these two factors. This exudation is not due to resistance to the flow of blood through the vessels as in venous obstruction, because we know that actually a larger flow of blood through the veins occurs in an inflamed part. Neither is it due to increased pressure in the vessels, but it is owing to *damage of the vessel wall*, which is the essential lesion of inflammation. In proportion to the injury the vessel wall loses its power of resistance to the passage of fluid and corpuscles. Alteration of the filter not only allows of quantitative changes in the filtrate, but also a very important qualitative change.

Inflammatory lymph has a higher specific gravity, contains more albumin, and more white corpuscles; it has, consequently, a greater tendency to coagulation than the exudation from venous obstruction. This proves that the vessel leaks in a different manner in the two cases. In severe forms of inflammation, especially when occurring in very vascular structures—*e. g.*, the lungs, the kidneys, and the heart—there may be an extensive escape of red corpuscles, giving rise to *hemorrhagic exudation*.

The extent and form of swelling which may occur in an inflamed part greatly depend upon the anatomical structure. The exudation occurs primarily into the connective tissues surrounding the vessels, and if absorption does not take place, it will accumulate in the inflamed area, and will naturally travel along the lines of least resistance. In pneumonia it accumulates in the air sacs. Inflammation of serous membranes and joints is attended with exudation into the serous cavities. Inflammation of the vagina, nose, respiratory tract, alimentary canal, bladder, and

kidneys, may be attended by little or no swelling, owing to the free exit which the inflammatory exudation products find from the body. We therefore see that although swelling has for its origin but one cause, yet in the mode of its appearance it is one of the most variable of signs.

(3) *Dolor (Pain)*.—The degree and intensity of the pain depend upon *the abundance of the sensory nerves* in the affected part, the *capability of distention* of the organ or tissue, by the exudation, and, lastly, upon the *amount of exudation*.

In organs which contain but few sensory nerves, *e. g.*, the kidneys, severe inflammation may occur without much pain. In periostitis, owing to the difficulty the exudation has in accommodating itself, the pressure upon the sensory nerves is great and the pain intense. The character of the pain varies considerably; often it is throbbing. This depends upon the increased pressure on the sensory nerves produced by the pulse wave in the affected part. When the part is dependent, an increase of the affluent blood is favored by gravity, and the effluent stream is retarded, conditions which favor exudation and thus account for the increased pain. Pain must, however, be considered conservative, for it tends to curative measures, such as rest, etc. Inflammation of structures in which the sensory nerves have lost their function, or have been destroyed, are usually attended with disastrous results.

There is a general belief in the existence of trophic nerves, and physiologists teach that there are two sets of nerves presiding over the nutrition of tissues, *viz.*, katabolic and anabolic, the former controlling destructive metabolism, the latter constructive. Injury to the fifth nerve leads to sloughing of the cornea; herpes zoster follows neuritis, and bed-sores occur after injury of the brain or spinal cord; rarefying osteitis may follow injury of nerve roots.

(4) *Calor (Heat)*.—An inflamed part feels hot to the patient, but, the temperature is never really above that of the rectum, or of the blood generally. If there were actually more heat produced in an inflamed part, its temperature would not be raised on this account, because the heat would be distributed over the whole mass of blood in the body.

The burning feeling may be explained by the fine degree of appreciation for

slight variations of temperature in the blood circulating in the skin of the inflamed part possessed by the sensory nerves, when contrasted with the sensations from the surrounding healthy structures.

Functio Læsa.—Impairment or loss of function of an inflamed part may be added to the four cardinal symptoms.

Glands may be unable to secrete, muscles to contract, nerves to conduct, and other structures to perform their functions, or to perform them in a normal manner. This may be temporary or permanent according to the severity of the inflammation and the nature of the tissues. The highly differentiated tissues of the central nervous system are incapable of regeneration.

Varieties of Inflammation.—The essential lesion of inflammation is damage to the vessel walls. The extent of injury will determine both the amount and characters of the exudation and the number of corpuscles, both red and white, which will escape.

The varieties may be said to depend upon three factors: (1) *The nature and intensity of action of the noxious agent*. (2) *The duration of its action*. (3) *The anatomical structure of the inflamed tissue*.

The following varieties depend upon the nature of the exudation products:

(1) *Serous*.—The injury is slight; as a result, the exudation, although it contains more albumin than a passive transudation, nevertheless, owing to its not containing many leucocytes, does not coagulate, or, at any rate, only flakes of fibrin are formed. The best examples are afforded by chronic effusions into serous cavities—*e. g.*, the pleura and joints. When it infiltrates the substance of a solid organ or structure, it gives rise to *inflammatory œdema*. In impoverished conditions of the blood, even if the inflammation be comparatively severe, the exudation may be serous in character.

When a *mucous membrane* is mildly inflamed, the exudation escapes from the surface, and such a condition is termed *serous catarrh*.

(2) *Sero-Fibrinous*.—This condition arises when the injury, although more severe than the above, is less so than the following form. The exudation is fluid but contains a very considerable quantity of fibrinous flakes.

(3) *Fibrinous or Croupous*.—Typical

examples are afforded by the serous membranes—pleura, peritoneum, pericardium—and mucous membranes. The exudation contains large numbers of white corpuscles, and the fluid is rich in fibrinogen, consequently it tends to form fibrinous layers on the surface of the inflamed membranes. The meshwork of fibrin incloses numbers of leucocytes, and this constitutes “lymph.” An adjacent serous surface may get coated with similar lymph, and the two united form an *adhesion*. This, by organization, may become transformed into connective tissue which, later, will contract.

The red corpuscles are usually few in number, because they remain around the vessels from which they have escaped; but in croupous pneumonia, owing to the proximity of the alveoli to the inflamed vessels, the exudation contains large numbers of red corpuscles. Croupous membranes may be formed upon inflamed mucous surfaces. They consist of an interlacing meshwork of fibrin inclosing leucocytes, or pus corpuscles, *e. g.*, plastic bronchitis and laryngitis.

(4) *Purulent or Fibrino-Purulent*.—In nearly all cases the inflammation is infective, micro-organisms being present. The exudation consists of a liquid plasma containing *pus corpuscles*. When a cavity is formed by the destruction and dissolution of the inflamed tissues, the cavity being occupied by pus, an *abscess* results. If the tissue destruction be superficial, and the part in which there is a solution of continuity of tissues secrete pus, we have an *ulcer*. A fibrino-purulent exudation is a condition in which the pus contains flakes of fibrin.

Pus is a thick creamy opaque yellow, or whitish-yellow fluid, of specific gravity 1030–1033, and alkaline reaction; it is slightly viscid and possesses a faint odor. It does not coagulate spontaneously, although containing a very considerable quantity of albumin. That pus, which is a derivative of the blood, should remain fluid, can be best explained by assuming that the micrococci and staphylococci found in pus have a peptonizing action upon the plasma.

Pus contains 10–15 per cent. of solid matter, of which two-thirds are albumin and the remainder salts and fatty matters. If pus be allowed to stand it separates into a yellow layer of pus corpuscles and a supernatant liquid, liquor purus.

Pus corpuscles are leucocytes which have undergone a process of degeneration. As a rule they have no power of amœboid movement, but are spherical masses of granular protoplasm, containing a nucleus, often showing indications of division into two or three nuclei. By the addition of acetic acid the nucleus is rendered more evident, the surrounding cell substance clearing up.

(5) *Hemorrhagic Exudation*.—When the exudation contains a sufficient number of red blood corpuscles to be apparent to the naked eye, the indication is either that there is a loss of vital resistance in the vessels, due to some constitutional disease or defect, *e. g.*, diabetes, hydræmia, etc., or a very intense action of the noxious agent which has led to the inflammatory process and the consequent damage to the vessel walls.

(6) *Putrid or Gangrenous*.—When the exudation undergoes putrefaction from the action of bacteria, the inflammation is very severe and the tissue destruction great. The color of the diseased part may be gray, greenish, or purplish-black, due to chemical changes. Gases may collect in the tissues, or escape, giving rise to foul odors.

(7) *Diphtheritic Exudation*. See DIPHTHERIA.

Any tissue in the body, with the exception of a few epidermoid structures, may be the seat of an inflammation.

Varieties of inflammation according to Anatomical Structure of the Tissues.—*Superficial*.—An inflammation of a free surface such as the mucous membranes, serous membranes, or the skin, is termed superficial. In the former the exudation either escapes from the body, collects in a space or cavity, or undergoes deposition on the inflamed surface.

Parenchymatous.—This term is applied to an inflammation of solid organs, such as the lung, kidney, or liver. The exuded liquid collects in the lymph spaces of the tissues and gives rise to an *infiltration*.

The process may be acute or chronic; as a rule the inflammation is intense, and the essential elements of the organ exhibit morbid changes from the onset of the process, thus differing from the next variety.

Interstitial.—This form of inflammation is much more frequently a chronic process, although it may occasionally be acute. The changes are limited to the

fibrous tissue framework of the organ, and the essential elements do not suffer until later on in the disease.

It is usually a question of degree rather than of difference in the process, and the distinction applies especially to certain organs, where the fibrous framework is well differentiated from the essential cell elements, *e. g.*, the liver, lungs, and kidneys.

The results of inflammation are: (1) Resolution. (2) Suppuration with discharge or caseation. (3) Regeneration. (4) Formation of granulation tissue (5) Cicatrization.

(1) *Resolution*.—If the inflammation be not severe, and the injurious agent does not continue in operation, the damaged vessel wall recovers, the circulation is renewed, and the exudation products are absorbed by the lymphatics.

(2) *Suppuration*.—If the injury to the vessel be severe, and pus have formed, giving rise either to an abscess or a purulent exudation, one of two events may happen: the pus may be discharged, leaving the abscess cavity to be filled up by tissue regeneration, or the pus may undergo changes which eventually lead to the formation of a cheesy mass (*caseation*), and later this may become *cretaeous*. Generally speaking, such a substance acts as a foreign body, and gives rise to productive inflammation in the adjacent tissues by which means it becomes encapsuled.

(3) *Regeneration*.—Repair is effected by the multiplication of the surrounding healthy tissue elements. Epithelium produces new cells by division, muscle forms fresh fibers, and periosteum new bone. The ganglia of the central nervous system cannot, however, undergo regeneration after destruction, probably on account of differentiation of function of these master tissue elements.

Ætiology.—The causes of inflammation may be considered under two main headings: (1) *Intrinsic or predisposing* and (2) *extrinsic or exciting*. The former is a variable factor in every tissue or organ and in every individual. It is an unknown factor in every human being, depending upon the family antecedents and the past life of the individual, and is perhaps more important to the physician than the extrinsic or exciting cause.

As a rule the exciting agent is only a part of the cause, *e. g.*, the morbid inflam-

matory conditions which arise in gout. The cause has been in operation for years, and it is generally only when it is far advanced and gives rise to pain that the physician is consulted.

Idiopathic inflammations are more and more regarded with suspicion as to their existence; pericarditis and pleurisy are often said to be idiopathic in origin. Cold and exposure to wet, such as by immersion, undoubtedly do produce inflammation of serous membranes; more frequently, however, it is the individual whose tissues have a predisposition to inflammatory affections of these structures, owing to a rheumatic or some other taint.

Peritonitis again is often said to arise idiopathically; most of these cases, however, are secondary to inflammation elsewhere. Females infected with gonorrhea may die of peritonitis by extension of the infective inflammation along the fallopian tubes: such cases may be misunderstood and termed idiopathic.

The *exciting causes* of inflammation are:

(1) *Physical*.—Heat, burns, scalds, exposure to the sun, cold, exposure to damp, immersion. The latter are among the most common exciting causes of inflammation of the viscera and serous membranes.

(2) *Mechanical*.—Direct injury, contusions, wounds, fractures. The following are, however, some of the more important causes with which the physician has to deal: improperly masticated food and indigestible food may set up gastritis; the inhalation of irritant particles into the lungs will produce pulmonary fibrosis, a disease common among miners, millers, and knife-grinders.

It may be due to parasites affecting the skin (*acarus*), the muscles (*trichina*) and the viscera (*hydatids*). Frequently in such cases the inflammation may be sanative, the parasite becoming encapsuled by the inflammatory product. Again, strain, combined with defective nutrition, plays a most important part in cardio-muscular inflammation and subsequent degeneration.

(3) *Chemical*.—Two classes: local, as the bite of an insect, owing to the irritation produced by formic acid; or, the application of irritating or corrosive fluids to delicate structures. The most important chemical excitants of inflamma-

tion are those which, owing either to defective elimination of waste products from the system, or to the circulation in the blood of poisons such as alcohol and lead, give rise to chronic inflammatory changes around the small vessels, and subsequently to the production of fibrous tissue and atrophy of the essential elements of the organ. The effect produced by the poison is particularly marked in those organs where the irritant is most concentrated—*e. g.*, cirrhosis of the liver in chronic alcoholism, and cirrhosis of the kidney in retention of imperfectly oxidized nitrogenous waste matters.

Many poisons, when taken into the system, tend to produce local inflammation—mercury causes stomatitis; cantharides, nephritis; potassium iodide affects the mucous membranes. These effects may be explained by the elimination of considerable quantities of the drug by these structures.

The above causes all tend to produce simple inflammation, that is to say, if the cause be removed, the inflammation will subside, or not progressively increase.

(4) *Infective causes which depend upon the action of living organisms.*—Most authorities believe that true creamy pus can only be formed when micro-organisms are present, and no one doubts that in most cases suppurative inflammation is the direct result of the action of micro-organisms, particularly micrococci, which by their peptonizing action prevent the formation of fibrin. A simple inflammation may become suppurative owing to infection—*e. g.*, simple endocarditis becomes ulcerative and may give rise to a condition like pyæmia; this has been proved to be due to the presence of micrococci in the vegetations.

There are two main groups of factors in the production of an infective inflammation; they are the *nature and the number of germs* introduced and *the soil*.

The mode of production of inflammation by germs varies considerably. They may produce a local inflammation, which may or may not become general, or they may from the outset produce a general inflammatory process, but usually they then attack some particular structures more especially.

The micro-organisms may be specific or non-specific; the former are especially prone to attack certain tissues in prefer-

ence to others—*e. g.*, the bacilli of anthrax attack the spleen; those of lepra, the skin; and the bacillus of tubercle affects particularly the lymphatics of internal organs.

The inflammation which is excited by micro-organisms is probably due to the fact that they multiply wherever they find a suitable nidus, and act as foreign bodies, setting up local inflammatory processes. These foci, owing to the dissemination of the germs by the blood and lymph streams, may be innumerable, as in general tuberculosis. During their growth and multiplication various chemical products originate, and these play a very important part, as we have already seen, in the formation of pus.

The soil is of almost as much importance as the number and nature of the germs. In general non-specific inflammations are much more likely to be suppurative if the vital resistance of the tissues of the body has been lowered, as, for example, by alcoholism, chronic Bright's disease, diabetes, and malnutrition. Moreover, it has been shown that animals suffering from inflammation artificially produced, when fed upon putrid meat, become affected with an infective suppurative inflammation. Again, the influence of soil is strikingly shown in the hereditary tendency of certain races and individuals to particular specific inflammations.

Latterly it has been shown that the white corpuscles of the blood are the essential agents in the destruction of micro-organisms. Direct observations prove this; moreover, we know that in suppurative inflammation, and in tuberculosis, the white corpuscles are greatly increased in number.

It is concluded that the white corpuscles migrate from the vessels in inflammation, for the purpose of removing the living or dead matter, which is either the cause or the result of the inflammatory process.

In the case of simple inflammation the white corpuscles have merely to remove the products of tissue-death and disintegration. In the case of a local infective inflammation they have to engage in a death struggle with the micro-organisms. If the leucocytes be victorious, the local suppurative inflammation terminates in an abscess, which may discharge its contents or dry up and become encapsuled.

On the other hand, should the leucocytes be unequal to cope with the micro-organisms, on account of their own inherent low vitality, or on account of the number and virulent potentiality of the germs, then the infective process will become general.

F. W. MOTT.

Symptomatic Indications.—The principal remedy in all acute inflammations is *aconite*. It is always indicated in the early stage of simple inflammatory fevers, in all inflammations of serous membranes, pneumonia, tonsilitis, acute rheumatism, erysipelas, croup, pleurisy, etc. *Belladonna* is useful in many forms of inflammations, especially when attended with bright redness of the affected part, stinging, burning pains, intense congestions, especially of the brain, eye, ear, testicle, throat, skin, bladder, uterus, stomach, kidneys, etc. *Gelsemium* is useful in congestive stages in cerebro-spinal meningitis, acute bronchitis, pneumonia, dysentery, urethritis, erysipelas, with slight fever, oppressed symptoms, dull pains in head, back, and limbs. *Veratrum viride*, in acute inflammations with uncompressibility of pulse, especially useful in congestion and inflammation of the brain, and organs controlled by the par vagum. *Arnica*, in inflammations resulting from mechanical injury, does good service. *Bryonia*, in pleurisy and inflammations of serous membranes, is an efficient remedy after subsidence; rheumatism, pericarditis, peritonitis of acute symptoms, also in bronchitis, etc. *Antimonium tart.* is a useful remedy in catarrhal inflammations of mucous membranes, lungs, and skin. Valuable in catarrh, croup, bronchitis, pneumonia, variola. *Pulsatilla*, in sub-acute inflammation with muco-purulent discharges, does good service; it is especially useful in inflammations of eyes, ears, veins, synovial membranes, sexual organs, and digestive tract. *Mercurius* is valuable in inflammation of the mouth, acute glandular inflammation of the throat and neck, in ileo-collitis, iritis, syphilitic inflammations of serous membranes, laryngitis, tonsilitis, diphtheria, bronchitis, dysentery, etc., checks suppuration when impending, and heals ulceration when extending. *Iodine* in inflammation of joints, glands, goiter, inflammatory croup, laryngitis, chronic bronchitis, and pneumonia is often useful. *Calcium chloride* will often check impending suppura-

tion, promoting a speedy termination. *Sulphur* is useful in chronic inflammations, especially of the skin, eyes, rectum, also in bronchitis of chronic type, pleurisy, and pneumonia.

INFLUENZA (La Grippe).—A specific epidemic disease, sometimes marked by catarrh of the naso-pharyngeal and pulmonary mucous membrane.

Symptoms.—The onset of illness is always sudden, and is marked by chilliness or actual shivering. From an early period there is marked prostration, the patient feels faint and giddy, he is sometimes drowsy, and may fall suddenly down. Sneezing, followed by a watery discharge from the nostrils, may be an early symptom; the eyes are red and watery; the fauces are also red. The fever is high at first, and the skin dry, but, in a mild case, it soon becomes moist; the pulse is rapid and small. Cough, either hard and dry or with a little secretion, is usually present; with this there may be some rhonchus and sibilus. There is complete anorexia and nausea, and loss of taste. Severe headache and a pain in the eyes are almost always present. Severe pains, especially in the back, chest, and limbs, may constitute the most prominent features, all catarrhal symptoms being absent. The urine is scanty and high-colored. The above is a description of a mild attack, such as usually lasts from three to five days.

The case may be more severe owing to an exaggeration of any of the symptoms, and any imprudence during convalescence may be followed by a relapse in which, instead of simple bronchial catarrh, there may be capillary bronchitis or broncho-pneumonia. Gastric symptoms may predominate, and there may be constant sickness, and perhaps jaundice, with diarrhea and blood-stained motions.

As a rule, recovery is complete; but in those who are predisposed to that affection an attack may be the starting-point of pulmonary tuberculosis. The aged and the very young often succumb to the lung complications, but in the case of an adult in good health an attack rarely gives occasion for alarm. One attack affords no protection against subsequent infection.

Ætiology.—It presents one of the most typical examples of an epidemic disease, and its spread is at times so rapid that in

a very short period a large proportion of the inhabitants of a town or district may become affected. In the great pandemics of 1833 and 1837, many countries were smitten by the disease as if at one blow. In the first two months of the year 1833 the disease is said to have spread all over Russia; in March it appeared in Poland, Bohemia, Northern Germany, Egypt, and Syria; in April it began to prevail in Austria, Hungary, France, Great Britain, and Ireland; Tyrol and Italy suffered in May, the Netherlands in June. More than one-quarter of the whole population of London suffered during the epidemic of 1847-48. In Paris at that period the proportion is said to have been nearly one-half. Russia has been the starting-point of the disease in all the great pandemics, and in 1889 an epidemic, originating in St. Petersburg, spread to nearly all parts of Europe, and to America and elsewhere.

During the epidemic prevalence of the disease in any country, a similar affection has been observed among animals, cats, dogs, cows, and especially horses, having been its chief victims.

There is no periodicity about the epidemics, and they occur quite independently of season, climate, or soil. A thick black fog has occasionally been observed to precede an outbreak of the disease. An epidemic may travel with the wind or against it; at times the rate of spread of the disease is very rapid, at others very slow. Epidemics rapidly attain their height and quickly subside. Insanitary surroundings probably favor an outbreak of the disease. Although direct contact is not essential, the disease is, to a certain extent, contagious. It does not appear sporadically. It is presumably due to some living organism transmitted by the air and capable of reproducing itself very rapidly in the air. The organism is stated to be present in the expectoration from all the cases of the disease. The incubation period may be exceedingly short, or may last two or three weeks.

The disease occurs more readily in adults than in children, and is particularly fatal in old age.

Treatment.—The patient should be kept in bed or in a warm room until convalescence is complete. Lowering treatment is not well borne; antipyrin, quinine, or salicin may be given in the febrile stage, with an occasional saline purge. Lung complications should be treated

upon general principles. Great care in avoiding exposure to cold is essential at all stages of the disease.

JOHN ABERCROMBIE.

Symptomatic Indications.—In the early stage *aconite* is the principal remedy, particularly with chilliness, weariness, and soreness, or when febrile symptoms are marked. *Gelsemium* is useful when chill up the back, remittent febrile symptoms. *Eupatorium* may be required when the soreness, bone pains, is a marked feature or there is intense bronchial irritation. *Arsenicum* is valuable when there is severe fluent coryza, headache, pain in the limbs, and great prostration. *Antimonium tart.*, for bronchial complications. *Bryonia* is useful when symptoms of pleurisy or pneumonia appear, and for severe frontal headache. *Arsenicum iod.*, when discharges are very irritating.

INHALATION.—It has been proved that not only gases, but liquids and solids, can be made to enter the lungs by the process of inhalation, provided not of an irritant nature. In the case of solids and fluids it is essential that they should be in a state of extremely fine division. Various remedial agents can thus be brought directly into contact with the mucous surfaces of the upper and lower air passages, and are capable of absorption into the general circulation. They may, therefore, have a local action upon the respiratory tract and a general action upon other organs. The influence of heat and cold may also be brought to bear directly upon the lungs by similar means.

Solids are rarely, if ever, employed by inhalation in lung affections, but are frequently used in the treatment of pharyngeal and laryngeal diseases. They are, however, much more effectively applied by insufflation through a straight or curved tube of glass or vulcanite, by which means they can be directed with accuracy upon the exact spot where they are required, without being distributed indiscriminately to all surrounding parts.

Liquids can only be inhaled when broken up into very fine spray. They can be employed at any temperature, and may be found useful as a means of applying the influence of cold. Spray producers of two forms may be used for inhalation, the simple hand-ball spray producer and the steam apparatus.

The steam spray is best adapted for

inhalation when it is desired to affect the larynx and bronchi; and to diffuse the medicament evenly over the mucous membrane.

The hand-ball spray producers are most useful in affections of the mouth, fauces, posterior nares, or nostrils, where a local more than a general effect is desired. The spray may be directed through suitably curved tubes. The liquids to be atomized by the hand sprays should be kept at a temperature of about 160°, as much heat is lost in the process of spraying.

In inhaling spray the lips must be widely separated, the tongue depressed, and deep inspirations taken. The patient should be able to obtain a view of the whole of his pharynx before a mirror, and, until he can do this, inhalation of spray should not be attempted.

In using the steam spray inhalers it is advisable to collect the spray in a glass tube of about one inch in diameter and four inches in length. The end of this tube should be taken between the teeth, and the lips closed over it. The steam may then be freely inhaled without the annoyance of its diffusion over the rest of the face. Unless deep inspirations be taken, there is but little chance of the inhaled medicaments reaching the lower air-passages.

The position in which the patient sits is also of importance. The body should be fairly upright and the head slightly raised, so as to render the angle formed by the mouth and the trachea as obtuse as possible. Inhalation should always be practiced in a room of equable temperature, and the patient should not leave the room for at least a quarter of an hour after the inhalation is concluded.

It is important that inhalation of medicated spray should not be practiced for a long time without pauses for the respiration of fresh air. Four or five respirations in succession are quite enough, and a pause should then follow of equal length. Inclusive of these pauses, each sitting should not be prolonged for more than a quarter of an hour. These observations may be taken to apply with equal force to the inhalation of medicated steam.

Gases and Vapors may be employed for inhalation either at the normal atmospheric pressure, or under increased or diminished pressure, and at any desired

temperature. The simplest forms of inhaler for vapors at the ordinary atmospheric temperature are respirators, fitted with a small space in front capable of holding a piece of lint or of sponge on which the required drug can be poured. Volatile oils, ethers, and spirits can best be inhaled in this way, but the inhalation must be long continued and the apparatus so contrived as to cover both the mouth and the nostrils, and fitted with valves permitting the expired air to pass out of the inhaler without again coming into contact with the sponge.

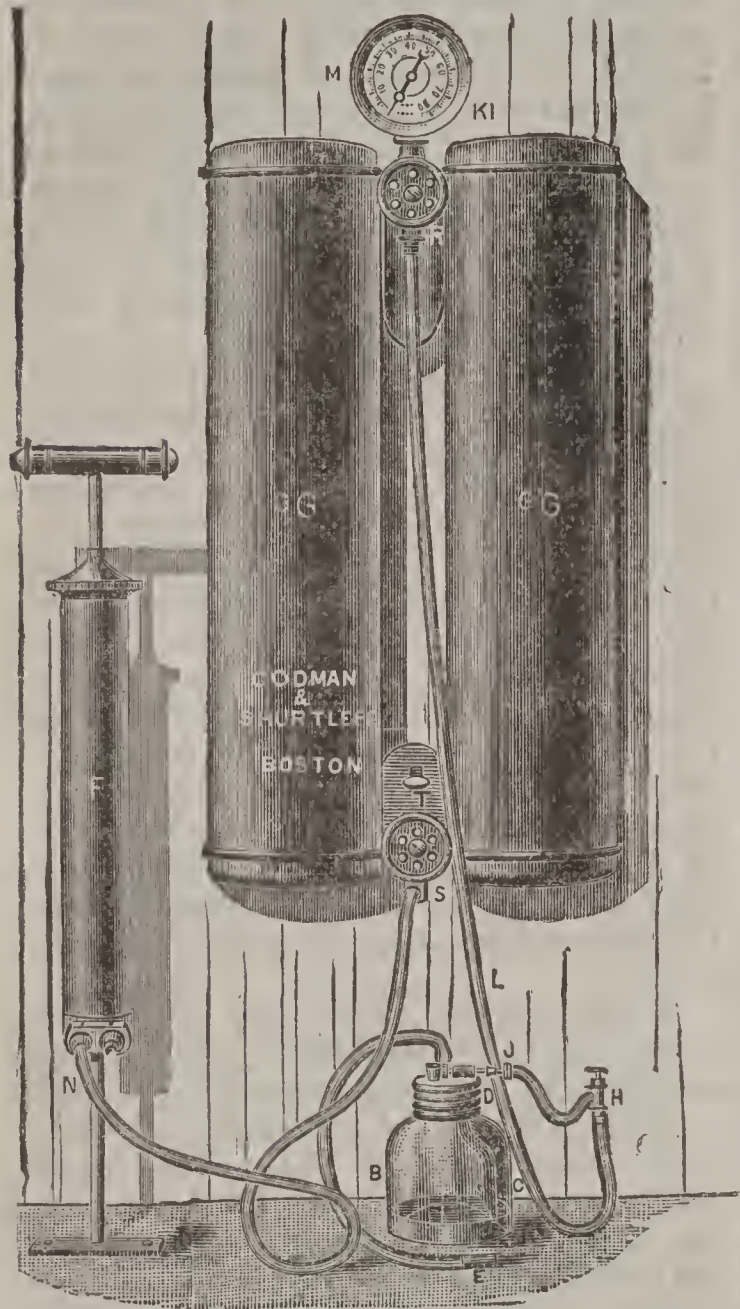
Steam, either medicated or plain, may be inhaled by means of an inhaler, in which the water is heated in a small spherical boiler, the steam escaping through a tiny pin-hole in the upper side. Two ounces of water are placed in the boiler, a few drops of the medicament to be inhaled are then added, the top screwed firmly down, and the spirit-lamp placed underneath; steam will soon issue from the pin-hole with considerable force, and may be inhaled, with the precautions already indicated, through a glass tube of one-inch caliber. The metal tube generally supplied with this inhaler is apt to become too hot to be used with comfort.

A very simple inhaler for medicated steam can be constructed by placing the medicament in a medium-sized jug and pouring over it about half a pint of water at a temperature of 180°. The medicated steam arising out of the jug can be drawn into the mouth and nostrils very effectively by simply preventing its escape at the sides of the jug with the hands or by a folded towel. Care must be taken, however, that not more than three inhalations are made in succession without a pause for the inhalation of fresh air.

These methods of inhalation are especially adapted where volatile oils have to be employed, a definite quantity of the oil being previously shaken up in a dram of water containing $2\frac{1}{2}$ grains of light carbonate of magnesium.

In all forms of vapor inhalers where tubes are used it is important that they should be of wide caliber and that the nose should be closed, otherwise the inhalation may be reduced to a mere sucking process which will not carry the vapor beyond the mouth. Medicated cigars or cigarettes are sometimes used,

with good effect in certain forms of spasmodic dyspnœa, but it is probable that their effect is due to direct absorption by the mucous membrane and not to any



local action. In many instances the same drug given by the mouth has been shown to have an equally powerful effect.

Chambers have been devised to insure the complete inhalation of medicated air, and consist of small rooms or cabinets into which medicated vapor can be introduced, either as a spray or by suspension of cloths kept wet with the required solution, which is allowed to evaporate freely and is constantly renewed, or by an arrangement of fans blowing air through the medicated fluid directly into the chamber. By all these methods the air is not only medicated, but also moistened. The volatile oils, such as eucalyptol and creosote or carbolic acid, can all be employed in this

way, and have been found effective in many cases of chronic bronchitis and phthisis with much bronchial secretion. The want of fresh air in the inhalation chambers is apt to become more apparent to the patient than the presence of the medicated air, and feelings of suffocation, headache, and nausea are sometimes complained of. To facilitate their entrance into the deeper parts of the lung, vapors are sometimes delivered under pressure, by means of inhalers constructed on the principle of the accordion, which can be compressed to any required degree.

Drugs best suited for administration by inhalation: Local astringents for application to the pharynx and larynx may be applied in the form of spray. Such are tannic acid (grs. x- $\frac{3}{4}$ j), chloride of zinc (grs. ij.- $\frac{3}{4}$ j), lactic acid (m. xx- $\frac{3}{4}$ j). Cocaine as a local anæsthetic may be used in spray of a strength of six per cent., or even stronger in severe cases.

Stimulant or sedative vapors are best used by means of oro-nasal inhalers or in the simple arrangement lately introduced, in which the volatile substance to be inhaled is dropped into a tube, a part of which is packed with coarse pine wood sawdust. This absorbs the fluid, and permits of its slow evaporation, as the patient inhales through the other end of the tube, which is shaped for the purpose. The vapor of chloride of ammonium has been much employed of late years, but chiefly for affections of the posterior nares and eustachian tubes.

Inhalers are now contrived by which the same act of suction draws the vapor of sal ammoniac and hydrochloric acid from separate bottles, to meet together in a common receptacle from which the mouthpiece opens. The mixed gas is drawn through water contained in this receptacle, and is capable of further medication by adding any volatile substance to the water.

The volatile oils suitable for use in the moist vapor or steam inhalers, are pinol (m. iij- $\frac{3}{4}$ j), creosote (m. j- $\frac{3}{4}$ j), carbolic acid (20 grains to the pint), compound tincture of benzoin (1 dram to a pint), conium (succus conii, 2 drams to a pint). Iodoform, iodine, or eucalyptol may be employed in small quantities in the simple respirator inhalers, a few drops of the following preparations being used for each inhalation: \mathcal{R} Ol. eucalypti, 3 ijss; chloroformi, m. xxxvj; sp. rect., 3 ijss;

iodoform, grs. xv. \mathcal{R} . Iodi, grs. viijss; ætheris, \mathfrak{z} ss; ac. carbol., \mathfrak{z} ss; creosotei, \mathfrak{z} ijss; sp. rect., \mathfrak{z} ij. \mathcal{R} Ol. eucalypti, alcohol ethylic. aa part æq.

In using the foregoing in the steam-draught inhaler, remember that the more volatile the remedy the more essential it is that it be used directly the steam begins to come off freely. Such substances are apt to be volatilized early, and hence the steam delivered during the first few minutes is of most importance.

E. CLIFFORD BEALE.

The nebulization, or reduction of liquids to a vapor, may be also readily effected by means of compressed air, a method which possesses the advantage over nebulization by steam that the inhalation may be given at any desired temperature; the inhalation of cold or iced liquids at times proving very beneficial. A very convenient form of air-compressing apparatus, consisting of air-pump, air-reservoir, gauge, cut-off, and filter (Codman & Shurtleff, Boston, Mass.), may be utilized for giving inhalations of compressed or rarefied air, (see PHTHISIS) as well as for the nebulization of liquids.

The Geyser Vaporizer and Inhaler (E. C. Chapman, Brooklyn, N. Y.), used



with compressed air, is a very serviceable instrument, the liquid being vaporized, without change in quality or temperature, and is inhaled and deposited upon the mucous membrane in the same state as before vaporization.

The following formula will be found valuable in connection with the diseases mentioned.

For profuse purulent expectoration :
 \mathcal{R} Cryst. Carbolic Acid..... \mathfrak{z} iss to \mathfrak{z} iii
 Borax..... \mathfrak{z} ii
 Glycerine..... \mathfrak{z} iv
 With distilled water q. s. to make \mathfrak{z} iv.
 Filter.

Catarrhal pneumonia, or where there is cough with scanty expectoration :

\mathcal{R} Saturated solution Boracic Acid..... \mathfrak{z} iv
 Glycerine.... \mathfrak{z} vi
 Mix.

Phthisis :

\mathcal{R} Sol logol. } aa..... \mathfrak{z} i
 Glycerinæ }
 Acid. carbol..... \mathfrak{z} iii
 S. \mathfrak{z} i of this mixture added to \mathfrak{z} i of water. M.

\mathcal{R} Ditto with the addition of m x-xx of Gardner's Pine-needle Extract after adding the \mathfrak{z} i of water.

\mathcal{R} Same as No. 3, with the addition of muriate of ammonium grs. x-xx to every \mathfrak{z} i of water.

\mathcal{R} Carbolic acid } aa..... \mathfrak{z} i
 Oleum eucalyptus }
 Oleum sassafras..... \mathfrak{z} ij
 Petroleol q. s. ad..... O
 Tinct. benzoin comp..... q. s

\mathcal{R} Fl. ex. hydrastis can. } aa..... \mathfrak{z} ij
 Glycerine }
 Aqua .. \mathfrak{z} iv
 Filter.

\mathcal{R} Fl. ex. hydrastis can..... \mathfrak{z} ij
 Sat. sol. chloride of sodium..... \mathfrak{z} vi
 Filter.

Bronchitis :

\mathcal{R} Aquæ camphoræ..... \mathfrak{z} iv
 Glycerinæ .. \mathfrak{z} i
 Acid carbolici crystal..... \mathfrak{z} ss
 M.
 Shake before using.

Chronic Bronchitis :

\mathcal{R} Terebene \mathfrak{z} i
 Alcohol..... \mathfrak{z} i
 M.
 \mathcal{R} Lig. iodi comp..... m xxx
 Glycerine..... f \mathfrak{z} i
 Aquæ ad to f \mathfrak{z} iv
 M.

Putrid Bronchitis :

\mathcal{R} Co. tr. benzoin.. \mathfrak{z} ss to \mathfrak{z} i
 Glycerinæ..... \mathfrak{z} ss
 Alcohol..... \mathfrak{z} iss
 M.

Nasal Catarrh :

Dobell's Solution.

\mathcal{R} Acid carbolici..... grs. xv
 Sodii bicarb. } aa..... \mathfrak{z} ss
 Sodii biborat. }
 Glycerinæ..... \mathfrak{z} i
 Aquæ..... ad \mathfrak{z} iv
 M.

INOCULATION is the introduction into the body of a morbid germ or poison by direct application to the subcutaneous or submucous tissues. It may be accidental or intentional. The *materies morbi* may be introduced by being applied to an abraded surface or by subcutaneous injection. Some diseases are only communicable by inoculation; such are vaccinia and acquired syphilis.

INSANITY.—This term comprises the various symptoms of disorder in the functions of that part of the nervous organization of man which is concerned

in the production of the phenomena to which we give the name of "mind." Insanity may be due to defective development, to acquired disease, or to the natural decay which is the fate of all organic structures.

Every medical man must be prepared to deal with insanity in its clinical, social, and legal aspects. The legislature, recognizing that insanity is a disease, has enacted that certificates of insanity shall be given solely by medical men. Moreover, it has recognized that it snaps the continuity of conscious existence, and creates for the time what for practical purposes must be considered a new individual, and for the care of this exceptional individualism, the product of disordered brain action, it has passed special laws and overridden the most sacred rights of citizenship.

Symptoms.—The first indication of insanity is a change in the character of the individual. Feelings of dullness, sadness, apathy, indifference, perplexity, or confusion, or on the other hand a sense of buoyancy, unwonted activity, or recklessness may be observed. Such conditions are common to all human beings, but in the case of the patient on the verge of insanity, they come on without due cause, and are totally foreign to his real nature. Thus, the cheerful and energetic may become moody and listless, and the placid restless and hilarious.

The actions soon correspond to the frame of mind, business is neglected or rashly executed, the personal habits alter and the appetite becomes capricious, there is loss of sleep, and often a feeling of ill-health or of impending trouble.

This is the premonitory stage, and if rest and change of scene be provided, the attack may pass off, but generally advances to well-established mental unsoundness. In the latter case we may find that from the feelings above mentioned definite delusions have crystallized. For example, the patient may imagine that he has committed theft or murder, or that the venial sins of his youth are rising against him. He may imagine he is ruined, that his children are destined to be injured, or that his wife has turned against him or been unfaithful, or a thousand other ideas may dominate him.

The occurrence of hallucinations will render further progress toward an active form of melancholia easy and rapid.

Visions may terrify him at night, and voices insinuate the facts of which he is most afraid. The anxiety about the bodily health may deepen to hypochondriasis, or the victim may fly to drink or seek distraction in objectless travel. The patient becomes violent and unmanageable, refuses his food, or threatens murder or suicide.

This is a gradually deepening melancholia, but the case may pursue a different course. After a melancholic prelude of short duration, symptoms of excitement may supervene, and the further progress of the case is the same as if the first symptoms had been unnatural gaiety and activity. The patient indulges in all sorts of extravagances, spends money freely, takes to drink, becomes perhaps erotic and indecent, and occupies himself with fresh amusements or frivolous pursuits, and becomes quite indifferent to family and business affairs, or propounds the most absurd ideas upon these subjects. Definite delusions of wealth and grandeur, or of suspicion, mysterious agency, and persecution may be developed. Many other symptoms will be described elsewhere, but the above will give a sufficient idea for the present of the two chief forms of insanity, melancholia and mania, of which there are many varieties.

The only other type which need be considered is dementia or weak-mindedness, which is a factor in all cases of insanity, and is the chief feature in some alcoholic cases, in most cases of general paralysis, and in all cases of senile and organic brain disease. Dementia (*q. v.*) is a weakening of the powers of memory, volition, judgment, reasoning, and of the association of ideas; it has been well called "the goal of all the insanities." A variety of dementia, namely stupor, is a chief feature in some cases of melancholia, and may vary from mere apathy to catalepsy or a trancelike condition. General paralysis may begin with any of the above symptoms, but its most striking characteristics are the steady progress toward dementia, and the constant association of motor and mental weakness.

It is evident that insanity does not evolve any new and unnatural powers of mind, but either weakens those already existing, or brings into prominence unused potentialities of the individual brain. It alters the relationships of the various elements of mind, overthrows the balance

which has hitherto been maintained, allows full liberty to tendencies which have previously been restrained, gives to the carefully concealed hopes, fears, and wishes of a lifetime the reality of facts, and permits the appetites and passions to run riot to the detriment or absolute loss of the established affections.

No absolute distinction can be drawn between insanity and the many forms of temporary mental aberration. In the individual who gives way to overpowering passion, in the victim of hysteria, in the delirium of fever, and in the action upon the brain of alcohol and other tonic agents, we see conditions closely allied to the various forms of insanity. In the phenomena of sleep and of dreaming, and in the actions of the hypnotized brain, we see temporary phases of mentalization which closely resemble mental conditions common among the insane. In dreaming, for example, self-control and all relation to time and space are lost, and impossible combinations of incongruous persons, events, and opinions seem natural, but the personal identity is quite definite, and the same conditions are often observed in the acute forms of insanity.

Diagnosis.—The elements of diagnosis are a knowledge of the various forms of insanity and practical experience in dealing with the insane. For the guidance of those who have had little experience, some general considerations, sufficient for the establishment of mental unsoundness, are here discussed, but the accurate diagnosis between the various forms is treated in the special articles dealing with each variety.

Great caution must be exercised in giving a decided opinion until the case develop, for in no department of medicine will a mistake be more readily discovered, or more deeply resented. Prior to seeing the patient, full information should be obtained as to the previous history, the family history, and the tastes and tendencies of the individual in question, and any changes in these latter must be carefully considered. Before the actual visit a general scheme of questions should be made out, and though each specialist will recommend his own method, it may be useful to suggest the most important subjects.

It is most desirable that the visit should be that of a doctor to a patient, and, un-

less the case be exceptional, it is well to have no misunderstanding on this point. It will thus be natural to begin by inquiring about the bodily health. The expression of face, and the condition of the pupils and tongue should be noted, and inquiries made as to the appetite and the relish for food. If any dislike for food exists, the reason should be elicited, as hallucinations of smell or taste may exist, or delusions of obstruction to the passage of food, or the patient may believe he is commanded not to touch food, or that it is wrong to take it for various reasons.

It is well also to ask as to the condition of the bowels, and special inquiries about sleep and the existence of dreams are most important. If sleepless, the patient will generally after a time confess the cause. Noises in the ears, or actual voices, flashes of light, or visions, curious feelings about the body, such as electricity, or annoyance by people outside the house, may be assigned as the cause, or simply pain in the head, uneasiness, or unhappy trains of thought.

The condition of the patient's dress and the appearance of the room may afford indications. The domestic relationships may next be touched upon, any change in the affection for wife or children and any undue anxiety for their future noted. The business or profession of the patient will suggest a series of questions, his hopes or fears for the future may be elicited, and questions asked as to his relations with his neighbors. Finally, a few words may be said on the social, political, or religious topics of the day, and if the condition of the memory be not already obvious it may be tested by a few simple questions.

At any part of the interview some hesitation, mental confusion, or incoherence may become apparent, or it may become obvious that the patient is concealing something. Slight contradiction or pretended misapprehension may then be necessary to break the slender bonds of self-control. When a hint has been obtained as to the line the mental unsoundness takes, it will often be advantageous not to follow the clew at once, but to recur to it at a later stage, when the patient's mind is occupied with other ideas. It is useful to force from the patient a confession that some change has come over him, to listen to his ex-

planations of the change, and to suggest trivial causes which will be probably resented, and lead him to give full details.

Of course all this trouble may be quite unnecessary, if the patient be excited or violent, or incoherent, or in the condition described as "raving madness;" the mere facts observed may be sufficient without a single question; but even here the actual words uttered should be given, and will always add considerably to the strength of a certificate. The possibility that the patient may be under the influence of drink, or of some narcotic or poison, or have been driven to his present condition by ill-usage, should never be lost sight of, but the ordinary knowledge of his profession possessed by every medical man ought to prevent the possibility of this error. It is important also to see some of the patient's recent letters, and any bearing upon the mental condition should be kept, as they would form useful evidence if legal troubles should ever arise.

Prognosis.—As to age, the younger the patient the better the prognosis, but some adolescents present a strong tendency to secondary dementia. A short duration of the symptoms is decidedly a favorable characteristic, but if the symptoms continue unchanged for a year, the prognosis is bad, though a few cases, especially those of melancholia, recover after an attack of several years' duration. Persistence of hallucinations of hearing or smell, any tendency to periodicity in the symptoms, little disturbance of bodily function originally, or improvement in bodily health without corresponding mental improvement, the absence of sufficient cause, and a dead stop after recovery up to a certain point are all of ominous prognostic import.

On the other hand, an adequate cause, acute symptoms with much disturbance of the bodily functions, followed by a gradual convalescence, in which mental and bodily improvement go hand in hand, are all favorable characteristics.

The effect of the presence of neurotic inheritance on the prognosis is twofold: there is a strong tendency to recovery, but an equally strong tendency to recurrence of the attacks. When the insanity is simply an exaggeration of previously existing eccentricity, the prognosis is bad, especially if the eccentricity be the result of neurotic inheritance.

Ætiology.—The causes of insanity are divided into predisposing and exciting, but many causes act in both ways.

The chief predisposing cause is neurotic inheritance. As knowledge grows, so does the certainty that we must look to the original constitution of the brain as the first and chief cause of mental breakdown. None of the ordinarily assigned causes are in themselves sufficient to bring on insanity. Such causes operate upon all human beings more or less, and it is not the brain which is subjected to the severest or most incessant action of the cause which breaks down, but the brain which is least fit to withstand the attack. What we call neurotic inheritance, undeniably renders the brain more liable to be affected by these various causes, but whether we can discover the fact of such inheritance or not, its existence, or the existence of a similar constitution of brain, is indisputable. For one man who breaks down mentally under the influence of drink, domestic troubles, or business worry, there are scores who, under a precisely similar causation, do not break down. The condition common to all mental disturbance is to be sought in inherent and inherited brain defect.

The influence of sex is slight, and the excess of female lunatics under treatment is due to the much greater mortality among males, and the shorter period occupied by them in recovery. Some causes press more heavily upon, or affect only the male sex.

The influence of age is marked, the vast majority of the cases of occurring insanity fall between the ages of twenty-five and forty-five, the period of full development of body and mind. The number of cases of insanity per 10,000 of population steadily increases to the age of twenty-five, and after forty-five as gradually decreases.

Poverty, insanitary surroundings, and privation are all contributing causes. Consanguinity, or great difference in the ages of the parents, accidents during pregnancy and birth, infantile convulsions, epilepsy, venereal excess, masturbation, nervous shock, the physiological crises of life, puberty, pregnancy, lactation, and the climacteric crisis, may all be mentioned as predisposing causes. But the cause which in its results to the individual and to his descendents ranks next to neurotic

inheritance, is unquestionably drink, and it is probable that neurotic tendencies are created both in the individual and in the family by indulgence in alcohol.

Among the exciting causes we find some of those mentioned as predisposing causes, such as drink, epilepsy, pregnancy, and disorders peculiar to women; and to these may be added, injuries to the head, acute bodily diseases, such as fevers, diathetic disorders, such as gout or syphilis, anæmia and diseases of the blood vessels, and special poisons, such as lead.

Treatment.—The cardinal principle is removal from old surroundings, and if this can be effected elsewhere than in asylums the friends will be grateful. But for acute cases, and the majority of all cases, asylum treatment affords the best chance of recovery, and the earlier the friends can be persuaded to take this view the better. Fresh air, abundance of food, light employment, and plenty of amusement, are main principles. The tonic effect which the indifference of the other patients has upon melancholics, and the absence of elements which attract the attention of the acutely maniacal, are not to be forgotten, and there can be no question that the patient suffers less in conforming to asylum discipline, which affects all alike, than when under surveillance in a private house, or in the home of which he was the active head.

Medicinal treatment is of little avail at first, sedatives should be sparingly used, but are imperative in some cases, and naturally are more frequently necessary in cases in private care than in asylums. Chloral is the most trusty and least harmful of narcotics, and may sometimes be usefully combined with morphia. The latter is useful in some cases of active melancholia, and in mild senile excitement and restlessness, but should be avoided when the excitement is very acute, and where there is any exhaustion, and in cases which refuse food, or in which dyspeptic troubles are present. Hyoscyamine and the hydrobromate of hyoscyne should not be used at all when the patient is young, and should be avoided whenever possible. The former finds its chief use in the restlessness, violence, and destructive habits of the confirmed general paralytic, but should not be given unless the appetite be good. Bromide of potassium, digitalis, henbane, Indian hemp, ergot of rye, and Calabar bean have all had their

fervent advocates, but with the exception of the first named are little used. Bromide of potassium has a distinctly bad effect upon some epileptics, apparently it lessens the number of fits, but favors the substitution of acute maniacal outbursts. Paraldehyde is very useful in some cases, but is nauseous and is generally refused by patients, and the same objection applies to hypnone, which is, however, yet upon its trial as a hypodermic remedy. Bromidia is useful as a mild soporific. Urethane appears to be useful, but in somewhat larger doses than at first recommended, and the latest addition to the long list of narcotics, sulphonal, is being tried with favorable results.

Generally speaking, the practitioner will do well to be chary in prescribing narcotics. Chloral is the most generally useful, and acts well hypodermically or by the rectum.

For excitement, when the bodily condition is good, prolonged hot baths and the wet and dry packs are used, but are not free from objection nor from danger. In cases with much excitement combined with bodily prostration, such as in active melancholia, or in puerperal insanity, energetic feeding, if necessary with the aid of the stomach-tube, and the free use of brandy, are absolutely essential. In such cases a few hours' delay may mean an aggravation of the symptoms, or even the death of the patient.

When the acute symptoms subside, general attention to the bodily health, the use of tonics, especially iron and cod-liver oil, is to be commended. If there be a tendency to secondary stupor or dementia, the cold shower bath and the Russian douche bath will be found stimulating. The value of electricity and massage is still an open question. In cases with stupor, hypnotism has lately been given a few trials.

G. T. REVINGTON.

Symptomatic Indications.—The best remedy in acute mania is *stramonium*, which allays irritation and induces sleep; it is useful in wild and furious delirium, especially in puerperal mania and nymphomania. *Belladonna* is useful in marked hyperæmic condition of the brain, monomania with fixed hallucination; acute maniacal delirium; headache, flushed face intolerance of light and noise. *Hyoscyamus*, in less active type, not congestive; hallucinations, startings, mutterings, mel-

ancholia. *Cannabis ind.*, in mania with horror of darkness, fear of insanity; spasmodic laughter. *Aurum* is useful in suicidal or religious mania, sexual excitement, great depression; speaks continually in questions, quarrelsome. *Anacardium* for rapid loss of self-reliance, memory, and mental vigor; stupid and childish actions; sensation of being possessed by opposing wills. *Calcium sulphide*, in dementia, with complete stupidity, sits silent in a corner. *Cantharides*, in amorous frenzy, intense erethism of sexual organs. *Cimicifuga*, in puerperal or uterine dependency. *Ignatia*, recent melancholia, from grief, fright; great mental depression.

INSANITY, CLASSIFICATION OF.—Various bases have been used for the purposes of classification, and the names will in each case indicate sufficiently the basis which was used—the somatic, the ætiological, the somato-ætiological, the symptomato-ætiological, the symptomatological, psychological, the physiological, and the psycho-symptomatological. But authorities are agreed that there are three main forms of insanity, to which, broadly speaking, all cases can be reduced, namely, melancholia or depression of brain function, mania or exaltation of brain function, and dementia or weak-mindedness, which includes amentia or congenital weak-mindedness, and the acquired weak-mindedness of adults.

Even general paralysis and epilepsy can be included, for while manical and melancholic symptoms are common in these diseases, the most striking characteristic of both is the inevitable progress toward dementia. Another form should be added: delusional insanity, in which, although there is frequently no marked depression nor exaltation of brain function, and the dementia which is always present may remain for years only a slight factor, there is definite distortion of brain function, as shown in the fixed and often outrageous delusions which exist, in spite of fair reasoning power and judgment upon topics other than the subject of the delusions.

Having recognized these primary forms, a classification according to the period of life will be found practically useful. To describe a case as adolescent stupor or puerperal mania will be satisfying as to symptoms, and useful as to treatment.

The character of the symptoms and the mode of treatment turn far more upon the stage to which the development of brain and body has attained than upon any other factor in the case.

The following is an arrangement which seems to answer all the requirements of a scientific classification:

The four primary forms of mental unsoundness.	{	1. Melancholy (depression of brain function).
		2. Mania (exaltation of brain function).
		3. Delusional insanity (distortion of brain function).
		4. Dementia (weak-mindedness—"the goal of all the insanities"—including amentia or congenital weak-mindedness).

Scheme of Classification according to the Period of Life at which the Disease appears.

Insanities of infancy.	{	Imbecility, idiocy.
Insanities of childhood.	{	Mania, melancholia, moral insanity, epileptic insanity.
Insanities of adolescence.	{	Mania, melancholia, insanity of stupor, epileptic and hysterical insanity, sexual hypochondriasis.
Insanities of maturity.	{	Mania, melancholia, puerperal and lactational insanities, delusional insanity, alcoholic insanity, general paralysis.
Insanities of the climacteric period.	{	Mania, melancholia, delusional insanity, visceral hypochondriasis.
Insanities of decay.	{	Mania, melancholia. { With dementia, as a prominent characteristic, and probable conclusion.

G. T. REVINGTON.

INSOLATION.—See SUNSTROKE.

INSOMNIA.—See SLEEP.

INTESTINAL OBSTRUCTION.—

This term is generally limited to cases in which there is complete obstruction to the passage of the contents of the bowels, solid, fluid, and gaseous, the state of merely imperfect evacuation of these contents being regarded as "constipation."

This distinction is not absolute, since the causes which may eventually operate to produce complete obstruction frequently, in their earlier manifestations, exhibit merely the symptoms of irregular constipation. Again, owing to the variety of the conditions which lead to obstruction, in addition to the cardinal symptom of complete constipation, there are often concomitant symptoms varying in

severity and in their relative predominance.

In some cases, where the health has been previously good, and the intestinal functions regularly performed, the symptoms of obstruction set in almost suddenly, with or without some exciting cause, such as a strain or injury, and rapidly become urgent. Such cases are generally denoted by the term *acute*. In other cases the absolute arrest of the normal evacuation is more gradual, and is preceded by a period of imperfect or irregular performance of this function continued over a longer or shorter time. Such are the *chronic* cases.

These terms are, however, only to be regarded as a matter of clinical convenience. They by no means imply that the underlying anatomical condition is in the one case recent or acute, in the other of long standing or chronic. For although in many cases it may be true that the condition giving rise to sudden and urgent symptoms is itself suddenly developed (*e.g.*, impaction of a gall-stone, or an intussusception), yet there is frequently no sort of parallelism between the clinical course and the anatomical state. For a condition of long standing may either directly or indirectly be first revealed by the onset of acute symptoms, and yet in other cases the same condition will have a clinical history more in accordance with what is known of its nature and probable duration.

Acute Obstruction occurs, as its name implies, with suddenness.

Symptoms.—The patient may have been previously in good health, never having had any symptoms of derangement of the bowels, when he is seized with a severe attack of griping pain in the belly. On inquiry it may not be possible to attribute this attack to any antecedent circumstance, such as indiscretion in diet, injury or strain, although in a certain number of cases such assumed exciting causes do exist. The pain may be very severe, and is usually referred to the region of the umbilicus, no matter where the seat of the obstruction may be. It is mostly followed speedily, or after a few hours' interval, by vomiting. From the onset there is no action of the bowels, not even the passage of flatus, and this notwithstanding that the occlusion may be high up in the intestine.

From this it would appear that, owing

to the sudden mechanical interference with its normal action, the bowel below the seat of obstruction becomes quite paralyzed, although it may be possible to produce an evacuation of the contents of the colon by means of enemata.

Urgent symptoms of obstruction may be induced (by reflex paralysis?) by sudden mechanical irritation of the intestinal nerves, without there being any actual obstruction—*e.g.*, acute strangulation of omentum, or of one wall of the gut.

The vomited matters at first consist of the gastric contents, but soon become bilious or duodenal, and have a greenish or bright yellow color. The act of vomiting is excited whenever food is taken, but after a time it tends to recur independently of taking food. Within a variable period, seldom more than three or four days, the vomited matters become obviously stercoraceous. It is generally considered that the *early* occurrence of vomiting indicates the seat of obstruction is situated high up in the small intestines, but this is not a safe diagnostic rule, since the same fact may be observed whenever the obstructing cause is such as to severely strangulate the bowel. Associated with this symptom, and in a measure dependent upon it, there may be great thirst, and also a marked diminution in the amount of urine passed, perhaps even suppression.

The belly is more or less distended, the degree of this distention depending both on the situation of the obstruction and on the duration of the symptoms. It is comparatively rare in acute cases for the individual coil of distended intestine to be visible through the parietes, although there are many exceptions to this, and the presence of visible peristalsis cannot be held to exclude an acute case. The distention, as a rule, is fairly uniform, but may exhibit a certain want of bilateral symmetry.

On palpation, there is tenderness, which usually develops a short time after the pain, but it is seldom so definitely localized as to be a trustworthy guide to the site of the obstruction. In some forms a tumor may be plainly felt, through the abdominal parietes (*e.g.*, intussusception) or on rectal examination, or else the latter only reveals the swelling formed by the coils filling the pelvis. To percussion the abdomen is in all parts tympanitic.

The patient rapidly becomes exhausted by the pain and incessant vomiting, the features become pinched, the pulse small, perhaps thready, the respirations shallow and rapid, and the temperature subnormal. There is no impairment of intelligence, but the condition is that of collapse, and death follows.

Chronic Obstruction has a different clinical history. In it the patient has probably suffered for months or years from irregular action of the bowels; he has been either habitually constipated, requiring frequent recourse to purgatives, or has been subject to attacks of constipation alternating with diarrhea, the latter probably being really excited by the former. At any rate there is in his previous history sufficient to point to the final complete obstruction being only the necessary sequence of deranged action of the intestine of long standing. Sometimes, but not invariably, he may have noticed that the tendency to constipation has gone on increasing with the lapse of time, and, perhaps, that the motions have become more scanty in amount or smaller in size. Then comes a time when the bowels no longer respond to the measures on which reliance has hitherto been placed for their relief, and perhaps stronger purgatives are tried with a like negative result, except the production of more or less severe griping pain. It may be learnt, too, that there has been of late a greater liability to attacks of "colic" than hitherto. Enemata also fail to procure the desired relief. After some days of absolute constipation, when even flatus does not pass, the abdomen becomes more and more distended and the true nature of the case is revealed. Now at length vomiting may set in, and in time becomes stercoraceous. The patient sinks into a state of collapse, in which he may die.

Differential Diagnosis, Acute from Chronic Obstruction.—Among the symptoms and signs which characterize the chronic cases as distinguished from the acute are the comparatively greater amount of urine excreted, the visibility of the distended coils, which may be often seen in peristaltic movement (due to the hypertrophy of the muscular coat of the bowel above the obstruction?) and perhaps the presence of tenderness and fullness over the cæcum.

There is one sign yielded by examina-

tion of the urine, which, though not pathognomonic, is yet very constant in intestinal obstruction, being far better marked in acute than in chronic cases. This is the presence of indican (or its derivatives) in the urine, which may be ascertained by gently adding to it some hydrochloric acid in the cold. At the line of junction of the two fluids there will appear a violet or dark bluish-black band, the tint being deeper in proportion to the amount of the "indican" present. In a recent case this test, which was well marked during the symptoms of obstruction, disappeared after the obstruction (a band) had been relieved by operation. The presence of indicanuria in such cases may be due to the absorption of indol retained in the bowel with other fecal products or possibly in part to the nervous disturbance in the abdomen caused by the attack.

Diagnosis of the Seat of the Obstruction is by no means easy. But there are certain rules which may be usefully applied to distinguish between obstruction situated in the large and the small intestine; beyond this rather wide limit it is often impossible to go.

The seat of pain or tenderness, which is generally localized about the region of the umbilicus (probably because of the contiguity to the solar plexus, where the painful impression may be referred), is not to be relied on. The very early onset of vomiting may be taken to indicate not only that the case is acute but that the obstruction is high up in the intestine.

The obstruction may be inferred to be in the *small* intestine, when (1) the abdominal distention is most marked anteriorly, the flanks being comparatively flattened: (2) large quantities of water can be readily injected into the bowel through a long tube introduced into the rectum, and when it can be proved by auscultation that the fluid passes into the cæcum: (3) indican is present in the urine in considerable quantity. The fact that in cases of obstruction of the small intestine there is great diminution in the amount of urine passed is probably allied to the severe and prolonged vomiting which so often characterizes this form, and cannot therefore be considered as a fact of much diagnostic value.

On the other hand the obstruction is probably seated in the *large* intestine if there be (1) marked general distention,

and especially fullness of the flanks, of both flanks if the obstruction be in the rectum or sigmoid, of the right more than the left if it be in the splenic or hepatic flexure; (2) failure to inject much water or to detect evidence of its passage on into the cæcum; (3) an obstruction detected in or outside the rectum on digital examination. In the case of obstruction higher up some aid might possibly be gained by the attempt to pass a long bougie into the colon, a proceeding which may, however, lead to a fallacy from the difficulty often experienced in passing the instrument through the sigmoid flexure.

Diagnosis of Intestinal Obstruction in General has in the acute cases to be made mainly from *acute peritonitis*, especially when the latter is dependent on perforation. In some cases, indeed, the distinction between these two conditions is well-nigh impossible, for in the history of the attack, the mode of onset, the occurrence of pain and vomiting, there may be no distinctive feature of the one over the other. Since, however, the causes of such perforative peritonitis (exclusive of typhoid ulceration) are practically limited to perforation of the appendix or of a gastric or duodenal ulcer, it may be possible by careful exclusion of these conditions to make a diagnosis. It is, however, here that the value of laparotomy as an exploratory operation is seen, a procedure which will be also available for the treatment of the case.

In acute peritonitis there is usually more general pain and exquisite tenderness of the abdomen than occurs in simple acute obstruction; the patient lies on the back with the knees raised; the signs of collapse are marked, especially the quick, small pulse, and usually there is some rise in temperature. Moreover, since peritonitis is rarely idiopathic, every care should be taken to discover whether there be any assignable cause for its occurrence.

In *chronic* cases the diagnosis rests between permanent obstruction or constipation, and here the effects of repeated and large enemata are of great service. It is seldom that constipation *per se* leads to complete obstruction, but this sometimes does happen.

Varieties of Intestinal Obstruction.—Mention has been already made of the division into acute and chronic, examples

of which are to be found in both the small and large bowel, but perhaps in the former the acute cases preponderate, in the latter the chronic. Or the conditions may be considered in reference to the part of the intestine in which they commonly occur. Or the division may have reference to the relation of the obstructing cause to the tube which is thereby occluded, as causes operating within the intestine, in its walls, and outside the canal. The order in which they are discussed here is framed rather on their anatomical and pathological affinities.

1. Fecal Accumulation, Gall-stones, etc.—Fecal Accumulation.—This, which may be the outcome of habitual constipation, depends for its supervention upon atony of the colon, where the chief accumulation takes place. The more or less paralyzed bowel may become greatly dilated and enormously distended with fæces, which are hardened and fixed. Sometimes the mass can be readily felt through the parietes, and under a prolonged and patient course of enemata, aided, if need be, by mechanical dislodgment of the contents of the rectum, the mass may be observed to gradually lessen.

The prognosis in such cases is rarely grave, but there is always a liability to recurrence, if the evacuation of the bowels be neglected. Indeed, in some cases this form of obstruction has proved fatal, and has been mistaken for a stricture of the colon, which it simulates in its course. The operation of colotomy has been done on this mistaken diagnosis.

Impacted Gall-stone.—The seat of impaction of a gall-stone in the intestine is likely to be the ileum, since the larger caliber of the duodenum and jejunum admits of the passage of a stone which could not pass through the ileum. The occurrence is mostly due to the escape of a gall-stone of large size into the bowel from ulceration of the gall-bladder, rather than from the duct, into which it is rare for stones large enough to occlude intestine to pass. The onset of symptoms of obstruction is sudden, the pain severe, and vomiting urgent. There may have been a history of former attacks of biliary colic and jaundice, but it is possible that no such events have occurred, in which case a material aid to a correct diagnosis will be wanting. The patient may have suffered for some time previously from a

pain in the hypochondrium, and it is possible that the existence of a tumor in the site of the gall-bladder may have given rise to the suspicion of the presence of a gall-stone before the onset of intestinal symptoms, which mark its escape into, and lodgment in, the bowel. Unless, however, there have been previous colic and jaundice, such a diagnosis would not be justified.

Enteroliths formed of matted hairs that have been swallowed, or of semi-calcified masses, as from insoluble salts of lime, magnesia, or bismuth, and all manner of *foreign bodies* swallowed accidentally or intentionally may come to block the bowel. Obstruction has also been caused by a collection of lumbricoid worms.

2. Internal Strangulation.—One-quarter of the total number of cases of intestinal obstruction from all causes (excluding hernia and affections of the rectum) are due to internal strangulation, according to Treves. The mode in which the strangulation is effected is very varied, and only some of the more common varieties will here be mentioned.

(a) **Strangulation through apertures**, as hernia through the foramen of Winslow, obturator hernia, retro-peritoneal hernia, or the passage of a loop of intestine through a rent in the omentum or mesentery, and the constriction of the gut, partly by the latter, partly from the weight of the bowel causing it to be sharply bent over the margin of the aperture.

(b) **Strangulation by bands.**—Are the most common, and the "bands" may be formed in a variety of ways. Some are formed by old peritonitic adhesions, and in such cases there may be a previous history of localized peritonitis. Or a loop may be caused by the adhesion of the vermiform appendix to the parietes, to a neighboring part of intestine, or fallopian tube, or other viscus. Or, the band may be formed by the adhesion of one of the appendices epiploicæ to another, or to the appendix, or elsewhere; the epiploic appendage becoming more or less elongated and cord-like. Or the omentum, from previous peritonitis, may have become adherent, forming a loop through which coils of intestine may pass (a condition liable to ensue after hernia). Or finally, and this forms a comparatively large class, the constricting band may be

formed by a Meckel's diverticulum, which has either retained its attachment at the umbilicus, or, what is more frequent, has become adherent to bowel or parietal peritoneum. The obliterated vessels passing from the region of the bladder to the umbilicus may similarly form constricting cords.

In these and other ways a cord-like loop is formed, through which a portion of intestine, generally as a single loop, may pass and become constricted. Hence in nearly all these cases it is the small intestine that is strangulated, and the onset of symptoms is acute. When it is possible to obtain a clear history of a previous attack of peritonitis (or of a herniotomy) the diagnosis may be aided, but such evidence is frequently wanting. As a rule the constriction is solitary, but now and then the bowel will be found to be strangulated at more than one spot. The effect of the constriction is to cause great distention of the gut above it, and the collapse of all the coils below. These collapsed coils tend to fall into the pelvis, where they may be felt on rectal or vaginal examination, and discovered on abdominal section.

Strangulation by bands is most common in males, but in the case of peritonitic adhesions the numbers are about equal, the greater frequency of pelvic peritonitis in the female being balanced by the predominance of typhlitis in the male. The latter fact also explains why strangulation due to an adherent vermiform appendix occurs more often in the male.

Liability is greatest between the ages of twenty and forty. These cases have been termed "internal hernia," and of course in dealing with them care must be taken to examine all the sites of hernia, before arriving at the conclusion that the obstructing cause is within the abdomen.

3.—Malposition of Intestines.

Volvulus.—This is the twisting of the bowel upon itself to such an extent as to completely occlude its canal. The twisting may involve the small or large intestine, the latter being perhaps the more frequent. In order for it to take place, it is requisite that the bowel should be furnished with a long mesentery, as is sometimes the case with the descending colon or the sigmoid. The occurrence of volvulus may sometimes be referred to any injury or unusual effort; the symptoms

are mostly acute, and referable to obstruction of the large bowel. The effect of a volvulus upon the intestine itself is similar to that produced by strangulation, but if the colon be the seat of the accident there will be much greater distention than in the case of involvement of the ileum.

Intussusception or invagination is a frequent cause of obstruction, especially in the young. In this condition a segment of bowel becomes invaginated into the portion next below it, thus forming a cylindrical tumor of variable length. The determining cause of the condition is no doubt undue peristalsis, which may have been excited by some irritation of the bowel. Thus it happens in the course of catarrhal enteritis, or it is associated with a tumor projecting into the interior of the bowel from its wall. But it is not always possible to refer the attack to any marked antecedent, such as the occurrence of attacks of colic, which would indicate that the bowel contained some material which it was endeavoring to get rid of by violent peristaltic movement. Thus the presence of a lumbricoid worm may favor the occurrence of intussusception, or of indigestible articles of food or other foreign body.

The *site* varies, thus (a) *Ileo-cæcal*, where the invagination begins with the descent of the ileo-cæcal valve into the cæcum and colon, so that the intussusceptum is formed by the ileum as well as by the cæcum and ascending colon, according to the extent of the invagination. This is the most common variety, and is occasionally of such extent that the ileo-cæcal valve may be felt per rectum. (b) *Colic*.—In this variety the invagination is limited to the large intestine, as of the ascending into the transverse portion, or of the latter into the descending colon. (c) *Ileal*.—Here the ileum is alone concerned. It forms a typical instance of the condition. (d) *Ileo-colic*.—This variety is characterized by the prolapse of the ileum through the lips of the ileo-cæcal valve. It is rare, and must be clearly distinguished from the ileo-cæcal variety.

The mere fact of the occurrence of intussusception does not suffice to cause obstruction. It is possible for the passage through the invaginated portion to be still pervious, and the condition may in such circumstance become chronic, and not be marked by the urgent symptoms

usually present. For in the majority of cases the invagination is productive of constriction of the invaginated portion at the point where this becomes continuous with the ensheathing portion. In consequence of this there is an impediment to the return of blood from the included bowel and its mesentery, so that these become swollen, and thus increase the liability to complete constriction. The intussusceptum becomes intensely congested, and its vessels on the mucous membrane may rupture, filling the interior with blood clot. Then, owing to the strangulation, a process of necrotic softening takes place, inflammation is set up between the contiguous serous coats of the two portions of bowel, which thus become adherent. After a time the detachment of the intussusceptum is effected by sloughing and it may come away entirely, and thus naturally restore the continuity of the bowel. The circular ulceration which remains may subsequently cicatrize.

Such recovery is rare, the case often terminating fatally from exhaustion due to the obstruction, and to the effects of blood-poisoning from the gangrenous intestine. It must not be supposed, however, that intussusception, unrelieved by art, will invariably run this serious course. There can be little doubt that occasionally the condition may occur and be spontaneously reduced after an interval of a certain time, or very shortly after the occurrence of the intussusception, without any serious symptoms having been set up, while, as remarked, the condition may sometimes be more or less chronic, and may have existed a long time before any obstruction is produced.

Symptoms.—There is much pain in the belly, tenesmus, perhaps some diarrhea, and vomiting and anxiety. There may in a few hours be some melæna (an important indication), which lasts only a short time, that is, so long as there is extreme congestion of the invaginated segment, a condition which precedes complete stasis. The detection of a tumor on palpation of the abdomen, for which it is often necessary to administer an anæsthetic, is, however, the chief diagnostic sign. This is of a smooth cylindrical or sausage shape, and usually lies in the position of the ascending colon, or even in that of the transverse colon. It may even be wholly on the left side of the abdomen,

and its lower extremity be felt per rectum. In some cases the tumor may be observed to shift its position as the intussusception continues to increase.

The *diagnosis* has to be made from other forms of acute obstruction; and the history of melæna, and the presence of the characteristic tumor, render this comparatively easy. It has further to be distinguished from a fecal tumor, but it is only in the chronic and milder cases that this mistake is likely to occur. Between typhlitis and intussusception the diagnosis may be more difficult, but here the suddenness with which the swelling appears, as well as the melæna, mostly suffice to point to the latter.

4. Compression, Traction, and Kinking.—Obstruction may be brought about by the more or less general matting of the intestines by peritonitis, as in general or local chronic peritonitis, tubercular or otherwise. The adherent coils, unable to exert their natural peristalsis, tend to become filled with fæces. In such cases there is a more or less prolonged history of abdominal symptoms before the onset of signs of obstruction. The cases therefore fall mainly under the "chronic" class, where complete obstruction is preceded by obstinate constipation, and often by attacks of colic. The adhesions may be limited to a few loops only, as when they result from localized peritonitis in the vicinity of the cæcum or the pelvic organs.

In obstruction from tumors external to the bowel, the rectum is chiefly involved. The condition is far more often met with in females than males. The commonest cause is the pressure due to an enlarged uterus or a fibroid tumor arising from the uterus or even retroflexion of this organ, the unyielding walls of the pelvic cavity compelling the flattening of the bowel. The diagnosis is readily made on rectal and vaginal examination.

The condition of "traction" is rare. It has been chiefly observed in connection with an adherent diverticulum which drags on the ileum and eventually produces its occlusion. This also is marked by chronic symptoms. An analogous state is that described as "kinking," where, owing to adhesion of the small intestine at one spot, the bowel (generally the ileum) becomes acutely bent on itself. The writer has seen this produced by a contraction of the mesentery, the result

of old inflammation of the mesenteric glands, which had become cretified at this spot. The patient had had previous attacks of the same kind, in which obstruction had lasted for some days and had then been spontaneously relieved. On the occurrence of a second attack the symptoms were more severe, and laparotomy was performed. It was found necessary to resect the portion of gut at the site of the kink. The case proved fatal.

5. Strictures.—The intestine may be completely occluded at birth by the non-union of the hind gut and anus. This condition of so-called "imperforate anus" or "atresia ani," finds a counterpart in the duodenum, where occasionally a similar entire dissection of the continuity of the canal is exhibited as a congenital malformation. But short of complete occlusion, strictures of the small intestine, which are manifestly of congenital origin, are occasionally met with.

Symptoms.—Early years of life may pass without any apparent discomfort, but as age advances and the narrow passage of the strictured portion becomes more disproportioned to the caliber of the rest of the tube, there may gradually arise symptoms of intestinal difficulty culminating in complete obstruction. The abdomen becomes more distended in its central portions, and the coils of intestine above the stricture become evident through the parietes, showing frequently their peristaltic movement. Such a chronic history and course of symptoms in a comparatively young subject may direct suspicion to this malformation, but the diagnosis is purely conjectural.

Of acquired strictures by far the most common are those which are due to **malignant growths of the intestine** (mostly epitheliomatous). These strictures occur in later life, more commonly in males than in females, and are produced by the contraction of a growth which, arising in one part of the bowel, may come to entirely surround it, and by its destruction from the typical "annular ulcer." In the vast majority these strictures are to be found in the large intestine, and (excluding the rectum) at the flexures of the colon far more often than in other parts. In frequency they occur more in the sigmoid than in the splenic flexure, and more in the splenic than in the hepatic flexure.

Symptoms.—The history is a chronic one. It is difficult to determine when the stricture commenced to cause any definite symptoms, so insidious is their onset. Sometimes, indeed, there is no suspicion of any grave trouble until the signs of obstruction set in almost acutely. As a rule the patient may have been subject to habitual constipation for some time, alternating perhaps with “diarrhea” attributable to the presence of accumulated fæces. He may also have experienced an increasing liability to attacks of colic, especially after taking purgative medicines. Then the abdomen will become more distended and voluminous, there may be aching pain and tenderness over the cæcum, which is especially liable to become distended and even ulcerated, while, owing to the long duration of the obstruction, the coils of intestine may become plainly visible. During an attack of colic peristalsis may be visible. Vomiting is a late event; it may not even occur at all. On the other hand, these cases may be characterized by recurrent attacks of copious fecal vomiting, with intervals of comparative comfort.

Diagnosis.—With such a history, the determination that the seat of the obstruction is in the colon, together with the age of the patient, justify the conclusion that the case is one of this nature. The condition most likely to be mistaken for it is that of chronic constipation with atony and dilatation of the colon.

In no case should rectal examination be neglected, since of all seats of stricture especially malignant and syphilitic, this part of the tract is the most frequently involved. Nor must a history of diarrhea be allowed to set aside this necessity, for the very presence of such disease may create an irritable condition of the mucous membrane, and a constant desire to defecate. Tenesmus and occasional melæna are further common signs of rectal disease.

Of other forms of stricture due to previous ulceration it must suffice to give a mere enumeration, so rarely do they occur. Such, for instance, are strictures following tubercular or syphilitic ulceration of the bowel or following the spontaneous detachment of an intussuscepted portion of intestine. Dysenteric and even typhoidal ulcers have very rarely been known to lead to stricture.

6. Tumors within the Intestine.—Obstruction may be also caused by the

gradual filling up of the lumen of the intestine by new growths arising in its wall. Here again cancerous tumors are the most common, and they are perhaps more frequent at the ileo-cæcal valve than elsewhere. Some growths indeed tend rather to dilate the bowel than to contract it. Among the rarer kinds of tumor are fibromata and lipomata, which may come to cause mechanical obstruction; various forms of polypoid growth, fibro-myxomatous or other, may possibly be so abundant or so large as to produce a like result. Similar in effect and in clinical characters are cases of chronic intussusception.

The *diagnosis* has to be made chiefly from fecal tumors when the intestinal condition is apparent to palpation. The obstruction is generally of long standing.

The *differential diagnosis of the foregoing conditions* must be based upon the consideration of several points in addition to those which are more or less characteristic of the particular form of obstruction, the acuteness or otherwise of the symptoms, and the determination of the site of the occlusion. It must be borne in mind that several of the conditions named take their origin in the presence of the relics of pre-existing peritoneal inflammation, mesenteric disease, or hernia, and a full inquiry into the previous history of the patient may thus sometimes be of much service. Thus, a history of abdominal symptoms in early life, or of pelvic or cæcal inflammation may shed light upon the long subsequent occurrence of symptoms of intestinal obstruction, and especially of cases of strangulation. The sex and age of the patient may point in favor of one rather than another form of obstruction. It may be stated almost aphoristically that intussusception is an affection of childhood, strangulation of early adult life, stricture of the colon of advanced life, although there are, of course, exceptions. If congenital malformation be suspected, then search may be made for any other congenital defects, since such errors of development often occur together. These and like considerations may aid in arriving at a conclusion, but it is often impossible to determine, especially in acute cases, the precise nature of the lesion without actual inspection, after exploratory laparotomy.

Treatment of intestinal obstruction

must necessarily vary with its cause, but there are certain general principles and methods that are applicable to the majority. The administration of purgatives must be absolutely deprecated; much pain, and no good, if not positive harm, may follow their employment. It is, however, incumbent, both as a matter of diagnosis and treatment, to have recourse to copious enemata. For if the condition be merely one of fecal accumulation, perseverance in this course may be rewarded by the removal of the obstruction. It is unwise to continue these attempts too long, and often the severity of the symptoms and exhaustion of the patient will point to their inutility.

The administration of opium is valuable in allaying pain and controlling peristalsis and vomiting, but for these very reasons it is inadvisable to prolong its use, lest the urgency of the symptoms be masked, and the time at which there is reasonable hope of relief by operation be overpassed. At the same time the treatment by opiates, combined with low diet, has been advocated as all-sufficient for the cure of many severe cases which in other hands would most certainly have been submitted to operation. It ought to be clearly understood that if the opium treatment be relied on it must not be abandoned in favor of operation at a late stage and when the patient is in a state of extreme exhaustion. In this way the latter procedure has indeed but slight chance of saving the patient, and it seems unscientific as well as wrong to suffer such exhaustion to occur, if the case be seen early enough to anticipate its appearance by speedy resort to operation; and although, unfortunately, but few cases of acute internal strangulation recover, even after laparotomy and the division of the constricting band, it is not possible, in face of the known pathological conditions, to refrain from advising an early recourse to this interference as affording the best chance of recovery in an otherwise almost necessarily fatal disease.

But there are less severe measures than abdominal section, which in certain cases may be tried before resorting to it, provided that the patient's strength admit of the delay that they occasion. One of these is free lavage of the stomach. This simple procedure, frequently repeated, has been followed by the disappearance of the symptoms of obstruction. The

writer has adopted the plan in two cases, but only as a preliminary to laparotomy, where the fecal vomiting was frequent and distressing, and believes that it is of great advantage in cleansing the stomach of its foul contents, thereby removing one cause of the depression of the vital powers, but that the measure *per se* could effect the liberation of a strangulated bowel is difficult to conceive. "Taxis," may be tried for internal hernia as for external, and abandoned in favor of surgical interference if it fail in its object. The first point in abdominal taxis is the full use of an anæsthetic, so as to obliterate all muscular resistance. Next (the bowels and bladder being supposed to be empty) the surgeon will forcibly and repeatedly knead the abdomen, pressing its contents vigorously upward, downward, and from side to side. The patient is now to be turned on his abdomen, and in this position to be held up by four strong men, and shaken backward and forward. This done the trunk is to be held feet uppermost and shaking again practiced directly upward and downward. While in this inverted position copious enemata are to be given. The whole proceedings are to be carried out in a *bona fide* and energetic manner. It is not to be the name of taxis, but the reality; and great perseverance is to be exercised. The inversion of the body, and succussion in this position, is on no account to be omitted, for it is possibly the most important of all. It may be conceded that such a procedure can untwist a volvulus, or indeed enable a loop of intestine to escape from a lax band. Yet the very energetic character of the procedure must, if it fail, materially exhaust the patient, and render him unfit for the severer measure of laparotomy. Thus, in the treatment of internal strangulation we seem to be on the horns of a dilemma, and one can hardly avoid the conclusion that, as soon as the diagnosis is made (the sooner the better), the division of the constricting band should be attempted. As regards the operation itself, it may be mentioned that the point before alluded to that the collapsed coils tend to drop into the pelvis, is of much practical value, as enabling the surgeon to find his way to the seat of constriction more rapidly than if he attempted to do so by tracing the distended bowel first in one direction and then in another. The

possibility of there being more than one constricting band (although rare) should always be borne in mind.

We have spoken chiefly of cases of acute obstruction by strangulation. There are, but in other forms of obstruction, such, for example, as intussusception and stricture, other lines of procedure. In the former, when the diagnosis has been verified by the discovery of the characteristic tumor (under chloroform if necessary), attempts to effect reduction should be made by the injection of air or water into the rectum. The earlier period at which recourse is had to these measures after the onset of symptoms the more likely are they to succeed. If they fail, then there are two courses open, either to invoke surgical aid to reduce the invagination after laparotomy (and in some cases this has proved very successful, in others it has been found impossible to effect the reduction), or to administer opium freely and trust to the natural process of separation of the invaginated bowel, supporting the patient by nutrient enemata, suppositories, and stimulants, as well as may be, during the prolonged period that must ensue before the spontaneous detachment is effected. In many instances the strength of the patient has given way before what may be termed the "natural" cure could be completed. In the case of an annular stricture of the colon the usual procedure recommended is the performance of colotomy. If the diagnosis be that the stricture is seated in the sigmoid flexure, then the operation may be performed on the left side, but in all other cases it should be a right colotomy, not only because of the uncertainty as to the exact site of the stricture and the avoidance of the risk of cutting down upon collapsed bowel, but also because in cases of long standing accumulation the cæcum often suffers from the distention, and its relief is more certainly obtained by that operation. Surgery has advanced beyond this merely palliative measure, and cases of successful colectomy have been recorded, the limitation of the disease in the bowel favoring such an expedient.

For the relief of extreme flatulent distention, especially in cases of obstruction of the large intestine, it is sometimes advisable, and even necessary, to puncture the distended gut. This should be done with a very fine trocar (the needle of a

hypodermic syringe would suffice), and the gas allowed to escape. The procedure only affords a temporary relief, and is likely to be followed by colicky pain, due to the peristalsis of the bowel being excited by the relief of the distention. It is well, therefore, to give opium when the puncture is made. It may happen that the removal of the tympanites will also be followed by the passage of fæces through the obstruction, owing to the stricture being relieved from undue pressure above. The procedure is not in all cases free from risk, since the dilated intestine may not be enabled to contract, and so close the opening, in which case there will be fæcal extravasation and peritonitis.

In all cases the amount of food administered to the patient should be very small and concentrated, consisting of milk, meat essence in small quantities, or, if vomiting be persistent, rectal feeding must be resorted to. In the less severe cases, where after a few days the obstruction is spontaneously relieved, the diet must continue to be carefully controlled. In such cases also, belladonna will be found of greater service than opium.

SIDNEY COUPLAND.

Symptomatic Indications.—The principal remedy is *nux vomica*, which may help in correcting irregular and excessive peristalsis, and reduce inflammation, crampy, remittent pains, with contraction or constriction of bowels, quick, spasmodic pulse and hot skin. *Belladonna*, when signs of local inflammation appear; great pain in ileo-cæcal region, cannot bear the slightest touch, nor weight of bedclothes, nausea and vomiting; high fever. *Opium* is useful in simple cases, when from fecal accumulation. *Plumbum* is valuable with partial spasm or paralysis; violent colic about umbilicus, stercoraceous vomiting, anus feels as if drawn in.

INTESTINES, TUBERCULAR DISEASE OF.—The intestines are seldom, in the adult, the primary seat of tuberculosis, but they are affected secondarily to pulmonary phthisis with extreme frequency. This has been attributed to secondary infection by the sputum, a view which is supported by the onset of symptoms being generally subsequent to the formation of freely discharging vomicae, and by its great frequency in laryngeal

phthisis, where expectoration is difficult, and in children who do not expectorate. In children, tuberculosis primarily affecting the intestine is not uncommon; it is probably started by milk contaminated by the tubercular virus.

Symptoms.—Diarrhea is the characteristic symptom of tuberculosis of the intestine in all its stages; before ulceration occurs the flux is easily controlled, and the early diarrhea of phthisis is attributed to this cause. When widespread ulceration is in progress the diarrhea is intractable; the stools are very fluid, yellowish, most offensive, and sometimes tinged with blood. There is abdominal pain, often severe, and generally localized patches of tenderness, most often found in the right iliac region; the tongue, at first red at the tip only, becomes red and glazed, and finally a brown streak forms down the center. There is irregular but often severe pyrexia, also night sweating; exhaustion is great, and emaciation rapid. Diarrhea is more severe and intractable when the colon is largely affected than when the ulceration is almost limited to the ileum.

Death is generally due to exhaustion, occasionally to perforative peritonitis, and still more rarely to hemorrhage. In children, coincident tubercular peritonitis commonly has a large share in bringing about the fatal result. In less severe cases constipation may be a marked symptom, diarrhea occurring only at irregular intervals, and then with great severity; in rare cases constipation is continuous, but, as a rule, the accumulation of solid fæces irritates the ulcers and causes the attacks of diarrhea.

Morbid anatomy.—The tubercular new growth commences in the lymphatic tissues of the intestine, and, whether it arises in connection with a solitary gland or a Peyer's patch, extension takes place in the direction of the blood vessels, probably in their lymphatic sheaths, and the resulting ulcer is therefore generally transverse to the long axis of the bowel. The tubercular process spreads laterally in the submucous tissue; it also spreads into the muscular coat, and finally reaches the peritoneum, upon which tubercles then form; it also involves the mucous membrane leading to destruction of limited areas. As intervening bands of mucous membrane remain at first, the tubercular plaque may have a cribriform appearance;

in a later stage, which is that most commonly seen, the ulcer appears to be deep, owing to the tubercular infiltration of its edges, and the floor and sides are ragged. The floor of the ulcer is generally so much thickened by tubercular material that perforation does not occur, though the event is, taking a series of cases, by no means rare. Owing to the presence of adhesions, which form as the result of the tuberculosis of the peritoneum, the opening generally forms between two coils of intestines; even when extravasation occurs into the peritoneal cavity it is probably *guttatim*, the opening being a mere pin-point, and the acute peritonitis which ensues is commonly limited in extent, and has a conservative effect. The ulcers occasionally cicatrize, and have been known to cause chronic obstruction.

Tubercular ulceration is most common about the cæcum, but authorities differ as to whether the lower part of the ileum, the cæcum, or the colon is the earliest and the most severely affected. The mesenteric glands and lymphatics are always affected, but widespread tubercular peritonitis is seldom seen except in children or adolescents.

Treatment.—The diarrhea is doubtless partly due to a catarrhal condition of the mucous membrane in the neighborhood of the ulcers; the food should therefore be bland, and to prevent overdistention of the blood, all articles which are prone to undergo decomposition, with the attendant production of flatus, should be avoided. When, from the history of the case and the presence of irregular fever with severe diarrhea, it is probable that ulceration is in active progress, the patient should be kept warm in bed, and fed frequently with small quantities of animal broths and milk; the latter may be predigested, or koumiss may be given. Poultices or turpentine steeps to the abdomen relieve pain; if there be localized tenderness, a small blister to that area will relieve it, and often check the diarrhea. At the onset of an acute attack a dose (3 j-ij) of castor oil in brandy and milk is recommended, preceded in some cases by a small dose of calomel (gr. ss-j). This to be followed by bismuth subnitrate, or carbonate (grs. x-xx) combined with ipecacuanha (gr. ss), or Dover's powder (grs. x.) The use and the dose of opium must be governed by the amount of pain. Subsequently, if diarrhea persist, vegeta-

ble astringents are of use. Tannic acid (grs. iv), logwood or fresh Indian bark may be given, but with these it will generally be necessary to combine opium. Sulphate of copper (gr. $\frac{1}{4}$ - $\frac{1}{2}$) in pill with opium (gr. $\frac{1}{2}$ -1) is a powerful astringent. In a few cases, sulphuric acid and opium is very successful. Pulv. kin. co. is a convenient remedy. In the latter and more chronic stages, where there is reason to suppose the large intestine to be much affected, enemata are often of great service, *e. g.*, enema opii, B. P., with acetate of lead (grs. v) or tannic acid (grs. v) administered twice a day. Some writers recommend large enemata, preferably of linseed tea, to which tinct. opii (m xxx-xl) has been added; where this somewhat heroic remedy appears inappropriate, suppositories will often give satisfactory results (suppos. morphinæ, B. P., suppos. plumbi co., B. P., suppos. acidi tannici, B. P.). Constipation is best treated with small doses of castor oil (3 j).

DAWSON WILLIAMS.

Symptomatic Indications.—In the early stage of the disease the best remedy is *calcarea carb.* Enlargement of the abdomen and mesentery glands, frequent sour eructations, constipation of clay-colored stools, or whitish, watery sour-smelling diarrhea. *Iodine* is valuable when great emaciation exists with good appetite, glandular enlargement, swollen abdomen, hectic fever. *Arsenicum* is useful when diarrhea is severe, great debility, emaciation, and thirst. *Phosphorus*, when there is great nervous debility with trembling, emaciation, copious, watery, whitish, debilitating diarrhea, exhausting, clammy, night sweats.

IODISM.—The condition produced by the administration of salts of iodine, and particularly the iodide of potassium. The symptoms only appear in certain individuals who show a special susceptibility to the action of the drug—*i. e.*, an idiosyncrasy. The most severe effects may follow the administration of a few grains, while they rarely come on in patients taking large doses. Conjunctivitis, lachrymation, swelling of the eyelids, sneezing, and nasal catarrh are early symptoms; the pharynx and gums become congested, and salivation may result if mercury in any quantity be already present in the system. The patient complains of a nasty taste in the mouth, nausea, anorexia,

frontal headache, and tinnitus, and may have wandering neuralgic pains and palpitation. If the drug be not discontinued he gets depressed and suffers from insomnia, and eventually becomes emaciated and cachectic. Certain characteristic effects are produced on the skin, for which see **MEDICINAL RASHES**. The symptoms usually soon subside if the drug be left off, but the severe bullous eruptions take some time to disappear.

INTUSSUSCEPTION.—See **INTESTINAL OBSTRUCTION**.

IRIDECTOMY.—See **EYE, DISEASES OF**.

IRIS, DISEASE OF.—See **EYE, DISEASES OF**.

IRRIGATION.—Applied to the practice of passing a continuous stream of water, usually cold, over a wound, with the object of removing injurious discharges as fast as formed, and of preventing inflammation by the action of cold. A variety of apparatus have been devised for this purpose, the simplest of which is a vessel containing the water which is placed a short distance above the part to be irrigated, from which the water is siphoned through a rubber tube.

A modification of this is made by substituting cotton or worsted threads for the tubes. If the thread be wet, one end dipped in a basin or jug and the longer end brought over the edge, fluid will drop from the longer end, exactly as if it were a siphon tube.

The Thread Siphons are chiefly used to *irrigate wounds* by moistening a cloth kept over their surface. A bottle containing the irrigating fluid (water or antiseptic lotion) is fixed to a cage over the wound. The amount of irrigating fluid is regulated as above. Below the limb, a mackintosh must be placed to catch superfluous lotion.

ISCHÆMIA.—A synonym for local or partial anæmia; the ischæmic part, when pricked, does not bleed.

ISCHIO-RECTAL ABSCESS.—Acute or chronic. Former usually occurs in strong constitutions, latter in weak persons.

Symptoms.—Signs common to abscess everywhere. Chronic cases tend to spread nearly round rectum, and to form sinuses

which may on the one hand burrow into buttock, and on the other become "fistulæ in ano."

Causes.—Blows, kicks, falls, and fissures, ulceration, impaction of foreign body in rectum, phthisical constitution.

Treatment.—Acute abscess requires poultices, fomentations, and ordinary

treatment. Chronic abscesses should also be opened early by free incision, or great danger of fistula will be incurred, general health should be given special attention.

ITCH.—See SCABIES. Also BAKER'S, BRICKLAYER'S, AND GROCER'S ITCH.

FLINT'S

ENCYCLOPEDIA OF MEDICINE AND SURGERY.

JAUNDICE (Icterus).—A yellow color of the tissues and of certain secretions of the body resulting from the absorption of the coloring matter of the bile. If the bile, instead of being poured into the duodenum, pass into the lymphatics of the liver, and thence into the general circulation, jaundice results.

Cases of jaundice may be divided into two classes: (1) in which there is an impediment to the flow of bile into the duodenum, its retention in the biliary passages being followed by absorption and jaundice—*jaundice from obstruction*; (2) cases in which there is no obvious obstruction—the so-called *jaundice from suppression* or *from suspended secretion*. It is, however, preferable to consider the subject from the point of view of the changes in the hepatic blood pressure and in the pressure within the bile ducts. It may be stated that the condition is in all cases due, either to (1) lowering of the blood pressure in the liver, or to (2) a rise of pressure within the bile ducts.

The former of these is observed in *icterus neonatorum*, which occurs in premature or feeble children, where the sudden alteration in the course of the circulation produces changes in the intra-hepatic blood pressure, and jaundice results; a similar condition may occur after the inhalation of chloroform. The production of jaundice in the latter case is probably also favored by a rapid and excessive destruction of red blood corpuscles, which leads to a hypersecretion of bile.

The latter condition is fulfilled whenever there is *obstruction to the outflow of bile*, whenever it arises from catarrhal swelling of the mucous lining of the common duct, from the presence of new growths in its walls or in the neighborhood, which compress the duct, and either narrow or occlude its lumen, or from the presence of foreign bodies, calculi or parasites, or from cicatricial or congenital occlusion of its opening into the duodenum.

The factors which determine the flow of

bile into the duodenum are: the pressure of the newly formed bile forcing onward the contents of the excretory ducts; the interrupted compression of the liver by the diaphragm at each inspiration; and the contraction of the gall bladder under nervous influences.

All cases of jaundice must be ascribed to one or other of these conditions, or to all combined. The jaundice of *fright* or *rage* is to be attributed to lowering of the blood pressure under nervous influence; in *yellow fever* and *septicæmia* to excessive formation of bile owing to increased destruction of red blood corpuscles combined with a lower blood pressure; in some diseases, as in *acute yellow atrophy of the liver*, we only know that there is no obstruction to the outflow of bile, so that we may infer that lowering of the blood pressure in the liver favors its entrance into the lymphatics. The early and rapid destruction of the liver cells prevents the supposition of an excessive secretion of bile, but the diffused yellow appearance of the liver shows that the bile has entered the lymphatics.

ROBERT SAUNDBY.

JAUNDICE, CATARRHAL.—Catarrh of the mucous lining of the common bile duct is most often secondary to catarrh of the duodenum, a condition which is usually due to an extension of catarrh from the stomach. The latter affection may follow errors of diet, the abuse of alcohol, catching cold, long-standing heart disease, pregnancy, enteric fever, pneumonia, Bright's disease, lithæmia, excessive tea-drinking, or malarial fever.

Primary catarrh of the bile ducts occurs in acute phosphorus poisoning, perhaps in some of the conditions named, and from the presence of irritating foreign bodies—*e. g.*, calculi and parasites. Occurs equally in both sexes, and more often in young persons.

Symptoms.—In ordinary simple catarrhal jaundice, however, such as occurs

not infrequently in young persons, they are fairly uniform. The attack commences with considerable malaise, loss of appetite, furred tongue, bad taste in the mouth, headache, and constipation. There may be also some sense of weight in the right hypochondrium. In three or four days the conjunctivæ are tinged yellow, and before this the urine contains bile pigment.

This can be recognized by the eye alone, but should be tested by diluting the urine in a glass to the color of pale sherry and adding nitric acid, containing a certain amount of nitrous acid (as it always does after keeping a short time, when it turns a yellow color) or some diluted liq. iodi (1 part to 10 of water), when a bright green color makes its appearance if bile pigment be present; or some of the urine may be allowed to mix slowly with nitric acid on a white surface, as a plate, when if bile pigments (bilirubin) be present a play of colors from green to red and violet is observed. (Gimelin's test). The green is the only color which really indicates the presence of bile pigment, as the red and violet tints are also produced by the presence of urebilin and indican in the urine.

The liver area is enlarged below the costal margin; there is often tenderness over it, and the gall bladder may be felt just outside the edge of the rectus abdominalis muscle. The stools are pale, clay-colored and of stiff consistence; if the occlusion of the duct be complete they may be as white as curd. The pulse is slow, probably owing to the poisonous action of the bile acids on the heart. The temperature is normal or subnormal.

Yellow vision, or *xanthopsia* sometimes occurs. Pruritus is often very troublesome. An attack of catarrhal jaundice may favor the occurrence of gall stones; and in rare cases, if long continued, may lead to general dilatation of the bile ducts or even to suppuration, and multiple small abscesses may form in the liver.

Diagnosis.—The first indication is often the appearance of bile pigment in the urine, which may be discovered even before there is any tinge of yellow in the conjunctiva or skin.

A new and very simple test has been lately suggested (M. Hay) by which results of some value may be obtained. A few grains of precipitated sulphur are sprinkled

on the surface of the urine, when, if the bile acids be present, the sulphur floats, instead of sinking, as it ordinarily does. It has also been suggested to employ a solution of peptone, which gives a precipitate with these acids. The other diagnostic points are the age of the patient, the absence of pain and the associated pathological conditions.

Prognosis.—The duration of the disease is from two to four or more weeks, and the prognosis is always favorable unless the condition be dependent upon some grave organic condition, such as heart disease. As a complication of pneumonia it is not a cause for alarm.

Post-mortem appearances.—In simple catarrh of the bile ducts these are not well marked. The mucous lining is slightly swollen, and the bile in the passages may be mixed with mucus. The gall bladder may be found distended with bile. The liver is slightly enlarged and bile stained. The stomach and duodenum present the signs of acute or subacute catarrh, more or less injection, and swelling of their mucous lining, which is thick-coated with turbid mucus.

In acute phosphorus poisoning it is the smaller ducts which are the seat of the catarrh, and the gall bladder and secretory ducts may be nearly, or quite empty, while on microscopical examination the small ducts are found to be plugged with desquamated epithelium.

In catarrh due to foreign bodies the tissue changes in the large ducts are more marked, and often accompanied by ulceration.

In very chronic cases of catarrhal obstruction the bile ducts above the obstruction become dilated and filled with bright yellow muco-purulent fluid. The liver is much swollen, stained with bile, and the walls of the gall bladder are œdematous.

Treatment.—The general management of catarrhal jaundice involves rest in bed, milk diet, and sinapisms to the epigastrium. The free administration of mercurials at night, followed by saline purgatives in the morning, is the most successful method of treatment. If there be much gastric catarrh, the following remedies should be employed: \mathcal{R} Hydrarg. subchlor., gr. j; sacch. alb., grs. v; fiat pulvis, mitte daus. Sig. One to be taken at bedtime on two following nights. \mathcal{R} Bismuthi carb., grs. x; sodii benzoatis, grs. x; pulv. rhei, grs. ij.; pulv.

cinnamomi, co. grs. v; fiat pulvis, mitte duodecim. Sig. One to be taken thrice daily in a little milk before meals. The bismuth powders should be continued till the gastric catarrh is relieved, and the calomel may be repeated at intervals of a week. Where there is no very obvious gastric catarrh, the following mixture will suffice: \mathcal{R} Sodii benzoatis, 3 ij; inf. gentiani, $\frac{3}{4}$ vj; misce. Sig. A tablespoonful three times a day before food. And if there be any constipation this pill may be given at bedtime: \mathcal{R} Euonymini, gr. j; ext. aloes, gr. ij; pulv. ipecac., gr. $\frac{1}{2}$; misce; ft. pil.; mitte sex. Sig. A pill to be taken at bedtime.

A tumblerful of hot water should be sipped every morning, in which a teaspoonful of Carlsbad salts have been dissolved, or a tumblerful of Vichy water (Célestins or Haute-Rive) may be taken twice a day with lemon juice.

ROBERT SAUNDBY.

Symptomatic Indications.—*Mercurius* is the main reliance, and is generally sufficient when the jaundice is the result of extension of catarrh to the bile ducts; it is especially useful in jaundice of infancy and childhood. *Cheledonium* is effective when jaundice is associated with pain in the liver and right shoulder; bitter taste, deep red, clean tongue, brown red urine. *Hydrastis* is useful in jaundice from catarrh of bile ducts. *Arsenicum* is valuable in malignant cases with typhoid symptoms, great prostration; especially valuable when of malarial origin or from disorganization of the liver. *Nitric acid* does good service in chronic jaundice from enlargement and induration of liver. *Cinchona* in malarial jaundice, sallow, dingy, yellow complexion, spasmodic, stitching pain in the liver. *Chamomilla* in recent form, especially in children.

JAWS, DISEASES OF THE.—Congenital Deformities of the Jaws.—With the exception of malformations of the palatal process of the maxilla, congenital deformities of the jaws are rare. The mandible is usually affected. Thus, in *congenital dislocation* there is more or less associated deformity of the bone arising partly from the developmental error, and partly from the interference with the action of the muscles which act upon the articulation. In other cases the lower jaw is *congenitally small* from

arrested development without luxation of the temporo-maxillary joint.

Diseases of the Gums.—1. **Simple hypertrophy** of the mucous and sub-mucous tissue of the gums sometimes reaches extraordinary dimensions; in fact, the teeth may be almost hidden by a vascular fungoid mass. The disease is incidental to childhood, although cases are recorded of the affection in the adult, but in them it appears to have commenced very early. The cause is obscure. In the majority of the cases there is defective mental power.

The *treatment* consists in excising the growth. Where it is extensive it is better to remove a piece of the alveolus with it.

2. **Spongy gums.**—The gums are liable to undergo inflammatory swelling and vascular engorgement from a variety of causes. They partake of the general swelling consequent on irritation of the adjacent periosteum and bone. They may inflame and even ulcerate from an accumulation of tartar. But reference is here made chiefly to the state induced by some constitutional disease, *e.g.*, scurvy, scrofula, syphilis; or chronic mercurial poisoning. It is common to find them ulcerated, either alone or as part of a more general stomatitis; notably the case in cancrum oris. Formerly, when it was the fashion to treat syphilis by the administration of mercury until excessive ptyalism was obtained, the unfortunate patients were subjected to the most horrible sufferings; the gums being swollen to a degree, bleeding freely, and exhaling the most fetid odor.

Treatment should be directed to the removal of the cause; to the cleansing of the parts by means of detergent and astringent washes; and to supporting the strength by tonics and a liberal diet.

3. **Lead Staining.**—Seen as a blue line on the gums in cases of chronic poisoning by the metal. Due to the formation of plumbic sulphide; the base, which is contained in the blood as a soluble salt, combining with the sulphur of the sulphuretted hydrogen set free by the decomposition of particles of food and albuminized discharges from carious teeth.

Treatment.—Interdict the further ingestion of lead. Give iodide of potassium with a view of dissolving the metal deposited in the tissues; and follow this up with a quinine and iron tonic.

4. In Addison's disease pigmented patches are occasionally met with in the gums.

5. *Polypus and papilloma of the gum* will be recognized by their general characters, by their localization, and by the fact that neither the periosteum nor the bone is affected. They should be excised, and their bases cauterized.

Epulis.—See EPULIS.

Alveolar abscess is of two kinds, superficial and deep. *Superficial alveolar abscess*, commonly known as *gumboil*, is associated with carious teeth, but it may also be caused by cold and other sources of irritation. It forms a small localized puffy swelling of the gum, which bursts spontaneously or on pressure with the finger. It seldom requires surgical treatment. *Deep alveolar abscess* is situated at the fang of a tooth. It gives rise to tensive, aching pain. The pus wells up by the side of the tooth, or if the resistance to its passage be too great in this direction, it finds its way through one or other of the compact layers of the alveolus. Before the latter is accomplished, the periosteum may be undermined by inflammatory exudation, and more or less necrosis of the bone determined. In the upper jaw the pus frequently burrows between the periosteum and the palatal process; when the abscess points in the roof of the mouth, it may be as far back as the junction of the hard and soft palate. Before bursting, or even afterward, the swelling may simulate a new growth. Again, the floor of the nasal fossa may be perforated, and the discharge, as it drains from the nostril, may at first sight be mistaken as a sign of *ozena*, but there is little or no fetor of the breath.

Treatment.—Extract the tooth without delay. If the abscess has passed the limits of the socket it will require a free puncture. Wash the mouth out frequently with hot water, and cleanse the abscess cavity with a weak solution of Condyl's fluid.

Abscesses of the lower jaw are chronic and acute. *Chronic abscess* may form in connection with the fang to a tooth, or result from suppuration in a dentigerous cyst (*q. v.*). In the former case it is often small, and apparently encapsuled. A suppurating dentigerous cyst will be diagnosed by the symptoms of acute inflammation supervening on expansion of the compact laminae of the jaw, and by the finding of a misplaced tooth in the floor of the cavity.

Treatment of the latter is the same as for a cyst without suppuration, viz., to remove a portion of the wall and extract the tooth.

Acute subperiosteal abscess.—The most common antecedents are caries of the teeth, injury, and exposure to cold. Impairment of the general health strongly predisposes to the onset of the inflammation. The symptoms are those usually met with in suppuration beneath resisting structures, viz., severe aching and throbbing pain, tenderness to touch, and marked constitutional disturbance. In addition to these are others referable to the locality of the abscess. There is spasmodic closure of the jaws. The teeth feel as though raised from their sockets. There is often reflex pain in other parts, supplied by the branches of the fifth nerve. In severe and advanced cases the cheek is much swollen, and the skin over the jaw is tense and shiny. Unless the pus is let out early there is great peril of necrosis. The abscess usually bursts into the mouth either on the lingual or buccal surface of the bone, or at the alveolar border. It may open externally near the angle of the jaw.

Treatment.—If the patient is seen ere the exudation has become purulent, an attempt may be made to arrest the inflammation by puncture, extraction of carious teeth, leeching of the gum, or skin just below the angle of the jaw; and by fomenting the parts internally with hot water, and externally with boracic lint poultices. As soon as pus is formed, it must be let out by free incision, preferably in the mouth, but wherever the abscess shows signs of pointing. The after-treatment includes free drainage and the use of detergent lotions. If the bone has necrosed it must be left to separate before it is removed.

Necrosis.—Suppurative inflammation and necrosis of the jaws may arise from: (1) Injury; (2) caries of the teeth; (3) acute fevers; (4) struma; (5) syphilis; (6) excessive use of mercury; (7) irritation of phosphorous fumes. Often there is a combination of causes, and one may predispose to the action of another; thus, in a scrofulous patient a slight blow may suffice to light up the inflammatory storm; and phosphorous necrosis is rarely seen apart from the pre-existence of caries of the teeth. So, too, mercurization, and the disease it is intended to cure (syphilis),

may act jointly in the induction of necrosis. Lastly, the cause may be obscure.

The earlier *symptoms* are those of "alveolar" and "periosteal" abscess. They vary in intensity according to the cause of the inflammation, the general state of health of the patient, and the time at which efficient treatment is commenced. When the necrosis forms part of a gangrenous stomatitis supervening on an acute specific fever, the suffering may be comparatively slight. It may be said that the more rapid and profuse the formation of pus in the initial stages of the disease, the more pronounced will be the local and general symptoms. *Loss of appetite and disordered digestion* need special mention, for besides the usual effects of acute inflammation ending in necrosis, the patient experiences difficulty in the ingestion of food, copious and continual salivation, and gastric irritation from the swallowing of fetid discharges.

The symptoms of *necrosis* may be associated with those of *caries*, especially where the lesion is entirely or in part dependent on constitutional depravity, as obtains in scrofula, syphilis, etc. This will be indicated by (1) the continued and progressive course of the disease after the primary abscess has been opened, (2) by the probe coming in contact with soft disintegrating tissue, as well as meeting with the dead resistance of necrosed bone.

Phosphorous necrosis is characterized by: 1. The insidious onset of the lesion. 2. Its sometimes appalling extent. 3. The superabundant formation of soft spongy bone, the osteo-plastic and destructive processes going hand in hand together. It rarely develops except in the presence of caries of the teeth. The immediate cause seems to be the irritation from the oxidized products of phosphorus, most likely phosphorous acid. The disease is not nearly so frequent as formerly, for red amorphous phosphorus is largely substituted in the manufactures for the yellow, readily oxidizable poisonous variety. Although a large amount of new bone is formed around the necrotic portions, it becomes rapidly less by absorption, after the sequestra are removed. The soft tissues about the jaw are swollen and spongy, and bleed freely on the least provocation. The entire jaw may lose its vitality. In one case the

carotid artery had to be tied to arrest the hemorrhage attendant on the operation of sequestrotomy.

Treatment.—The dead bone should be allowed to separate before an attempt is made to remove it: 1. Because, prior to this, the extent of the necrosis may not be evident. 2. Because, when the necrosis involves the whole or the greater part of the thickness of the jaw, the force employed may fracture the surrounding deposit, and any of the old bone that may have retained its vitality. Apropos of the danger of fracture, I may say that I have known the action of the powerful masticatory muscles to suddenly snap the bridge of new bone left after extraction of a large sequestrum from the lower jaw, ten days after sequestrotomy. From this experience I advise the surgeon, in cases where the new bone is very porous, or deficient in amount, to restrict the movement of the jaw after the operation until the necessary support is obtained. With this end in view the patient should be ordered liquid and minced food. Except where the necrosis is superficial, *e. g.*, at the angle of the jaw, and the dead bone can be extracted by enlarging an external sinus, the sequestra should be removed through the mouth. There are few cases that do not admit of this procedure. To facilitate the operation it may be expedient to divide the sequestrum with cutting forceps. Care should be taken to apply traction in the axis of the bone, especially when the necrosis affects the ascending ramus. Twisting of a fragment might wound the inferior dental artery. The patient should be told not to swallow the discharge, and in order that it may drain through the mouth during sleep, he should be advised to lie on the affected side. To prevent the matter becoming pent up or burrowing, it is well to plug lightly the cavity which furnishes it. Decomposition should be checked by the frequent use of antiseptic lotions. Any loose or carious teeth in the vicinity of necrosis must be drawn.

Diseases of the Temporo-maxillary Articulation.—**A. Chronic rheumatic arthritis** is a disease incidental to advanced life. It is comparatively rare. It may affect one or both joints. The pathological changes are of the same nature as obtains in the other joints, *e. g.*, the hip. There is a gradual absorption of the articular cartilage. The interarticular

fibro-cartilage disappears. Simultaneous with the destructive process, a quantity of new bone is formed, so that the condyle of the jaw is much enlarged, it may be to such an extent, when the disease is unilateral, as to tilt the chin toward the opposite side. Greater freedom of movement in a forward direction is allowed by the absorption of the eminentia articularis. This may be so marked as to amount to a partial dislocation, which, of course, is apt to recur. The dislocating force is the action of the external pterygoid muscle. When both joints are affected, the jaw is carried directly forward by reason of the luxation. The patient complains of more or less aching pain in the part, and a sensation of creaking when the joint is moved. The cervical lymphatic glands may undergo irritative enlargement. In extreme cases, movement of the jaw is impossible. The *treatment* consists in giving iodide of potassium, and in the application of counter-irritants over the articulation. If the deformity is great and the jaw fixed, the condyle may be excised. The disease is incurable.

B. Acute arthritis is caused by (*a*) traumatism; (*b*) inflammation of the middle ear, extending to the joint through a fissure in the tympanic plate. This variety, like the following, is mostly met with in children. (*c*) Acute exanthematous fevers, especially scarlatina. The *symptoms* are swelling below the zygomata, severe pain, increased by pressure, or by an attempt at movement of the jaw, which is checked directly by the swelling, and reflexly by the pain. If suppuration occurs, the pus escapes by a sinus on to the face; or by way of the external auditory meatus.

Treatment.—Rest the joint. To carry this out the patient should be placed on liquid diet. If the inflammation is severe, apply a couple of leeches over the articulation. Foment the part and protect from cold. If the middle ear is diseased it will require attention.

C. Enlargement of the condyle of the lower jaw may arise from injury, but as a rule it is the result of chronic rheumatic inflammation, associated or not with affection of other joints. It may so seriously impede the movement of the jaw as to necessitate removal of the enlarged mass.

Anchylosis of the Jaws is the abiding

result of past arthritis. The bones may be united by fibrous bands or by bone. The patient is unable to masticate.

Treatment.—If the anchylosis is of the fibrous variety, the surgeon should attempt to remove the adhesions either by means of a screw gag or by passing a tenotome into the joint. Should these means fail the condyle must be excised; this is best done by a **T**-shaped incision, the larger horizontal cut being made just below the zygoma, and the vertical one below this. The temporal artery should not be divided. The condyle can be raised from its bed by means of an elevator. Osseous anchylosis peremptorily calls for excision. It may be necessary to saw the bone twice, at the neck and through the line of union; but usually one cut is sufficient, the condyle being then wrenched away from the temporal bone. The operation, on the whole, is very successful in restoring the movement of the jaw.

Closure of the Jaws is of two varieties: (1) Spasmodic, due to reflex contraction of the muscles, from acute irritation of one of the branches of the fifth nerve supplying the jaws and teeth. It is seen in varying degree during the cutting of the wisdom teeth. (2) Organic or permanent from (*a*) anchylosis of the joint; (*b*) contraction of the cicatrices within the mouth; (*c*) contraction of inflammatory lymph effused into the masseter muscle. Cicatricial contraction of the mucous membrane and deeper tissues of the cheek is the result of acute destructive inflammation, or of gangrene. It is a sequel of ulcerative stomatitis, and of cancrum oris, and is consequently met with after the acute fevers, chronic mercurial poisoning, etc. It may also be a consequence of cauterization or corrosion. The natural elasticity of the parts is replaced by fixed rigidity, so that the jaws are held firmly in contact. I have seen almost complete closure as a consequence of simple and syphilitic plastic periostitis of the ramus of the jaw, the masseter muscle being invaded and stiffened by the inflammatory process. If there is destruction of the mucous membrane throughout its full depth, viz., from one jaw to the other, closure is an inevitable result, and the chances of attaining useful movement turn upon the success attending *surgical treatment*. If the cicatricial band is a narrow one, it may be possible to restore the mucous membrane by a plastic op-

eration ; or to stretch the band by a spring or lever gag.

In severe cases but little good can be expected from this procedure ; it requires to be carried out systematically, for a long time, and the patients get tired of the pain and inconvenience ; and the contraction returns with certainty when the treatment is discontinued. If the process of stretching the cicatricial tissue fails, or it is not deemed expedient to resort to it, the patient must either go unrelieved, or submit to *division of the lower jaw* in front of the contraction. It is certainly the surgeon's duty to advise the operation, since it is not attended with much danger, and if properly performed it gives excellent results. The object in view is to establish a false joint. To effect this, remove a wedge-shaped piece from the lower jaw, the apex of the wedge being at the alveolar border. To be secure against ankylosis at the seat of operation, it is necessary that the base of the wedge should be nearly an inch in length. The alternative operation is simple division of the jaw from within the mouth by means of cutting forceps.

If the closure depends on interstitial contraction of the masseter, the muscle should be gradually stretched by forcing open the mouth by mechanical apparatus, and if this does not succeed it should be divided by a tenotome passed through the mucous membrane of the cheek. Care must be taken to avoid wounding any large vessel. The bleeding that ensues on incising the muscle can be arrested by firm pressure with a pad and bandage applied over the ramus of the jaw. Considerable relief may follow the administration of iodide of potassium in cases where the masseter has become implicated by the inflammation which started as syphilitic periostitis. Commencing with five grains, the dose should be rapidly pushed to twenty-five grains three times a day.

Diseases of the Antrum.—See ANTRUM.

Tumors of the antrum and upper jaw.—In addition to the cysts originating in the antrum, the upper jaw may be the seat of (a) dentigerous cysts connected with retained teeth ; (b) simple cysts, which probably have their starting-point in disease of the teeth fangs ; (c) cystic tumors, especially the sarcomata.

Epithelioma.—There are two forms of

epithelioma of the upper jaw. *Squamous*, which begins in the mucous membrane of the palate or gum. *Columnar*, arising within the antrum. The latter is the rarer of the two, and its true nature cannot be diagnosed without a microscopical examination. The former presents the general clinical and pathological characters of squamous epithelioma, modified only by the density of the tissue in which it spreads. It is prone to ulcerate and form an irregular fungating mass which yields a fetid discharge, and is very liable to bleed. The cervical lymphatic glands are sooner or later affected. Secondary growths in the internal organs are rare. The patient succumbs under the combined influences of septic absorption, hemorrhage, and dyspepsia from inability to masticate food, and probably from the injurious effects of swallowing the decomposing discharges. Pneumonia, from the inhalation of septic matter, is a common occurrence.

Sarcoma affects patients of all ages, but it is chiefly met with in young and middle-aged adults. Every form may be observed, but the most common varieties are the round and spindle-celled, or a mixture of the two. Myeloid usually grows in the form of an epulis from about the teeth sockets. Central myeloid is not nearly so frequent as in the lower jaw. The tumor may undergo nutritive modifications ; thus it may ossify, chondrify, or become studded with cysts of various sizes. As regards their malignancy, sarcomas of the jaws differ widely, *e. g.*, one meets with a firm, spindle-celled tumor of slow growth, and with little tendency to recurrence after removal ; while in a second case there is a pultaceous, highly vascular mass, which runs its course with appalling rapidity, so that within a few months the patient dies from the effects of the local disease and widespread dissemination in the viscera and other parts. The so-called "vascular tumors" are in reality soft sarcomas richly supplied with blood vessels, and in fact largely composed of them.

Fibroma occurs in two situations, within the antrum ; attached to the periosteum of the gum (fibrous epulis).

Enchondroma is rare to a degree. It may form the main bulk of the growth, but as a rule it is combined with round or spindle-celled sarcoma. In fact, enchondromata of the jaws are for the

most part chondrifying sarcomas. The recurrent growths are softer, and contain fewer cartilage elements than the primary tumors.

Osteoma is more common in the lower than in the upper jaw. There are two varieties, marked respectively by the cancellous or ivory-like structure of the new-formed bone. There is some doubt whether "*diffuse hypertrophy* of the bones of the face," including the upper jaw, should be considered with the tumors proper or be relegated to chronic inflammation of bone. Its affinities appear to belong rather to the former, for it develops irrespective of injury or known constitutional disease. It belongs to the periods of childhood, youth, and early adult life, and it is utterly unamenable to treatment. The bones become "spongy, puffed, nodular."

Diagnosis of tumors of upper jaw and antrum.—On account of the complicated anatomy of the maxilla the diagnosis of the different forms of new growths is often beset with difficulties. This applies with greatest force to tumors of the antrum, where, in the early stages, mistakes may easily be made. The surgeon should, in the first place, ascertain whether the tumor is solid or fluid or a combination of the two. The answer to this will often give a clew as to whether the growth is simple or malignant. Malignant growths are further indicated by rapidity of increase, early bulging of the antral walls, implications of the soft parts with ulceration and fungation, and, lastly, by the evidence of cachexia and secondary formations. The lymphatic glands are usually affected in the carcinomata, occasionally in the sarcomata.

The primary seat of the growth will lend some aid to the diagnosis; *e. g.*, a tumor attached to the alveolus is probably a myeloid or fibrous epulis, or an epithelioma. Distention of the antrum is suggestive of a cyst; but on the other hand it may be caused by solid growth. Again, it is important to ascertain not only whether the tumor has started from the antral walls, but whether it is confined to the cavity. The treatment and the diagnosis turn largely on the answers to these queries.

Treatment of tumors of the maxilla and antrum.—In the case of a simple growth it is sufficient to remove it, together with its base of attachment. When the antrum is involved the precise

operation will depend upon the size, nature, and connections of the tumor. Thus, the extirpation of a simple polypus may be affected through an opening made into the cavity from within the mouth. Larger growths, and especially those connected with the naso-pharynx, or pterygoid region, require removal of the jaw, or "osteoplastic section." The latter procedure consists in temporarily displacing the jaw to give room for the necessary manipulations. Unless the entire tumor can with certainty be removed, an operation is worse than useless; nor should it be attempted when the surrounding lymphatics or the superjacent skin is widely infiltrated. The mere fact of the skin being involved is not a contra-indication. I have removed the entire jaw with one side of the nose and a portion of the cheek for a rounded sarcoma, and which, after the lapse of two years, has not recurred. In the case of malignant growths the only alternative to an operation is leaving the patient to endure terrible suffering and certain death within a short period. Enlarged lymphatic glands may be extirpated if they are not massed together and adherent to the deep structures; *e. g.*, the carotid sheath.

Tumors of the lower Jaw.—The tumors of the lower jaw are the same in kind as those met with in the upper. There are some, however, which occur with greater frequency in the former situation: *e. g.*, cysts, either as a substantive disease or in combination with solid growths, central myeloid sarcoma, and epithelioma, or adenoid cancer.

AUGUSTUS J. PEPPER.

JOINTS, INJURIES OF.—Contusions.—Joints are often *contused* by direct violence, such as falls, blows, or kicks. The injury ought always, but especially in the young and delicate, to be regarded as serious; for with very slight external evidence of injury a considerable amount of mischief may be set up, or consecutive inflammation of the structures entering into the formation of the joint may follow and involve the integrity of the articulation. Thus, in delicate children, a contusion of the hip, from a fall on the trochanter, may be the starting-point of hip-joint disease, which may run its course to complete destruction of the articulation.

In some cases there is little to mark the

injury beyond the history of the accident and pain, increased on moving the joint; in other cases, rapid swelling of the articulation follows, indicating the effusion of blood, mixed with synovia, into the cavity of the joint. In these latter the blood and fluid, under the influence of appropriate treatment, is slowly absorbed, generally without leading to any permanent inconvenience.

Treatment.—The essence of the treatment consists in perfect rest and the maintenance of complete immobility of the joint by the application of a splint; and there is good reason to believe that, in the majority of cases, if this were thoroughly carried out, no untoward results would ensue. The limb should be raised, and cold, by means of evaporating lotions, Leiter's tubes, or an icebag assiduously applied. If the joint is so much distended with fluid as to cause tension and severe pain, it may be relieved by means of the aspirator.

Symptomatic Indication.—*Arnica*.

Sprains.—By *sprain* is meant a violent twisting or wrenching of a joint, whereby its ligamentous and tendinous structures are stretched or torn, but in which there is no separation or displacement of the bony surfaces from each other.

The amount of lesion varies from a slight tearing of a few ligamentous fibers to a complete laceration or detachment of one or more of the ligaments of the joint, with perhaps displacement of tendons from their sheaths, laceration of muscles or tendons, and considerable extravasation of blood. In some cases small scales of bone, to which the ligaments are attached, may be torn away, constituting "sprain fractures." The lesions of a severe sprain closely resemble, and differ in degree only, from those of fracture, with which they are very liable to be mistaken.

Symptoms.—The immediate effect of a sprain is very severe pain, often of a sickening character, rapidly followed by a swelling, partly due to extravasation of blood into the surrounding tissues, and partly to effusion taking place into the cavity of the joint, as the result of inflammation which has been set up by the injury. After a short time, discoloration, extending for some distance above and below the joint, appears. There is inability to bear any weight on the limb, and any attempt to move the joint surfaces

on each other is attended by increased pain. The degree and extent of these symptoms depend upon the amount of injury which has been sustained,

The remote effects of this lesion are often permanent pain and weakness, or stiffness and even ankylosis. The former of these conditions may arise from imperfect repair of the torn structures, or from non-absorption of the effused fluid; the latter from chronic inflammation causing adhesions within the joint, or in the sheaths of the neighboring tendons. In some constitutional conditions, as the rheumatic or scrofulous, the subsequent inflammation may assume the characteristic type of these conditions, and be very persistent.

Treatment.—Sprains require as much care and attention as many graver injuries, and perhaps a greater amount of judgment on the part of the surgeon; for whereas rest is absolutely necessary for the repair of the lacerated tissues, too protracted rest is often mischievous, stiffening the joint and delaying recovery, so that it often requires great discrimination on the part of the surgeon to know how long to continue to keep the joint at rest and when to commence passive motion. Immediately after the receipt of the injury the limb should be laid on a pillow in the position most comfortable to the patient, or, what is perhaps better, loosely connected to a splint, taking care to leave the injured part exposed. This secures perfect immobility of the joint, and at the same time prevents stretching of the damaged tissues by supporting the limb. Cold assiduously applied, to subdue inflammation and prevent further effusion, will generally be found agreeable to the patient. This may be done by irrigation with spirits and water, which is to be preferred to the application of a bag of pounded ice, or Leiter's tubes, the weight of which is generally a source of annoyance and discomfort. Sometimes warm applications, such as hot Goulard water with laudanum, or poppy fomentations, are more grateful and may be applied. As soon as the patient can bear it, equable pressure must be resorted to, and will be found a most potent means of promoting absorption of the effused fluids. This can be done by means of a bandage wetted in lead lotion and carefully applied, the bandage being kept constantly damp with the lotion; or strapping may be used.

This treatment must not, however, be continued too long, but as soon as the patient can bear passive motion without pain or renewed inflammation, systematic shampooing and movement of the joint must be resorted to with friction, and the patient must be encouraged to use the limb as much as possible without causing himself pain.

Symptomatic Indications.—The principal remedy is *arnica*, which is usually all that is needed; *aconite* may be required if inflammation should develop. *Rhus tox.* may be useful, when joint is stiff, with pain on first moving.

Wounds of Joints.—Are always serious, the severity depending partly upon the nature of the wound and the size of the articulation, but also, to a considerable extent, upon the age and general constitutional condition of the patient. The wound may be incised, punctured, or lacerated; but the severity of the symptoms does not depend so much upon the extent or nature of the local mischief, as upon the fact that putrescible matter collects in the cavity of the joint and undergoes decomposition, setting up a serious train of symptoms and leading to complete destruction of the articulation. Medium-sized wounds are often the most dangerous, especially if the edges are contused and lacerated, so that they cannot unite by adhesive inflammation and at the same time are not large enough to permit of the thorough drainage from the cavity of the effused fluids.

If the wound into the joint is large, so that the articular surfaces are exposed, the nature of the injury is at once evident; but if the wound is small, and particularly if it belongs to the class of punctured wounds, some doubt may rise as to whether the joint has been opened or not. This will generally be solved by the escape of synovia, which will be recognized by its oily, glutinous character. In some cases, however, this fluid does not exude; but under no circumstances is it admissible to introduce a probe to clear up any doubt, for it may have the effect of completing the perforation into the articular cavity, and thus inducing the mischief which is to be dreaded. The standard rule in every case of wound in the neighborhood of a joint, running in the direction of the articulation, ought to be to treat the case as *one of wound of the joint*, until the subsequent progress of the case proves that

no perforation has taken place, or that, if it has, the wound has rapidly healed, without setting up a serious amount of inflammation.

Pathology.—When a joint is wounded it rapidly becomes filled with an accumulation of blood, followed almost immediately by synovial fluid, mixed with serum derived from the vessels of the synovial membrane and the clotted blood in the sac. Thus the joint is distended with a highly putrescible matter, to which air is admitted through the wound. It therefore rapidly undergoes decomposition and becomes converted into a septic material which results in an acute inflammation of all the tissues of the joint.

There are certain cases where this may not occur, even though no special treatment is adopted to prevent it. If, for instance, the wound is small, and is inflicted with a clean instrument, and if the edges are brought into immediate apposition, union by adhesive inflammation may take place; no air is admitted to the joint, and no decomposition of the effused fluids ensues. Thus, we find that a surgical wound may be made into a joint, as, for instance, for the removal of a loose cartilage, without any destructive changes taking place in the joint. Again, on the other hand, if the wound is large and the articulation freely opened, so as to allow the effused fluids to escape, no retention of decomposable matter takes place, and there is therefore no septic influence brought to bear on the part, and recovery may take place without any severe local or constitutional disturbance.

If, however, the cavity becomes filled with putrescible material, decomposition speedily sets in, if this material is brought into contact with impure air; and acute inflammation, running on to suppuration, is the result. During the first twenty-four hours or so, the synovial membrane becomes intensely injected and red, and loses its natural luster. Its fringes also become injected and swollen. The cavity becomes filled with a thin, turbid synovia, in which bacteria are commonly to be found on microscopic examination. The ligaments become swollen and softened. The cartilages lose their natural lustrous appearance, and become opaque and yellow, loosened from the surface of the bone, and eventually they perish and become eroded, especially in their centers, or where the two articu-

lar surfaces are in contact. The articular ends of the bones become exposed and superficially ulcerated. The inflammation extends to the structures outside the joint, which become œdematous, and in which suppuration occurs. Later, in about a week or ten days, the joint surfaces become covered with a layer of granulation tissues, and the cavity of the joint filled with a thick creamy pus. It is now impossible to recognize the various structures, which present a uniform gelatinous appearance, infiltrated with inflammatory products. In this way, the whole of the tissues of the joint are thoroughly disorganized and destroyed, and the bone surfaces laid bare and ulcerated.

If the patient's strength has survived this protracted disintegration, a reparative process now sets in. Granulations spring up from the exposed bony surfaces, and, coalescing, become converted into osseous matter, just in the same manner as in the union of a compound fracture, and complete synostosis takes place.

Symptoms.—If, in a case of wound of a joint, these untoward conditions are set up and the case becomes one of septic inflammation, within a few hours of the receipt of the injury great swelling of the joint comes on, accompanied by acute lancinating pain. The swelling is at first due to effusion into the synovial membrane, and takes the shape of this sac; but after a time the tissues external to the joint become infiltrated, and the swelling more globular. The skin is red, hot, and œdematous. The pain rapidly increases and becomes tensive in character. If the wound is left open, synovia, turbid and opaque and mixed with shreds of lymph, escapes. The limb is semiflexed. Later the pain becomes altered in character, and is described as throbbing. The swelling and œdema around the joint increase, and the redness is of a more dusky hue. There is starting of the limb, especially at night, or as soon as the patient falls asleep. The constitutional symptoms are very severe, especially during the first ten days or so, during which time absorption readily takes place through the synovial membrane. Later, when this structure becomes covered with granulation tissue which offers a barrier to septic absorption, the fever becomes considerably lessened. In the early stages the temperature is very high, the thermometer sometimes registering 105°

or 106°. The pulse is full and bounding; the skin hot and dry; the face flushed, and the tongue covered with a thick creamy fur. There is often nocturnal delirium, with restlessness and inability to sleep. Or should the patient fall asleep, he will be awakened by the sudden, painful starting of his limb. Later, when the fever lessens, it assumes a more hectic type. There are often rigors, and the patient may die from pyæmia, or, at a still later period, from exhaustion from the excessive discharge.

If the wound in the joint is small, and unites by first intention, and the patient escapes the danger of septic inflammation, there will probably be some swelling, from effusion into the joint, accompanied by heat and pain, which will pass off in the course of a few days, and the joint be completely restored, though it may be stiff and tender for some time.

Treatment.—The first question is whether any operative interference will be necessary. In deciding much will depend upon the joint implicated, its size, and whether it is situated in the upper or the lower extremity. Wounds of the joints of the upper limb, as a rule, do much better than those of the lower. To this, however, there are exceptions, for wounds of the wrist-joint are particularly dangerous, while those of the ankle, unless complicated with fracture, or extensive injury to the soft parts, often do well, and recovery takes place with a fairly useful limb. If the joint has been extensively opened, with much contusion and laceration of the edges of the wound, and especially if the articular ends of the bones are fractured or displaced, operative measures will probably be necessary. In less severe injuries an attempt should be made to save the joint. Under these circumstances, in conducting the treatment much will depend upon the nature of the wound. If it is a small puncture or a cleanly incised wound, especially if it passes obliquely into the joint, an endeavor should be made to procure union by the first intention. The wound, if sufficiently large to require it, should be sewn up with silver wire, and coated with collodion or some other material, which will completely exclude the air. The limb must be placed on a splint, so as to secure perfect immobility of the joint, and irrigation with cold water, or spirit and water, assiduously applied. This is much

to be preferred to the application of an icebag, the weight of which is often uncomfortable and distressing to the patient. If the joint swells the case is one of considerable anxiety to the surgeon; but as long as the temperature does not rise to any considerable extent, the treatment must not be abandoned. If the pain is very severe, and tensive from the distention of the cavity, the fluid should be evacuated with the aspirator, and opium should be given to relieve pain and procure sleep. If, however, the temperature rises, and suppuration has evidently taken place, long and free incisions must be made into the joint, which must be thoroughly washed out with some antiseptic lotion, such as carbolic acid lotion or tincture of iodine and water, and free drainage provided for. The syringing out of the wound must be continued daily, and the part must be dressed with carbolic gauze, carbolic oil, boracic acid, lint, salicylic wool, or some such antiseptic material. If the temperature falls, and the discharge lessens, care must be taken to maintain the joint in such a position that, when ankylosis results, the patient's limb shall be of service to him. If, on the other hand, the high temperature is maintained, and the discharge continues profuse, and symptoms of hectic develop, amputation must be at once resorted to.

If the wound in the joint is a large one, and particularly if its edges are contused and lacerated so as to preclude all hope of obtaining union by first intention, the case must be treated on antiseptic principles from the first, so as to endeavor to prevent decomposition. The joint should be thoroughly washed out with carbolic acid lotion (1-20), and every particle of foreign matter and blood clot carefully syringed away. A drainage-tube is to be inserted, and if the wound is in such a position that complete drainage cannot be obtained, a counter-opening is to be made in the most dependent part, and a tube inserted. The external wound must now be closed by sutures, and the limb fixed on a splint and dressed with some antiseptic dressing. If, in spite of all the efforts of the surgeon, septic inflammation should supervene, the case must be treated in the manner before mentioned. Generally, however, it will be found in these cases, if antiseptic measures are rigidly carried out, that though suppuration may come on, the discharge will be

very slight in amount, and will be unaccompanied by fever, and that recovery will take place with comparatively little local inflammation or constitutional disturbance by complete bony union of the articular ends.

J. PICKERING PICK.

Symptomatic Indications.—In all contused wounds of the joints *arnica* is the principal remedy; *hypericum perf.* in lacerated wound; *ruta graveolens* in injuries of the periosteum. *Calcium sulph.*, when suppuration appears inevitable, limits and controls.

JOINTS, DISEASES OF.—Synovitis.—Inflammation of the synovial membrane of the joints may occur in a variety of forms. It may be, as to its intensity, acute, subacute, or chronic; as to its products, serous or purulent; while, as to its cause, it may be local when dependent on some mechanical injury or overexertion; or general (or constitutional) when due to struma, rheumatism, pyæmia, etc. Although acute and chronic synovitis merge insensibly into each other, through the various grades of the subacute form, they yet, when typical examples are selected, present a strong contrast, alike in respect to their morbid anatomy, their symptoms, and their results.

Acute synovitis.—The changes that take place are in all respects analogous to those met with in inflammation of any of the connective tissues. The membrane becomes vividly injected with blood, so that its surface presents a bright red appearance, involving especially the various folds and processes, whose color forms a striking contrast with the pearly whiteness of the articular cartilage; while here and there are to be seen minute petechial specks, or larger extravasations of blood which has escaped from overdilated vessels. Becoming rapidly loaded with exudation products, the membrane is rendered velvety and succulent, and so swollen that it overlaps and obscures the borders of the articular cartilage, and lies closely packed in all the recesses of the joint. At the same time, the synovial fluid rapidly increases in quantity, and becomes charged with inflammatory products, so that the articular cavity becomes distended. The fluid is at first clear, but is afterward mixed with leucocytes, and flakes of fibrine, which give it a cloudy appearance; and

commonly also with a small admixture of extravasated blood. Having advanced to this stage, when all its characteristic features as an acute inflammation have been developed, synovitis, under the influence of treatment, may subside, and undergo resolution, cell proliferation cease, exudation products be absorbed, the blood vessels regain their normal caliber, and the membrane recover its natural appearance. In other cases, however, which from the first are more severe, or in which appropriate treatment is not brought to bear, the synovial fluid is rendered turbid and milky by cell exudation, and converted into completely formed pus. Should pus thus resulting be evacuated early, under safeguards against septic infection, repair may occur, and the membrane gradually return, in part or altogether, to its normal condition. In many instances, however, an acute purulent synovitis passes on to destructive changes involving the membrane itself, the ligaments, and articular cartilages, and even to some extent the ends of the bones forming the joint, so that a general arthritis is established.

In *subacute synovitis*, changes similar to those occurring in the early stage of the acute form are met. They are, however, less marked, and of lower intensity.

In **chronic synovitis**, whether primary and induced by some local cause too mild in its action to excite acute inflammation, or remaining after acute inflammation has subsided, the synovial membrane is unduly vascular (often rather from venous congestion than from active arterial injection, such as is present in the acute form), swollen, and succulent, and loaded with exudation products, which, as the case proceeds, may either undergo development into fibrous tissue, so that the membrane becomes thickened and indurated, or pass into a state of fatty or "pulpy" degeneration. The amount of fluid in the articular cavity may be but little increased; but generally it is in considerable excess, so that the synovial membrane is distended. The fluid is largely diluted with serum, and often highly albuminous, but as it contains few exudation cells, or flakes of fibrine, it is either only slightly opalescent, or remains quite clear. Although often prolonged over considerable periods, chronic synovitis usually at length undergoes resolution, and the changes are slowly

repaired; fluid is absorbed, swelling subsides, and the tissues return to their normal degree of vascularity.

Symptoms of acute synovitis are pain, of a tense, bursting, or burning character, worse at night, and aggravated by the slightest movement of the joint, but generally not associated with those spasmodic startings of the limb which occur when the deeper structures are affected; swelling, which, as it is due mainly to effusion into, and as it takes the shape of, the synovial membrane, is very characteristic; in very acute cases swelling is due in part also to effusion into the soft structures around the joint; heat detected when the hand is lightly placed on the surface, tenderness on pressure, and in severe cases, a faint surface blush. The joint is somewhat flexed, and is kept in the position of greatest ease, so that the capsule and ligamentous structures are relaxed. Muscular atrophy, detected on measurement, is generally present early in the case, and sometimes is well marked even in a few days. These various symptoms, after persisting for a time, may gradually subside, and recovery may take place, the usual result when appropriate treatment has been adopted. The affection, however, is apt to be prolonged into the chronic stage.

Treatment.—The first step in the treatment of *acute synovitis* consists in placing the articulation at complete rest. This, in the joints of the upper extremity, is effected by means of well-fitting splints; while, when the joints of the lower extremity are involved, the patient must also be confined to the horizontal posture. The position of the joint is a matter of great importance. It must be borne in mind that the attack may, through the formation of adhesions, leave the articulation fixed; and that, as the result of softening of the ligaments, and reflex spasm of some of the surrounding muscles, there is a marked tendency, especially in the hip and knee, to the production of deformity. The joint must, therefore, be very gently brought into a position in which, should it be left stiff, it may still be useful. To effect this, and while splints are being applied, an anæsthetic may, particularly in children, be used with advantage, both to produce muscular relaxation and to save pain. Subsequently care must be taken that no

deformity is allowed to occur. At present leeches are seldom employed, nor often required; yet, when the inflammatory process is very acute, and sudden in its onset in strong adults, the application of eight or ten leeches has a markedly beneficial result. Much relief also is obtained by cold evaporating lotions, the application of an icebag, or by irrigation with iced water. Should the synovial cavity become rapidly distended, the fluid may be drawn off with the aspirator, the utmost care being taken to avoid the entrance of septic matter. The removal even of three or four drams from the knee-joint will often give great and permanent relief. Should the case be seen at its very commencement, or in the first few hours after the attack has set in, the inflammatory process may sometimes be checked by the application of an india-rubber bandage, which should, however, not be put on tightly. This method is appropriate in instances in which synovitis has been produced by a sprain or wrench, particularly in such joints as the ankle and the elbow.

Adequately treated, acute synovitis usually subsides in the course of from three to eight or ten days, and recovery gradually takes place. In some instances, however, the affection runs on to suppuration; a result indicated by an increase of pain and swelling, the appearance of a distinct blush on the surface, and the presence of œdema of the soft parts around the joint; by rise of temperature to 101° to 104° , often by the occurrence of a rigor; and by an increase of the symptoms of general illness, the patient being restless, and unable to sleep or take food, and showing rapid loss of flesh and strength. The treatment necessary under these circumstances is that laid down for acute arthritis.

Subacute and chronic synovitis.—As in the acute form, the joint must be kept at complete rest. Small blisters are often useful. They should be applied in a series of three or four, one healing before the next is put on. In tedious cases the blistering may be continued for three or four weeks, or may be superseded in adults by the application of the benzoline cautery. If the joint still contains fluid, or if thickening of the synovial membrane remains, uniform pressure by means of the india-rubber bandage, carefully adjusted twice or three times a day,

should be used. Under this application swelling will often completely disappear in the course of a very few days. Should this plan fail, the joint may be covered with the unguentum hydrargyri or the unguentum hydrargyri compositum spread on lint, and over this the elastic bandage be adjusted. Rest must be maintained as long as there is heat or pain in the joint; or while either of these symptoms or any increase of stiffness is produced by tentative exercise. Later, the joint may be douched with hot salt water and rubbed with stimulating liniments, and passive movements (provided they do not produce swelling, heat, or stiffness, that does not quickly subside) may be used. In some instances the joint remains distended with a large quantity of fluid, constituting one of the forms of hydrops articuli.

Symptomatic Indications.—In acute cases, when inflammation is marked, *aconite* is the main remedy, followed by *bryonia* when acute symptoms have subsided. *Kali iod.*, is useful in chronic cases, especially when of syphilitic origin, predominance of serous effusion. *Mercurius* is valuable in chronic scrofulous cases. *Pulsatilla* in children; chronic swelling after acute synovitis, does good service. *Apis mel.* is valuable when there is much effusion without great pain; tenderness, burning, and stinging. *Calcium sulphide*, when suppuration is apparent. *Silicea*, after evacuation of the pus.

Pyæmia.—In pyæmia the joints may be attacked at any period of the disease which, though often acute, is sometimes chronic, and prolonged over many months. In acute cases, often the first symptom of blood poisoning is synovitis of the shoulder, the knee, or some other joint, and soon other articulations are involved.

In the worst cases several joints are attacked in rapid succession. In these instances the synovial membrane is acutely inflamed, and the joint rapidly becomes distended with flaky pus, often mixed with blood, giving it a red or grumous appearance; and the membrane itself, the ligaments, and the cartilages undergo destructive changes; the skin becomes red, shining, and perhaps œdematous, and the joint within three or four days becomes completely disorganized, the capsule bursts, and the surrounding soft parts become widely involved. In less severe examples the inflammation is subacute, and

the synovial cavity is distended with pus, so that its outline is marked out by a flaccid swelling, in which fluctuation is extremely obvious; the skin, however, is unaltered, and there is so little heat or pain that the patient makes no complaint of the joint, the condition of which may be easily overlooked, or be only accidentally discovered; while on post-mortem examination little swelling or redness of the membrane is to be observed; and the ligaments and the cartilage present no obvious change. In some, synovitis is acute and plastic, and is followed by firm fibrous, or bony ankylosis; while in others, large, readily fluctuating collections, not involving the joint itself, form in the periarticular tissue, yet without redness or other signs of acute inflammation. It is remarkable that in some examples of pyæmia the local manifestations are entirely confined to the joints, while in other instances the joints entirely escape.

Prognosis.—In cases in which the patients survive, and repair takes place, the effusion may be slowly absorbed, and the joint may regain free movement. In the majority of instances, however, there is considerable stiffness; often firm, fibrous, or bony ankylosis frequently associated with serious distortion.

Treatment.—In consequence, in the less acute cases, of the large amount of effusion which takes place, and which is associated with relaxation of the ligaments, and, in acute cases, in consequence of the rapid disorganization of the joint, there is a strong tendency to the displacement of the articular ends of the bones. This is especially the case in the knee and wrist. Moreover, the joint is frequently the seat of excessive pain, aggravated by movement. It is essential, therefore, that the limb should, from the first, be carefully supported on a splint. When the disease is acute and attended with suppuration, matter should be at once evacuated under strict antiseptic precautions, and free drainage should be provided. When effusion is more passive, and there is no pain or redness of the skin, the fluid may be drawn off with the aspirator. The removal of fluid is advisable. With care the operation may be safely conducted, while, if fluid is left, the fibrin remaining after its more liquid parts have been absorbed, will lead to the formation of adhesions and the development of ankylosis.

In cases in which joints have become disorganized, amputation may, should the patient survive, become necessary. The operation must, generally, be delayed till the active stage of septic infection has passed, and the temperature is no longer high or widely fluctuating.

In scarlet fever synovitis resembles that met with in pyæmia in being sometimes acute, and leading to rapid disorganization of the joint, by extension of the inflammation to the deeper structures, and sometimes subacute or chronic; in affecting one or several joints, and in its general course and termination. The treatment is the same as that of synovitis, depending on pyæmia. The same may be said of synovitis occurring in the puerperal state. The joint affection is essentially pyæmic in its character. Often the knee is the only joint affected, and the inflammatory process is throughout subacute. The mischief, however, spreads to the deeper structures, is very persistent, is accompanied with severe pain, and tends to induce deformity and to terminate in fibrous ankylosis. In some instances many joints are involved, and the case runs the usual course of an acute pyæmia.

Symptomatic Indications.—See PYÆMIA.

Gonorrheal or urethral synovitis.—It is well known that not only gonorrhea, but also simple purulent urethritis, such *e. g.*, as sometimes occurs after the use of catheters, may give rise to synovitis. In this affection, for which urethral synovitis or arthritis is a better name than either gonorrheal synovitis or the old term gonorrheal rheumatism, usually one joint, and that a large one, is attacked. The knee is most often affected, but the hip, the ankle, and the wrist are often attacked, while a very troublesome form involves the ankle and the contiguous tarsal joints and the fibrous structures in the sole, with the result of inducing a very aggravated form of flat foot. The disease, though sometimes acute, and passing on to suppuration, or even to complete disorganization of the joint, requiring amputation, is for the most part subacute (often chronic) and characterized rather by plastic exudation than by copious effusion. The ligaments and the periarticular structures are involved in the inflammatory process, and the tendency to the formation of new fibrous tissue is marked. Bony ankylosis, though rare, may occur. The attack may

be preceded by an increase of the urethral discharge. Often, however, the amount of discharge is unaltered by the onset of the joint disease; while sometimes discharge is considerably diminished. The disease, attended by pain, heat, and moderate swelling, often persists in a form much resembling subacute or chronic rheumatism, now subsiding, and presently returning with increased intensity for many weeks or months, and at length leaving the joint permanently stiff. It is often symmetrical. In those cases in which several of the larger joints are attacked (both the knees and both the hips, or the ankles and the knees) the patient may be left completely crippled. Even the joints of the spine may be affected, and cases are on record in which, in the course of different attacks, every large joint has become fixed. The affection is rare; *i. e.*, its percentage among cases of gonorrhea is very small. Sometimes it is ushered in by slight fever and a sense of chilliness, or the occurrence of a distinct rigor. In other instances the premonitory symptoms are absent, and the first sign is that one of the joints is hot, tender, painful, and swollen, as in subacute rheumatism. A notable fact respecting the affection is that in some individuals it is repeated with every attack of gonorrhea. Urethral synovitis, though occasionally met with, is rare in the female sex. A correct diagnosis is important, and is readily made if the mind of the surgeon is on the alert. In any case in which arthritis, simulating subacute rheumatism, especially when monarticular, occurs in a person who has never had rheumatism, and when the attack tends to be prolonged and persistent, the question of the presence of urethral discharge ought to be inquired into.

Treatment must be addressed: (a) To the arrest of the urethral discharge. (b) To the local management of the joint attacked. The treatment of the urethral discharge must vary with the gonorrheal or other origin of the affection, the stage it has reached, the amount and character of the urethral secretion. The joint should be placed at rest. When heat and other symptoms have subsided under the use of cold applications, a course of small blisters (one healing before the next is applied) should be prescribed, and the joint may then be covered with mercurial ointment spread on lint, and over this an

elastic rubber bandage may be adjusted; or the part may be strapped with soap plaster. Iodide of potassium is often useful in five-grain doses in the after stages of the disease. Iron tonics will be called for if the patient is anæmic and weakly; if gouty, lithia or colchicum should be used. Motion may sometimes be restored by movement of the joint under an anæsthetic, followed by daily passive movement, hot douching, and shampooing.

Symptomatic Indications.—In the first stage, when attended with much sexual excitement, *aconite* is the principal remedy and should be followed by *thuya* or *clematis*. *Thuya*, when the pains are tearing and pulsative, or as from subcutaneous ulceration, with a sensation of coldness or torpor of the part; *clematis* when the rheumatic symptoms succeed rapidly an attack of gonorrhea. *Cimicifuga* after aconite is the most generally valuable remedy; pains are worse at night, and in wet and windy weather. *Veratrum* is useful when the pains are increased by the warmth of the bed and by wet weather; bruised feeling in the joints, better from walking. *Rhus tox.* is called for when the joint is stiff and painful, better from motion. When the arthritis follows upon suppression of the urethral discharge *gelsemium* will generally restore the discharge and relieve the joint.

In the course and after the subsidence of typhoid fever, and less frequently of variola, one or more of the joints may be attacked either with a subacute synovitis (the most common form), or with a plastic inflammation involving also the ligaments and the cartilages, or very rarely by an acute suppurative arthritis. The joint most frequently attacked, at least in typhoid, is the hip, but other joints occasionally suffer. There is developed synovitis, rapidly leading to effusion, distention of the capsule and often to spontaneous dislocation, an occurrence that is sometimes unfortunately overlooked till the patient is convalescent from his fever.

The plastic form of arthritis is usually subacute and attended with considerable pain. It leaves the joint stiff, or in severe cases completely ankylosed, and this often, where treatment has not been applied, in a very inconvenient position.

Hydrops Articuli.—**Hydrarthrosis, hydrarthrus.**—In this affection, vaguely spoken of as dropsy of the joints, the synovial cavity becomes distended with a chronic

serous or watery effusion. The condition is produced in several ways. It may remain after acute synovitis has subsided; or it may arise in the course of chronic synovitis, especially when this is of rheumatic origin; or it may be developed apart from any of the usual signs of inflammation, in the form apparently of a mere passive exudation, resembling the simpler forms of hydrocele of the tunica vaginalis. The morbid anatomy of the first two varieties is the same as that of chronic synovitis. In the third form, which is rare, the synovial membrane is anæmic and pale, or presents a white or yellowish, macerated appearance. In cases of long standing, the membrane itself and its subserous layer become thickened by new fibrous tissues; and its processes and fringes undergo hypertrophy, present numerous tufts and pedunculated growths, and often contain nodules of cartilage.

In some cases the major part of even a large swelling of the joint is due to the close packing of these synovial fringes, and the quantity of fluid present is very small. As time goes on the ligaments become elongated, and displacement occurs; or the joint is loose, weak, and insecure when weight is thrown upon it. In many cases large bursal collections are formed in the neighborhood of the joint. The fluid of hydrops articuli (which may amount to three pints or more) is a thin, often turbid, form of synovia, containing in many instances flakes and fibrinous shreds. The affection is most common in the knee. It may be limited to one knee-joint, but often both are ultimately attacked. It occurs also in the shoulder and elbow, and, though very rarely, also in the other joints. Often single, it seldom involves more than two joints in the same patient.

Symptoms.—The knee-joint, which may be taken as the example, is largely distended, cool and painless, but weak, and its movements are embarrassed. Fluctuation is obvious. The patella, unless distention is too great, can be pressed down so that it strikes the femur. The synovial membrane, in old cases, is thickened; and indurated folds and fringes, or even masses of cartilage, can be felt. The bursa under the semi-membranosus muscle in the ham is often enlarged, and may extend for some distance down the calf. The patient cannot walk far, and finds going upstairs a great difficulty. The

disease is most common in men between thirty and sixty, but it may be met with in females, and at any age after puberty.

Treatment.—In the early stage, especially when hydrarthrosis is of inflammatory origin, the joint must be kept at complete rest by means of firm leather or other splints, cut away so that there is space for blistering. A succession of blisters, one and a half to two and a half inches square should be applied at intervals of four or five days, or as they severally heal; or counter-irritation may be produced, either by iodine paint, or by rubbing in the unguentum hydrargyri biniodidi over a space of two or three square inches. After the blistering (continued for three or four weeks) the joint should be compressed by a carefully applied india-rubber bandage, under which may be placed lint spread with mercurial ointment or with oleate of mercury; or the joint may be aspirated and the treatment by elastic pressure be continued. When all these means fail, the method has been occasionally practiced, of removing part of the collection with a trocar and canula, and injecting the synovial cavity with a solution of tincture of iodine in two or three parts of water. This, though it sounds formidable, seems, carefully employed, to involve very little danger. Its success, however, is doubtful; for though it produces considerable inflammatory effusion, similar to that following the injection of a hydrocele, the fluid often reaccumulates, and the disease continues to progress. As an ultimate step, provided the patient is under thirty and in sound general health, the joint (antiseptic precautions being strictly carried out) may be opened by two free lateral incisions and the fluid evacuated; drainage-tubes, or, better, strips of guttapercha tissue, should then be introduced, and retained for two or three weeks while shrinking of the synovial cavity is taking place.

Symptomatic Indications.—*Helleborus*; dropsical swelling of joints, stinging, boring pains. *Iodine*; pricking, burning pains, worse from touch.

Arthritis.—When inflammation attacks a joint, it begins in the synovial membrane or in the bones. Neither the ligaments nor the cartilage are subject to primary inflammation. The changes they undergo are always secondary. The disease, however, soon extends to the other structures, so that all alike are involved. This

condition, termed arthritis, has many forms. It may be acute or chronic, traumatic, infective (as in pyæmia, gonorrhea, etc.), or diathetic (as in struma, gout, rheumatism, etc.).

Symptoms.—Attacked with acute inflammation, the joint is placed in the position of greatest ease, that, which it habitually occupies during rest, and in which the articular ends are relieved, as far as possible, from mutual pressure, and the ligaments and the capsule relaxed. The shoulder remains with the arm close to the side; the elbow and knee somewhat flexed; the wrist a little dropped; the ankle a little extended; the hip, in a typical case, is flexed, abducted, and rotated outward. The local symptoms are those of acute inflammation, *i. e.*, pain, heat, swelling, and often some redness of the skin. Pain is throbbing or bursting in character, often so intense that the patient screams with agony if the limb is moved, or even if the bed is jarred. Nocturnal exacerbations are severe, and, whenever he attempts to sleep, the patient is disturbed by spasmodic startings and jumpings of the limb, the latter symptom indicating that the articular ends beneath the cartilage are affected. Increased heat is easily detected, either by the hand or the surface thermometer. Swelling, which is usually considerable, is due mainly to fluid in the joint, but it depends in part on swelling of the synovial membrane, and effusion into the periarticular tissues.

Constitutional disturbance is often severe, and the temperature ranges from 100° to 104°. When carefully treated from its onset, the affection may subside; but often advances to suppuration. This is indicated by further rise of temperature, and often by the occurrence of rigors, as well as by an increase of pain and swelling; the integuments become red and œdematous, so that they pit on pressure; and, as the ligaments become either softened or destroyed, the articular ends of the bones tend to undergo displacement; grating is often detected, and the patient loses sleep and appetite, becomes flushed and emaciated, and has copious perspirations. In some cases the quantity of matter formed is not great; in others it rapidly increases, and unless evacuated, bursts through the distended and softened capsule, and becomes widely diffused through the limb, which is largely œdematous; the skin is ruddy or

dusky, and pits deeply on pressure, and it becomes evident that not only the joint itself, but also the adjacent soft structures of the limb, are disorganized.

Diagnosis.—Abscess outside a joint may resemble acute arthritis. In external abscess, however, there is no uniform distention of the joint, but the swelling is irregularly placed, and both it and the fluctuation to which it gives rise are confined to one aspect of the articulation, and are noticed also to be superficial to the various bony prominences and strong ligaments, *e. g.*, the patella or the ligamentum patellæ; or the olecranon and triceps tendon. The joint is not fixed, and admits of movement without severe pain; fluctuation is distinct; there is no abnormal mobility of the ends of the bones on each other, and no grating. Constitutional disturbance is not severe.

Acute traumatic arthritis sometimes occurs from a severe crush or wrench; it usually, however, follows a wound in which infective changes have taken place. This is a very dangerous form, prone to pass on to suppuration, and rapid disorganization and destruction of the joint, attended with high temperature, rigors, and severe constitutional disturbance.

Acute infective arthritis, met with in pyæmia, puerperal and scarlet fever, and other allied conditions, is almost equally formidable; the symptoms are usually acute; suppuration ensues, and the joint is quickly destroyed. Another variety of acute arthritis is that which is secondary to disease of the articular ends of the bones, as met with chiefly in young subjects during the growth of the epiphyses. Here, as suppuration about the epiphysis advances, the articular cartilage is perforated, and pus, or the detritus of the ulcerative process, escaping into the interior of the joint, leads to a violent arthritis, which, in the course of a few days, entirely destroys the articulation. Very rarely acute arthritis occurs from the extension of erysipelas or cellulitis to the interior of a joint, or from the bursting into it of an abscess in the neighboring soft parts, *e. g.*, when abscess in the popliteal space bursts into the knee-joint.

Treatment.—In acute arthritis, the first point is to secure rest in a favorable position. Should suppuration ensue the matter must be evacuated antiseptically. Should disorganization of the joint occur, the question of amputation presents itself.

Where, however, arthritis has arisen, in the course of pyæmia or puerperal fever, or of any of the exanthemata such as scarlatina or typhoid, the general condition forbids the operation, and the treatment must be expectant, in the hope that a stiff joint may be obtained; or that later, as the original disease subsides, amputation may be ventured upon. In the arthritis secondary to disease in the articular ends of the bones, which sometimes is very rapidly destructive, and which is most frequent in subjects under eighteen, and common in children of five or six, amputation may be called for. It can, however, as a rule be avoided, by freely opening, washing out, and draining the joint; by maintenance of complete rest; and by the continued use of antiseptics. It should be resorted to only when the patient's general condition threatens to become serious to life, as shown especially by rapid wasting, failure of strength, and increasing pallor, the results of pain, and loss of appetite and sleep. Should acute arthritis decline, recovery and the restoration of the functions of the joint may be promoted by the means alluded to for the treatment of the subacute and chronic forms of synovitis.

Symptomatic Indications.—Traumatic arthritis will require *arnica* when the result of a fall or blow: *rhus tox.* when produced by a strain. In the early stage of acute arthritis, with much local inflammation, pain, tenderness, *aconite* is the main reliance, to be followed by *bryonia* as the more acute symptoms subside. When the occurrence of rigors indicates the formation of pus, *calcium sulphide* will limit and control the suppuration. *Silicea* is also useful in this condition, particularly when the pus is thin or unhealthy. See also synovitis. Arthritis from extension of erysipelatous inflammation, cellulitis, *apis mel.*, when with stinging, burning; *belladonna*, bright redness of affected part, throbbing pains, or suddenly appearing and suddenly ceasing pain; *calcarea carb.*, and *sulphur* are useful in persons of scrofulous tendency.

Epiphysitis.—The rapid growth which in early life takes place between the epiphysis and the shaft of the long bones, involves an instability, as the result of which healthy nutrition is apt to be supplanted under the influence of feeble health, struma, or local injury, or the presence of some septic or other irritative

material in the blood, by inflammatory action. This process, termed *epiphysitis* is not usually met with after the age of eighteen or twenty, when nearly all the epiphyses have coalesced with the shafts. It is most common under the age of ten. It may be acute, subacute, or chronic; but in all cases alike, one of the main dangers is that the disease may extend into, and lead to inflammation of, the neighboring joint. It is now well known that a very large number of examples of joint disease in children are secondary to disease originating in one of the adjacent epiphyses.

Acute arthritis of infants.—Here, generally in infants under a year, and often only a few weeks old, sometimes from local injury, sometimes from absorption of septic material from the umbilical cord, or other source, the epiphysial line of growth becomes the seat of acute inflammation, quickly running on to suppuration, with the result that pus, breaking down the soft tissue of the epiphysis itself, travels toward, and soon bursts into the joint, sometimes by a mere pin-hole orifice, but often by a large, ragged opening in the articular cartilage. Upon this, acute inflammation of all the structures of the joint ensues. The articular cavity rapidly becomes distended with pus, the synovial membrane, ligaments, and cartilages are destroyed by ulceration, and even the articular ends of the bones themselves are lost, so that disorganization of the joint is complete; the capsule bursts, and a large, plainly fluctuating periarticular abscess, holding sometimes as much as fifteen ounces, is formed, and burrows widely in the limb. This affection may involve any of the large joints, but the knee, hip, and shoulder most often suffer. Sometimes several joints are attacked in quick succession. The malady is often fatal by exhaustion. On the other hand, when the case is seen early, and matter is evacuated before the joint is involved; or if, when pus has reached the joint, the articulation is at once freely opened and drained, many patients recover, and may even retain perfect movement of the limb. In other instances, though the patient recovers, the joint is left useless and flail-like, the ends of the bones consisting of mere stumps connected by fibrous tissue.

Treatment consists in the immediate antiseptic evacuation of pus (if possible, before it reaches the joint), free drainage by strips of gutta-percha tissue, the use of

a splint to prevent deformity, and of liquor cinchonæ and brandy to support the strength.

In *subacute* or *chronic epiphysitis* in older children, the disease, which is often dependent on struma, usually begins at the junction of the epiphysis with the shaft, and spreading through the substances of the epiphysis toward the joint, produces either chronic synovitis, or, if matter bursts suddenly into the articulation, a violent and destructive general arthritis.

Symptoms.—In *acute epiphysitis* the joint is kept in a fixed position, and is stiff, painful, and tender. There may be obvious swelling of the articular end of one of the adjacent bones, with tenderness on pressure and redness of the skin. Within a few hours after it is reached the joint becomes distended and the swelling rapidly increases, so that an abscess, bursting through the capsule, forms a collection of from two or three to as much as twelve ounces among the muscles of the limb. In epiphysitis of less violent character the symptoms are of a similar nature, but of proportionately diminished severity.

In all cases of epiphysitis the surgeon's chief anxiety must be to avert the impending affection of the joint. In the early stage the limb must be kept at rest on a splint; in acute cases one or two leeches are often useful. Should matter form it must be at once let out. When swelling, local tenderness, pain, and high temperature indicate that matter is probably inclosed in the epiphysis, an incision should be made over the tender spot, and the epiphysis cautiously perforated. If matter is found, an adequate portion of the superficial wall of the cavity containing it should be removed, so that pus may readily escape toward the surface. Though not invariably, yet frequently, the cases described as chronic abscess in the articular extremity of the tibia are examples of chronic epiphysitis, followed by suppuration.

When the epiphysis at the growing end of one of the bones (the upper end of the humerus and tibia, the lower end of the femur, radius, and ulna) has been long involved in slight chronic inflammation, the increased blood supply may lead to increased growth, and the limb may become an inch or even two inches longer than its fellow. On the other hand, should epiphysitis have been acute

and destructive, the subsequent growth of the bone may be to a great extent arrested.

A formidable and not rare effect of acute epiphysitis, and ulceration in the line of junction with the shaft, is the complete detachment of the epiphysis. The upper epiphysis of the femur, when thus separated, being left without adequate blood supply, perishes, and forms a sequestrum. In the case of other epiphyses, however, though necrosis is still the rule, repair may occur, and the epiphysis regain its attachment. During epiphysitis, especially at the upper end of the tibia, though no complete separation occurs, the connection of the epiphysis and the shaft may be so weakened that, either at the time, or during subsequent use of the limb, the junction may yield, and a deformity, which is very difficult to remove, and which greatly impairs the use of the limb, is produced. Should displacement be observed, it must be at once arrested by appropriate mechanical support.

Symptomatic Indications.—*Calcium sulph.* or *silicea* to limit and control suppuration; *calcareæ carb.* when occurring in children of a strumous diathesis.

Scrofulous Diseases of the Joints.—Scrofula, or struma, is a defective condition of the general health, with a tendency to various forms of chronic inflammation, as of the lymph glands, cancellous bone, mucous and synovial membranes, and the skin, tending to pass on to suppuration and caseation of the effused products. In a considerable number of instances well-marked tubercle is present, while in other cases of more limited duration or of lower intensity, no histological elements beyond those of mere chronic inflammation are produced. The scrofulous process arises either when healthy nutrition fails and deviates, apart from any obvious external cause, into a low form of chronic inflammatory action of the type just mentioned; or when the same result follows disturbance of nutrition by some local agency, such as injury, etc.

The chief clinical characters of scrofulous inflammations are their origin, either spontaneously, or as the result of some trivial local injury which in a healthy subject would have been quickly repaired; their tendency to suppuration and caseation; their proneness to advance, extend,

and relapse; their occurrence chiefly in phthisical families; their multiple development in the same family, or in the same patient; and their prevalence between the ages of three and seven, a period of life during which general tuberculosis and tubercular meningitis are more frequent than at any other time, and when local injury is certainly not more common than it is a few years later.

When we meet with children who come of a phthisical stock, and who suffer without any obvious cause from a variety of tedious local inflammations; when, in the same family, several children are affected; and when it is observed that as one inflammatory lesion is slowly repaired, or while it is still in progress, others are developed under conditions that exclude the ordinary exciting causes of inflammation in healthy subjects, we appear to be dealing with a morbid condition quite as definite as many to which distinct names are assigned, and one for which, at least for the sake of convenience, some general heading should be used. These chronic inflammatory processes, grouped under the name of scrofula, are very much what they are allowed to become. Probably no affections are more dependent on external conditions, on the difference between careful treatment and neglect. Many a child who, between the ages of three and seven, is the subject of various forms of scrofulous inflammation, such as caries of the spine and of the tarsus, ophthalmia or otorrhea or ozæna, if well managed, subsequently becomes to all appearance perfectly healthy, and remains free from any return of these affections. Experience, indeed, clearly demonstrates that the traditional view of scrofula has been derived from cases in which the disease, allowed to run its course, has attained a stage of development and assumed characters which appropriate treatment would have prevented. In short, when it is opposed in its outset, and subsequently, by suitable treatment, scrofula, in the great majority of cases, is merely a chronic inflammatory process, formidable in no other sense than that it is tedious and prone to relapse.

These affections are most often developed between the ages of three and seven or eight, and although they often commence after this period, they grow more and more infrequent as age advances. The disease takes its origin either in the syno-

vial membrane or the ends of the bones, but with what relative frequency it is not easy to say. Synovitis is common in all the joints except the hip, though here also it is certainly met with. In this joint disease most frequently begins in the bones, either the head of the femur or the acetabulum. When disease arises in the articular ends it commences just beneath the cartilage (subchondral), in the epiphysial line of growth, or in some spot in the cancellous tissue, often in the neighborhood of the ossific nucleus. It subsequently involves the joint by extension of the inflammatory process, either gradually or by the sudden entrance of pus into the articular cavity.

Symptoms.—Scrofulous synovitis, of which a good illustration is found in the knee, is usually chronic, constituting white swelling or tumor albus. It may be more or less acute, either when it follows injury, or is secondary to disease originating in the bones. In the usual chronic form the joint is a little flexed, and cannot be completely straightened; movement, though it may be free in the middle range, is restricted before the extreme natural limits are reached; there is, though it may be slight, puffy swelling of the synovial membrane, most apparent where the joint capsule is thin. Some abnormal heat may be detected with the hand or the surface thermometer, but is often inappreciable. Pain is often entirely absent; lameness, though almost invariably present, may be so slight as to escape all but a very observant examination. Muscular wasting occurs, and is often one of the most trustworthy symptoms.

All the symptoms must be critically investigated, for undoubtedly incipient strumous disease is often overlooked, and the affection, thus left to itself, steadily advances, and frequently, by involving other structures, passes on to a general arthritis. Under these circumstances the membrane becomes thickened and gelatinous (pulpy degeneration), the ligaments and cartilages are eroded, or in great part destroyed, and the joint on manipulation is often abnormally "loose"; while in the knee, hip, and wrist serious displacement occurs. Effusion is seldom present in any amount, but slow suppuration may lead to the formation of flaky or cheesy pus. In other instances the inflammation is plastic, and the effused lymph undergoes organization, so that although the disease has never assumed an

active form, and no suppuration has taken place, firm fibrous or even bony ankylosis may occur. These cases of "quiet" strumous disease, ending in absolute stiffness, are more common than many suppose. When mischief begins in the ends of the bones (*see* EPIPHYSITIS) the joint is at first free; but there is enlargement together with pain, tenderness, and puffy swelling at the seat of disease, and local heat; while, as soon as the joint is reached, the symptoms of synovitis, above described, become apparent. Sometimes synovitis remains slight and subacute, often with intervals of apparent recovery; in others, when the joint is suddenly inoculated with pus, acute arthritis is immediately developed.

Treatment.—It is a law to which no exception can be safely made, that a strumous joint must be kept at absolute rest. The view that, because the disease is "constitutional," local treatment is not so important as that the patient should have exercise in the open air is completely erroneous. Fresh air is of high value as an adjunct, yet local treatment must invariably stand first. If these joints are, from the onset of the disease, kept at rest, their recovery, often with completely free movement, is, in the great majority of cases, merely a question of time. Even those that are more or less stiff are strong,

useful, and free from deformity. The knee is best inclosed in leather splint (*see* Fig. 1) till all active disease has subsided. Then Thomas's splint may be used. The remaining joints should be kept in leather splints (Figs. 2, 3, 4,) these being removed every two or three days, while the skin is gently sponged and dried, and then immediately reapplied. In the meantime, the patient must not put his foot to the ground, or make any use whatever of the joint. Everything depends on the absolute manner in which these rules are carried out. If matter forms it should be evacuated antiseptically.

The period required for recovery must vary with the case, from three months to nine or even twelve months being the necessary time; while, if the disease is already

of long standing, the time must be extended to eighteen months or even two years. Excellent recoveries may be thus secured, in cases that would otherwise come to ex-

cision or amputation. It is quite certain that if the patient is well fed, and is in a well-aired room, or in the open air when the weather is suitable, enforced rest will not materially impair the general health. The period of rest must in each case be determined by the previous duration of the disease, and the readiness, or the reverse, with which the symptoms subside. As a rule, rest should be maintained for at least three months after all signs of disease have disappeared, and active exercise should be very gradually renewed. The danger always is that it may

be resumed too soon. The common belief, that if joints are kept long in a fixed position they will become stiff, is a fallacy. Stiffness results when inflammatory action has led to ankylosis. Hence the surest way to avoid this result is to subdue the inflammation by rest. Many a joint retains unimpaired motion after it has been at rest for six months, or even for upward of a year. In those cases, in which stiffness follows long rest, the result is due not to rest, but to the plastic character of the inflammatory process. Another fallacy is that joints often become permanently fixed by muscular rigidity ensuing during enforced rest. With

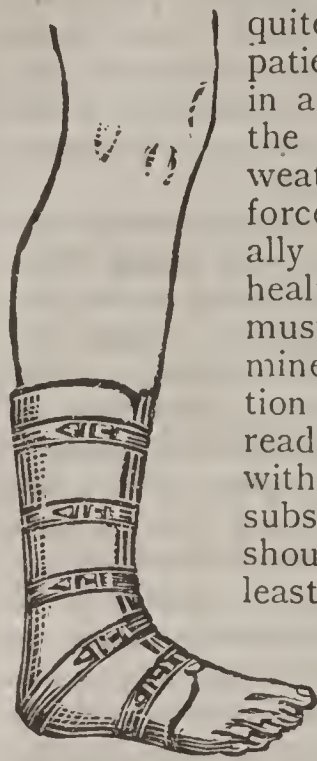


FIG. 2.

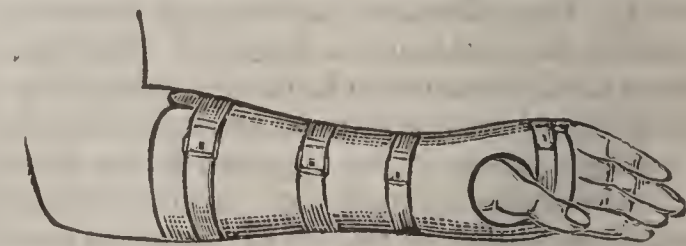


FIG. 3.

local rest must be combined a dry climate, fresh air near the sea, where this is practicable, nutritious diet, warm clothing, and tonics, of which cod-liver oil is the best during cool weather, and the more easily digested preparations of iron in the summer months.

Before leaving this subject reference may be made to "senile scrofula," a term given to cases in every respect resembling scrofulous affections as they are met with in children and adolescents, except that they occur in persons from fifty years of age and upward, sometimes in patients past seventy. Diseases of this nature attacking the joints, usually the wrist and elbow, but occasionally the hip, knee, and other articulations, either spontaneously or after

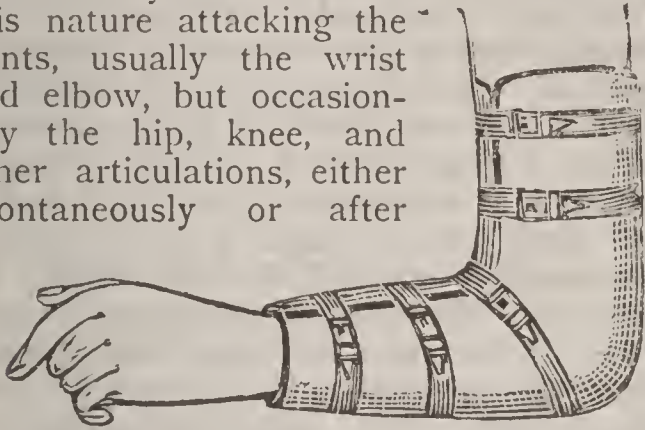


FIG. 4.

some light local injury, run sometimes a chronic, but, in other instances, a rapid and destructive course, quickly going on to suppuration and disorganization of the joint. Even in their milder forms they prove little amenable to treatment, which should be that laid down for scrofula; while, when they are acute, they quickly advance to a stage in which amputation may become necessary.

Symptomatic Indications.—The most important remedy for the treatment of scrofula is *calcareæ carb.* Especially where there is morbid tenderness of the glands, bones, and joints, ulceration of the knee and hip joints, enlarged and hard abdomen in children. *Calcium sulphide* for chronic glandular abscesses, symptoms of general scrofulosis, slight injuries suppurate. *Silicea* in scrofulous affections of bones is very valuable.

Loose Bodies are most common in the knee, but are also occasionally found in the elbow, hip, and shoulder. In the other joints they are extremely rare.

1. Though coagulated blood in a joint does not undergo conversion into a mass of cartilage or bone, yet those loose bodies which present a merely fibrinous structure may possibly be derived from altered blood clot. 2. Blood extravasated into a synovial fringe may become organized and form a pedunculated body, and, when the stalk gives way, fall loose into the synovial cavity. 3. When a synovial fringe or a patch of subsynovial tissue has become, from injury or other cause, enlarged and

thickened, and when it is caught and dragged upon by the movements of the joint, its base is gradually drawn out into an elongated pedicle, and it becomes a floating body. Such a body may long remain attached; but its stalk may at length give way so that it falls free into the cavity of the joint. Bodies of this origin consist of connective tissue and fat, often mixed with inflammatory products, covered with endothelium. 4. Synovial fringes, hypertrophied in the course of chronic rheumatic disease, or of osteoarthritis, often become converted into cartilaginous bodies by overgrowth of the cartilage cells, which are normally present in them. These bodies remain for a time attached by a pedicle, but this at last gives way and they become free. Such bodies consist of hyaline cartilage, or of fibro-cartilage which, however, may undergo calcareous degeneration, or be converted into true bone. 5. After a severe contusion or other local injury, a portion of articular cartilage may undergo "quiet necrosis," that is, may perish independently of any overt sign of inflammation, and be shed into the joint. In other cases the mass so necrosed and cast off includes not only the articular cartilage, but also a portion of the subjacent bone. 6. Or a piece of cartilage, or cartilage and some of the subjacent bone, may be chipped off, and fall into the joint. 7. The nodular masses that form about the joints in osteoarthritis may project into the articular cavity attached by a thread of synovial tissue acting as a pedicle. In many cases the pedicle at length snaps and they are free. 8. A case is recorded in which a loose body was found, on removal, to contain the point of a broken needle. Probably the needle, accidentally embedded in the subsynovial tissue, had, by causing irritation, led to the formation of the body which had subsequently become detached.

Joints in which loose bodies are contained are often otherwise healthy, or subject from time to time merely to slight inflammatory attacks when the body is caught between the articular surfaces so as to inflict mechanical injury. In classes 4 and 7, and often in class 3, the joint is the seat of chronic rheumatism, or osteoarthritis. In hydrarthrosis the synovial membrane often presents nodular masses of cartilage, or thick fringes that produce analogous symptoms.

Loose bodies are frequently single, but their number is subject to wide variety. In osteo-arthritis there are often as many as from six to twenty or more.

Symptoms.—These vary with the nature of the body itself, and the condition of the joint in which it is present. In a typical case (*e.g.*, of quiet necrosis, or in which a mass of cartilage has formed in a hypertrophied synovial fringe, and has become detached, the joint being otherwise healthy), the patient, while walking, is seized with such agonizing pain, coming on as suddenly as if he had received a blow, that, losing all power in the limb, he falls overcome with a sense of momentary faintness. Sometimes the joint remains freely movable, and the patient can walk, when in the course of a few minutes the pain goes off. In other cases the limb becomes fixed at an angle of about 130° , and any attempt at movement causes unbearable suffering. This stiffness may remain for a time, and then, on some movement of the limb, suddenly disappear. It may, however, continue till the joint is surgically manipulated. The accident is followed by sharp synovitis indicated by pain, heat, swelling, and stiffness lasting two or three days.

Often the patient detects the body, and ascertains either that it remains in one situation (when attached), or shifts to different parts of the joint. Probably loose bodies are most commonly felt in the pouch over the external condyle of the femur. The agonizing pain alluded to is produced when these bodies are caught between the joint surfaces, so that the ligaments are severely stretched and the articular surfaces contused by the powerful leverage with which the bones act upon each other.

The articulation remains fixed when the body is caught and held like a stone in the hinge of a gate, but usually the cartilage slips away as pressure increases, and the joint is freely movable again. The symptoms may return frequently when the body is of moderate size and movable. But when it is large, and can be caught only in certain positions, the attacks occur at wider intervals; once a month, or even in three or four months. In osteo-arthritis, or other conditions in which the joint is extensively diseased, the symptoms are much less characteristic; but there is still the occurrence of sudden pain coupled with arrest of move-

ment, and the fact that either the patient or the surgeon detects the body.

Treatment.—Formerly the complications ensuing upon wounds of the large joints were so formidable that the removal of loose bodies by cutting down upon them (the "direct method") involved a mortality of at least twenty per cent. This was considerably reduced by the introduction of the valvular or "indirect method." An instrument like a large-sized tendon knife, but with its blade mounted on a long shank, is passed through the skin at a distance of an inch and a half from the cartilage, and is carried horizontally onward till the body is reached. The synovial membrane is then freely divided, and the knife, when it has been slightly withdrawn, is moved from side to side in the subcutaneous fat, so that a space, or a pocket, is formed. Into this the cartilage is slipped. Here it may be allowed to remain permanently, or, when the wound in the synovial membrane has healed, it may be cut down upon and removed. A serious drawback is that, even in experienced hands, the operation may fail, either because the synovial membrane has been insufficiently divided, or a large enough space has not been formed in the periarticular fat for the reception of the cartilage, or because the cartilage is not free, but still attached within the joint.

Hence, the direct method is still almost exclusively used. The cartilage is securely held (at some spot where the joint capsule is thin) by transfixing it with one or two strong steel needles, (of which a trustworthy assistant should have charge), exposed by a careful dissection, and extracted. Any bleeding should be arrested before the joint is open. If the body is attached its pedicle must be divided, having, should it appear vascular, been first tied with fine catgut. The wound is then brought together with fine catgut sutures, which should include the synovial membrane, and dressed with carbolic gauze; and the limb is placed on a back splint so that absolute rest is maintained. Healing generally takes place by the first intention, and there is no rise of temperature. This proceeding, properly carried out, is so free from risk that it may be recommended without hesitation in cases in which the joint is free from advanced disease, and the patient is sound and not far past middle age; and it may be re-

garded as in all respects preferable to the indirect method. In instances of osteoarthritis or rheumatic disease, in otherwise sound patients, in whom multiple adventitious bodies materially interfere with the functions of the joint, all those that are completely loose, or that can easily be removed, should be extracted; while others should be left till they become troublesome; in elderly or unsound patients it is best not to operate, especially if, as is not rarely the case, a knee-cap, or a pad and bandage, suffices, as the joint is no longer the seat of vigorous movement, to relieve the symptoms.

Displaced Semilunar Cartilage.—The general impression that the internal cartilage is most often involved is probably true, but cases are not rare in which the external is at fault. The following conditions are met: (*a*) In a healthy joint, during a violent effort, often of rotation, one of the cartilages at some part of its circumference may either protrude or slip inward, in relation to the condyle of the femur. In such cases either a prominent rim or a deep sulcus may exist over the site of the cartilage. (*b*) The strain on the cartilage may be so great that its marginal attachments are partly or completely torn through, and the disk may be displaced, its anterior portion slipping back entirely behind the corresponding condyle; or the whole cartilage slipping inward, so as to lie in the middle line, in the intercondyloid notch of the femur. (*c*) The cartilage may not only be uprooted at its circumference, but be also torn across, so as to slip about like a pedunculated loose body. (*d*) The end attachment of one of the cartilages may be torn away, bringing with it a fragment of the tibia. (*e*) In cases of old synovitis, especially in rheumatic subjects, the attachments of the cartilages become elongated, so that, acquiring too wide a range of movement, they frequently slip out of place. (*f*) After injury, the external cartilage, and perhaps the internal, may become enlarged and thickened, so that on certain movements of extension and rotation it protrudes widely, and can be very distinctly felt. (*g*) A case is recorded in which the internal cartilage was accidentally transfixed by a hackle pin, and apparently torn, or partially separated, from its connections, so that it could be felt protruding beneath the cicatrix of the

wound, where it interfered considerably with the movements of the joint. Displacement of these cartilages, though most common during the vigorous period of adult life, may occur, as the result of injury, in children of six or eight, or in elderly persons whose joints are the seat of chronic rheumatic effusion.

Symptoms.—These vary with the nature of the case. When in a healthy joint the cartilage is driven, by a sudden screw movement of the femur and tibia on each other, out of place, but without laceration of its attachments, the pain at the moment is as severe as that attending the slip of a "loose cartilage," and the joint is found partially flexed and "locked," and perhaps with some deviation of the axis of the tibia, often in the direction of abduction. The patient cannot usually move the joint, yet on manipulation, though it is locked against full extension, it admits of partial flexion.

Sometimes the disk is felt protruding; or it may have so slipped inward as to cause a deep tucking in of the skin; often, however, nothing can be seen or felt on external examination, and the accident must be inferred from the "locked" condition of the knee. In a few hours all the signs of a more or less acute synovitis generally come on.

When the attachments of the disk are widely torn, the cartilage, from the moment of the injury, slips freely about, and the joint goes "in" and "out" with every attempt at movement. Subsequently the slip becomes less frequent, and occurs only on certain movements, usually of flexion, or flexion combined with rotation.

Many patients know exactly how to put the "joint out," and can thus materially help the surgeon in forming a diagnosis. In cases in which the attachments of the cartilage have become relaxed by chronic synovitis, or otherwise, the joint is liable to become suddenly locked and painful on any casual movement; *e.g.*, as the patient rises from his chair, turns in bed, or crosses one knee over the other. Sometimes the lock is only momentary: in other cases the joint remains fixed. The slip is at first followed by synovitis, but after a time the joint becomes more tolerant, and the subsequent heat and swelling are little marked. In the intervals between the attacks the joint is, to all appearance, normal.

Treatment.—In many cases, though

the "slip" causes some momentary pain, and is followed by two or three days of synovitis and lameness, the cartilage at once passes back into its place, and does not, therefore, lock the joint. In others it remains displaced so as to lock the joint until it is set free, either by some accidental movement, or by manipulation of the limb. If overlooked, the displacement may remain for some weeks, or even months. Many patients know how either to move the limb so as to effect reduction, or to direct a passer-by to do so. Sometimes one movement has the desired effect, sometimes another. The plan most likely to succeed is to bend the knee to the fullest extent; a movement which, by relaxing all the ligaments, and separating the articular surfaces of the bones as far as possible from each other, tends to disengage the cartilage; then to freely rotate the tibia upon the condyles of the femur, at the same time that the bones are drawn as far as they can be apart, and then suddenly, but not with undue violence, to carry the limb into full extension. During these movements firm pressure with the thumb should be made on the cartilage at any point at which it seems over-prominent, or where there is tenderness. Sometimes reduction is effected with a snap, to be distinctly felt or heard. In many cases an anæsthetic is advisable, or necessary, in order to secure muscular relaxation, and so limit the amount of force that is required to extend the limb.

In these cases of slipping cartilage it is not enough merely to effect reduction. Means must be taken to prevent a return of the displacement. For this purpose a clamp in the form of a light semicircular steel spring, passing behind the joint, and ending in two plates, which embrace the edges of the patella and make pressure on the lateral parts of the joint, or two jointed bars, one for the outer and one for the inner sides of the joint, connected above and below with steel semicircles, and fastening above and below the patella with straps, will be found extremely useful. To either clamp a pad for pressure over any part of the cartilage that protrudes may be added.

In a case in which the cartilage was torn across, the joint remained useful after the lacerated disk had been removed. This example, together with others that have been recorded, is important, as show-

ing that the removal of the semilunar cartilages involves no material impairment of the function of the joint. Such an operation, however, can be very seldom required, and ought never to be undertaken until all other means, especially the use of the clamps described above, modified according to the case, have been tried and have failed. In instances in which displacement has followed recently on an injury, or relaxation of the attachments of the cartilages resulting from recent synovitis, the use of the clamp may be discontinued after from three or six months to a year. In some cases, however, it must be permanently worn. Many patients find themselves able, when wearing the clamp, to play tennis or take any form of active exercise without recurrence of the slip.

In those rare cases in which repeated attempts have failed to secure reduction, the joint will gradually acquire fairly free movements as the cartilage adapts itself to its new position.

Tumors of joints.—Very important cases are occasionally met with in which the question arises whether we have to deal with some inflammatory or other disease of a joint, or with a new growth in the articular end of one of the bones. Tumors that imitate joint disease most commonly involve the original growing ends of the bones, that is, the upper end of the humerus and tibia, the lower ends of the femur, radius, and ulna. Hence the question of diagnosis between tumors and joint disease mainly, though by no means exclusively, concerns the shoulder, the wrist, and the knee. Tumors near joints belong generally to the sarcomatous group; some are myeloid in structure, some round or spindle-celled. Some, however, are entirely cartilaginous, or sarcomatous with a large admixture of cartilage. Some spring from the interior of the bone, while others, probably the majority, are subperiosteal. In the course of their growth they impinge upon and at length come to occupy the cavity of the joint, and lead to the entire destruction of the synovial membrane, ligaments, and cartilages, as well as the articular end of the bone in which they have originated; and to wide displacement and deformity of the joint.

The likeness of a new growth to joint disease is sometimes so close that great care is required to avoid an error that

may lead to disaster. This is the case when the new growth is soft and elastic, and when it is seated in the immediate vicinity of, or has even extended to the synovial membrane, so that both by its position and its consistence it may be mistaken for a mere inflammatory thickening of the latter structure; and when, moreover, as not rarely happens, the growth, by interfering with the circulation, has led to effusion into the cavity of the joint. Such tumors, which are usually subperiosteal, generally grow toward the joint in the form of fleshy or spongy, ill-defined or flattened lobes, surrounding the bone and merging imperceptibly into the adjacent soft structures; or of firm nodules closely abutting on the joint. The joint-diseases which they may closely resemble are (*a*) synovitis attended with some effusion, but mainly characterized by considerable pulpy thickening, and induration of the synovial membrane; (*b*) certain forms of chronic rheumatism or osteo-arthritis with synovial effusion, and irregular nodular enlargement of the articular ends of the bones. The main points indicating the presence of a new growth are: A new growth is irregular and, as a rule, extends in some directions obviously beyond the confines of the joint. The shaft of the bone, as well as its mere articular border, is distinctly enlarged; the swelling at the part most remote from the joint is often hard, nodular, lobed, or tuberoso; one bone only is affected; movement of the joint within certain limits may be free. Enlargement is usually rapid and continuous, so that in three months the disease has attained considerable size; the lymphatic glands may be enlarged. Pain, heat, effusion, and distention of the cutaneous veins are symptoms on which in respect to diagnosis, little dependence should be placed. In new growths pain may be either slight, moderate, or severe; heat of the surface and general rise of temperature may be as marked as they are in mere inflammatory joint-disease; the cutaneous veins are often enlarged and conspicuous in some forms of synovitis. Some guidance may be derived from observing whether the patient presents any evidence of the strumous or of the rheumatic diathesis, or is suffering from disease of any other joint; and the history of the case, and of the patient's family, should be inquired into. Should doubt remain, the disease should be closely watched, careful meas-

urements taken, and the case treated as if the affection were inflammatory, with rest and well-fitting splints, or with such remedies as the features of each case may suggest. It may even be advisable, due care against septic infection being taken, to remove a portion of the disease for microscopic examination, so that diagnosis may be completed.

Treatment.—In tumors of the articular ends of the long bones involving the joints, the choice must lie between amputation of the limb and enucleation of the growth; or in the case of the upper end of the humerus, or the lower extremity of the ulna or radius, excision of the end of the bone. The latter proceeding may be adopted when the tumor is either myeloid or cartilaginous, and not too extensive; but in other instances amputation should be performed. As some uncertainty usually remains, an incision ought always to be made into the tumor before amputation itself is proceeded with.

The Question of Excision in Joint Disease.—In estimating the value of excision it is at once apparent that the question, far from turning on any simple issue that can be concisely stated, is one in the discussion of which several important considerations have to be taken into account. This is not always borne in mind. It must first be shown that there are no means of a less heroic kind that will secure a still better, or even an equally good, result. Operations rest in different cases on different principles. Now the principle of excision is the same as that of amputation, or the removal of an eyeball or a testis. That is, it abandons all attempt to cure disease, and falls back on the somewhat primitive expedient of cutting away the part in which the disease is placed. Although there are many circumstances in which the surgeon is driven to adopt this kind of operation (*e.g.*, in dealing with malignant disease), it should be avoided whenever it is possible to do so.

It must be remembered also that the necessity for an operation often depends on the stage which surgery has reached. Many operations, formerly called for, have been to a great extent, or even entirely, set aside. Our knowledge of diseases of the joints has increased, the means of forming an early diagnosis have been attained, and the efficacy of early treatment on the principle of complete rest has been amply demonstrated. It has also come

to be well known that, if due precautions are taken, a joint in which suppuration has occurred may be freely opened and drained as safely as any other large abscess cavity, and the majority thus treated recover with a very serviceable limb.

Arguments for excision.—There are three grounds on which some still advocate the frequent resort to excision as a means of treating strumous joint-disease: (1) that the operation saves time; (2) that, as tuberculosis is present, recovery without operative interference is improbable; (3) that by removing the structure in which tubercle is deposited the danger of general tuberculosis is averted. None of these arguments will bear close examination.

1. The time saved (the rapidity of repair after excision) turns on the period of the disease at which the operation is performed. In many cases of long standing disease, in which the tissues have become widely degenerate, so far from time being saved, the wound often never heals at all; or it heals only after a period of many months, or even years, more than sufficed for a cure by continuous rest. In many instances the disease is unchecked, or aggravated by the operation. The only cases in which rapid healing can be depended upon are those in which such slight changes have taken place that continued rest would certainly lead to recovery, and often to the restoration of perfectly free movement in the joint. Besides, it is obvious that rapid repair is not everything. If it were, amputation ought to be performed in many compound fractures, and even for many lacerated wounds. 2. To the proposition that as tubercle is commonly present, recovery without operative interference is improbable, the reply is that tubercle is often absent in the early stages of these affections; and that, whether tubercle is present or absent, cases which are treated by rest will, in all but very exceptional instances, end in recovery. 3. The view that excision averts or largely diminishes the liability of systemic infection is met by the observation that tubercle is often absent; that general tuberculosis is rare as a sequel of articular disease; that even in cases in which tubercle is present, it is impossible to insure its complete removal by excising the affected joint, or to guard against the existence of other and more active centers of infection elsewhere, *e.g.*, in some part of the lymphatic system.

Obvious drawbacks to the general resort to excision are: That repair will not take place unless the patient is in fairly good health. Hence, to secure what are termed good results, the operation must often be performed early, that is, when rest alone would have sufficed to effect a cure. At later stages the operation frequently entirely fails, the wound remaining unhealed, suppuration continuing, and the case, unless amputation is performed, ending fatally by exhaustion or amyloid disease. And the limb after excision is, as a rule, much less useful, even when favorable repair has taken place, than after recovery without operation. After excision of the knee in patients under ten (and the conditions for which the advocates of excision employ the operation are much more common before than after that age), the limb is, in many instances, so short and deformed by gradual yielding that it is in great part or entirely useless.

In the case of the joints, as in that of the eye, the testis, and numerous other instances, true progress lies in the direction of cultivating early diagnosis, in diffusing a knowledge of the great importance of attacking disease before serious structural changes have occurred, and in the adequate application of the principle of rest. When all this has been done, the necessity for such a proceeding as excision will very seldom arise.

Cases adapted for excision.—There are, however, various instances in which excision should be adopted.

In the *knee* excision is mainly of use in cases in which the bones are in good condition, but where, as the result of subacute synovitis of long standing, attended with relaxation of the ligaments, so much displacement has occurred that the limb cannot be brought into a serviceable position; or in which, though displacement is limited, the synovial membrane is the seat of extensive pulpy degeneration, a condition in which repair is unlikely to take place. The operation is not generally suitable when the patient is under seven; when disease is acute; when the bones are extensively involved; or when the general health has broken down.

As to the value of excision in the other articulations, the *shoulder-joint* is comparatively seldom diseased, it is easily kept at rest, and shows a strong tendency

to gradual recovery ; it is liable to no deformity, and although the joint almost invariably becomes stiff, compensatory movements, at the elbow and between the scapula and the trunk, are so free that the limb remains useful. Hence, excision is very seldom either called for or performed, and certainly the limb, after it, is generally much less serviceable than after repair by continued rest.

The *elbow* is that in which excision yields the best results. As growth takes place at the upper extremity of the humerus, and the lower extremity of the ulna and radius, the removal of the elbow-joint ends of these bones does not materially affect the length of the limb, nor is length here a matter of much importance. If sufficient bone is removed to prevent ankylosis, and if the anconeus is preserved, free motion and considerable power are secured ; the amount of repair to be effected is comparatively small. Yet even in this instance it is only in cases that have been utterly neglected that excision can be necessary ; for if the joint is kept at rest and in good position, the disease will very rarely indeed become serious ; on the contrary, it will undergo steadily advancing repair. Even when suppuration occurs, if the joint is opened antiseptically, provision made for free drainage, and rest continued, recovery will still, as a rule, ensue.

Excision of the *wrist* for disease is a rare operation, generally attended with very limited success. There are but few cases in which disease of this joint, when adequately treated by rest, does not end in recovery, and the restoration of considerable or even unimpaired movement ; whereas, after excision, the movements and strength of the hand are alike very seriously impaired. Usually the removal of any of the carpal bones that are provoking prolonged suppuration is better than a systematic excision.

In the case of the *ankle*, excision is both rare and inadvisable. In the early stage disease readily yields to treatment by continued rest ; in the later stage it is very rarely confined to the end of the tibia and fibula ; it much more commonly involves the tarsus also, so that the astragalus and perhaps some other bones must be removed ; it is difficult to perform the operation without injuring surrounding tendons and other important anatomical structures ; repair is tedious, and the

limb is apt to be subsequently less useful than it is after a Syme's amputation of the foot.

As to excision in patients over twenty-five, although successful cases have been recorded, the operation in the case of the hip and the knee is so formidable to life that it cannot be generally recommended. Amputation is almost constantly the safer alternative. In the other joints, especially the elbow, excision may, in properly selected cases, yield good results in healthy subjects in whom disease is not acute, and in whom the bones are not extensively involved.

The Question of Amputation in Joint-Disease.—The grounds for resorting to the operation may refer either to the joint itself or to the general condition of the patient. Thus, in some instances in which the disease has become so advanced that there is no probability of repair by rest and its accessories, the ends of the bones are so extensively involved that excision is inadmissible ; in others copious suppuration and wide burrowing of matter through the limb preclude excision ; in acute disease, should the question between excision and amputation arise, amputation, as a rule, had better be performed.

As regards the general condition of the patient, satisfactory repairs after excision of a large joint will take place only when the patient is in fairly good health. Hence, a state of exhaustion or feebleness, and the cachexia of advanced tuberculosis, are conditions which tend to preclude repair, or at least to render it doubtful. In these cases, on the other hand, amputation is usually followed by rapid recovery.

The age of the patient is a very important point. Subscribing to the great principle of conservatism, every surgeon, if his choice were free, would prefer excision to amputation. Experience, however, has shown, that in many cases amputation is the better operation. In children under five the articular ends of the femur and tibia are so largely cartilaginous that firm union after excision often fails to take place. In adults, say after, at the latest, thirty years of age, the risks of excision are so great, and those of amputation so comparatively small, that the latter operation should, as a rule, be performed. In dealing with the advanced forms of joint-disease, it is very important not to misjudge the case so as to allow

the period at which amputation would succeed to pass by.

The grounds for resorting to the operation without further delay have reference chiefly to the patient's general condition. So long as this is not unfavorable, expectant treatment by rest, etc., may be persevered in; but should it be found that the patient is steadily losing appetite and strength, that he is also losing flesh (always a highly important point), that the temperature remains high, that sweating is copious, and that the pulse is becoming smaller and more rapid, delay is dangerous. Especially in these cases must a watch be kept for the appearance of albumin in the urine, and for enlargement of the liver, as evidence that amyloid degeneration of the viscera has commenced. Formerly it was supposed that this condition precluded operative interference, but it is now well known that if the suppuration on which it depends can be arrested, this complication will generally disappear. This is the case, however, only when amyloid degeneration is of recent date. When it is of long standing, not only is it irremediable, but it is extremely likely to determine a fatal result if amputation is performed.

Diseases of Individual Joints.—Shoulder.—*Strumous affections* of the shoulder-joint are common in childhood and early adult life. Disease may begin either as synovitis, the most usual form, or as epiphysitis of the humerus, soon extending to the joint itself. In either case the affection is generally subacute; often so insidious that it is apt to be overlooked. Pain is often absent, or very slightly marked; it is felt in or around the joint, or near the insertion of the deltoid. The most prominent symptoms are wasting of the deltoid and of the scapular muscles, and stiffness of the joint, the scapula following the humerus both when the patient moves the arm, and when an attempt is made to rotate the humerus in the glenoid cavity. The arm remains at the side, and no deformity is produced. Suppuration is rare, but in epiphysitis abscess may form beneath, and at length point at the anterior border of the deltoid, or in the axilla. The shoulder is so easily kept at rest, its movements being so readily performed between the scapula and the thorax, and at the elbow, that disease of the joint, though it may be tedious, shows a marked tendency to recovery. Treat-

ment consists in maintaining rest by keeping the arm bandaged to the side; and if it is thought necessary, a leather shield splint may be molded to the joint and upper half of the arm. Even in early cases rest should be continued for at least three months. If abscess forms it should at once be opened antiseptically. In epiphysitis necrosis is rare, and operative interference is seldom required. Should a sinus, however, remain unclosed, in spite of continued rest of the joint, it should be carefully explored. If a sequestrum is detected it should be removed, but generally no carious or inflamed bone should be gouged away.

As the result even of slight disease this joint usually remains stiff, and the question of endeavoring to restore movement by manipulation presents itself. The necessity of interference after mere sprains or contusions is now well understood; but when stiffness has followed disease manipulation will very seldom be attended with benefit, while it will often be injurious by provoking a return of inflammatory action. This is especially the case in strumous disease.

Acute arthritis is common in this joint in infants under two. As its result, a large collection of matter is rapidly formed beneath the deltoid, sometimes extending forward under the pectoral muscles as well as into the axilla. The upper end of the humerus is often completely destroyed, and with the loss of the epiphysis the subsequent growth of the bone is arrested, and the arm may ultimately be three or four inches shorter than its fellow, and remain weak and flail-like.

Treatment consists in the early evacuation and free drainage of matter, and in supporting the strength of the patient by the means already described. In *pyæmia* and *septicæmia* the shoulder is often the seat of the rapid formation of a large abscess, which gives the joint a globular or rounded outline. Fluctuation is very distinct. In some instances, however, effusion is merely serous, and may undergo absorption. *Charcot's disease* and *osteo-arthritis* are common in the joint. In the latter, the articulation becomes stiff and painful; cracking or grating is felt on movement, muscular wasting is marked; and pain of a dull aching or gnawing character is complained of either in the joint itself or the outer part of the arm beneath the deltoid. As the disease

advances the articular surfaces become altered in outline, and the head of the humerus, enlarged by osteophytic growths around its margin, is found to be displaced upward and forward so as to imitate the appearance of subcoracoid dislocation. This should be borne in mind, and in any case of obscure injury of the shoulder in an elderly person careful inquiry should be made into the previous condition of this joint before any step is taken to effect the reduction of what at first sight may be erroneously mistaken for a recent dislocation. *Syphilitic disease* of this joint is extremely rare.

The elbow.—*Strumous disease*, both in the form of synovitis, and of osteitis, beginning either in the articular end of the humerus or the ulna, is of very frequent occurrence. The joint is more or less, but sometimes very slightly, restricted in its various movements; puffy swelling, especially over the head of the radius and by the sides of the tendon of the triceps (giving the joint an appearance of increased width when viewed from behind) is well marked; there is often increased heat of the surface; muscular wasting, especially of the arm, is a constant, often an early, symptom. The disease is generally chronic, but may be acute, and pass on quickly to the formation of matter, distending the synovial membrane and pointing either at the outer or inner aspect of the joint. Pain is seldom a marked symptom, and is often so entirely absent that parents, and even the surgeon, may be misled. Stiffness, puffy swelling and muscular wasting, are, in fact, the most reliable symptoms.

Treatment consists in the use of well-fitted leather splints, confining the joint at a right angle, the arm being kept in a sling. Matter, if any form, must be evacuated, a "window" being cut in the splint to allow of drainage. Though stiffness sometimes remains when inflammation is plastic, perfectly free movement is often regained when treatment has been applied early and has been sufficiently prolonged. The splints must be continued for from three months to nine months, or even, in older cases, for a year or more. When the articular ends of the bones are carious it is useless to gouge away the inflamed structures. With rest the osseous tissue will very usually regain a healthy condition; but this failing, or where the extensively

diseased synovial membrane continues to suppurate in spite of long-continued rest, excision will be indicated.

Acute arthritis of infants is frequent in the elbow. The joint, often within two or three days, becomes the seat of a large abscess, and the articular ends of the bones, as well as all the ligamentous structures, are rapidly destroyed, so that the humerus and bones of the forearm are widely movable in all directions on each other. In early cases, if matter is at once evacuated, this extensive destruction may be avoided, and the joint regain all its normal movements, while in cases in which treatment has been neglected the joint remains weak, loose, and flail-like. The elbow is a common seat of *Charcot's disease*, and often presents, in a characteristic form, the changes induced by this affection. The joint becomes, sometimes very rapidly, enlarged and deformed by the accumulation of fluid in the interior, and in adventitious periarthritic bursal sacs; and also by the destruction of the articular surfaces of the bones and the heaping up of irregular osteophytic masses about the ends of the shafts. The joint admits of abnormally free motion and coarse grating is felt. There is, however, little or no pain, and the patient uses the limb freely. *Osteoarthritis* often involves this joint, though less frequently than it does the knee, hip, and shoulder. The usual symptoms of slowly increasing stiffness, pain of a dull wearing character, cracking and creaking on movement, together with the presence of the disease in other joints, frequently, among the rest, in the opposite elbow, will render diagnosis very easy. In the course of *pyæmia* and other forms of blood poisoning, the elbow (an articulation, however, which often escapes) presents lesions, the features and treatment of which have been described. *Syphilitic disease* of the elbow-joint is not rare, and probably many instances of chronic and relapsing inflammation in adults, attended with thickening of the synovial membrane and not yielding to the prolonged use of rest, have been of this character.

Wrist.—In children, young adults, and occasionally in old persons, strumous affections are prone to attack this joint, which becomes slightly flexed, swollen, and puffy both on the dorsal and palmar aspects; normal depressions between the tendons are lost, and the part assumes a smooth

fusiform outline, the result of synovial thickening. A well-marked feature is impairment of the movements of the hand, especially of pronation and supination; and the power of grasping objects firmly is lost. Muscular wasting of the forearm is always present; pain and surface heat are variable symptoms; they are often absent in cases in which the joint is in a state of advanced disease.

Treatment.—The joint must at once be inclosed in leather splints, and the forearm supported in a sling, the patient being forbidden to make any use of the limb. Cases are rare in which recovery will not follow, if this plan is adopted early and continued for the necessary period of from three to six months. In advanced cases the time must extend to a year, or even longer. If suppuration occurs, matter should be evacuated and drainage provided for. When, in spite of three or four months of rest, suppuration continues to be free, it should be ascertained, with as little disturbance of the structures as possible, whether any of the carpal bones have become necrosed and loose. If any are so found they should be removed; but if the bones are merely inflamed, or in a state of caries, they should be left for repair by a still longer period of rest; for here, as in all other cases, the gouging away of inflamed or carious bone will have the effect of aggravating rather than of removing the disease. In cases of extensive disease some surgeons resort to a systematic excision of the wrist-joint. Very generally, however, a better result will be obtained by long-continued rest, combined with the removal of any sequestra that are from time to time found to be loose. It is difficult, without experience, to credit the amount of repair that will follow this treatment by rest perseveringly maintained. *Osteo-arthritis* frequently attacks this joint, which becomes stiff, particularly as regards pronation and supination, and painful; swelling, usually slight, in some instances becomes considerable, as the result of ganglionic enlargement involving the sheaths of the flexor and extensor tendons. Such cases are always tedious, but much good may sometimes be done by placing the limb in splints, carefully evacuating any large collections that may have formed, by antiseptic puncture, blistering the joint for five or six weeks, and then applying Martin's india-rubber bandage,

to secure uniform pressure. In the management of *pyæmic* and other forms of blood poisoning, affecting the wrist, the main points, locally, are the support of the joint so as to prevent deformity, and the early antiseptic evacuations of matter. *Syphilitic disease* of this joint appears to be very rare.

Hip.—*Osteo-arthritis* of this joint was formerly designated *morbus coxæ senilis*, from the fact that, especially in males, the hip is often the only joint attacked. *Monarticular rheumatism.*—The affection commences, usually in persons over forty-five (it may be met with earlier), with pain about the joint, or at the back of the thigh in the course of the sciatic nerve, or in the neighborhood of the knee; gradually increasing lameness and stiffness, so that the patient is unable to stoop or dress himself; and wasting of the muscles of the thigh and hip. As the disease advances all the symptoms become more pronounced. Pain is often constant and severe. The limb becomes gradually shortened and everted, and on examination it is found that, as the result of absorption of the upper border of the acetabulum and head of the femur, the trochanter has become displaced so as to lie considerably above Nélaton's line, shrinking of the limb continues, and lameness becomes extreme. These cases are often, in their early stage, mistaken for sciatica. A correct diagnosis, however, can at once be made by testing the movements of the hip.

Treatment.—The patient should wear flannel over the joint, so as to secure warmth at a uniform temperature, and should take moderate exercise. Complete rest promotes stiffness. Blisters and liniments of opium and belladonna often diminish pain. Hot fomentations and douching give relief, and many patients find great benefit from the hot douche treatment at Baden. If urates or deposits of uric acid are present in the urine, five grains of the citrate of lithia should be given once or twice daily in potash water. Usually the limb remains in a position of extension, and no splints or other mechanical appliances are of any service. Occasionally, by manipulation, under an anæsthetic, motion may, for a time, be increased by the detachment of osteophytes around the joint and the rupture of adhesions, but, as a rule, forcible movement aggravates rather than improves the con-

dition of the limb, and it should not, therefore, be adopted without careful consideration. *Acute inflammation* of the hip-joint, developed in the course of *pyæmia* and other kinds of blood poisoning, is formidable in the highest degree. Pain is usually very severe, the joint quickly becomes disorganized, and the patient is threatened with death by exhaustion. The joint must be, at the very outset of the disease, placed at rest by the application of a weight to the foot, combined with the use of a Thomas's splint, or of an interrupted long splint, and matter should be evacuated, either by the aspirator or by antiseptic incision, and free drainage be provided. In young subjects, should other conditions be favorable, amputation may sometimes be performed; but in adults this step generally cannot be ventured upon. In the course of *typhoid fever* the hip (apparently more often than any other joint) is liable to be attacked with inflammation, attended with the same symptoms as are met with in ordinary hip disease. The affection is usually subacute, and rarely goes on to suppuration; serous effusion, however, is often considerable, and spontaneous dislocation is apt to occur. In any case, therefore, should the patient complain of pain, careful examination should at once be made, and if the joint is found stiff and sensitive on movement, weight extension should be applied, the limb should be supported between sandbags, and a cradle placed over the foot to prevent pressure by the bed-clothes.

In *gonorrheal rheumatism* the hip is very liable to be affected. The symptoms are those of an acute or subacute and very persistent inflammation, which often leaves the limb completely fixed by adhesions within and around the joint. Suppuration, though rare, is occasionally met with.

After active stage has passed, in order to restore movements, manipulation, under anæsthetic, followed by hot douching, shampooing, and passive movements, and repeated, if necessary, at the end of a fortnight or three weeks, will be required. These means will often succeed, but no undue violence must be used; nor should forcible movement be persisted in if it is followed by severe pain that does not quickly subside, or by marked swelling about the joint.

Strumous Disease of the Hip-Joint.—Although met with at any age up to

puberty, and occasionally in middle and even in advanced life, hip-disease most frequently begins in childhood between the ages of three and seven. It originates most commonly in the bones, *i. e.*, in the upper end of the femur, or in the floor of the acetabulum. The frequency of disease in these structures is probably due to the fact that, being centers of rapid growth, their nutrition is unstable, and apt, on any disturbance, to pass into inflammatory action; and it is easy to see that, as these parts themselves are within the capsule, disease in them must almost inevitably provoke a general arthritis. In a certain number of cases disease commences in the synovial membrane.

Synovial cases, though they are sometimes acute, generally take a mild course, yield readily to treatment in their early stage, and often end, though convalescence is tedious, in complete recovery. Cases in which the bones are affected are much more serious. If carefully treated they, like the synovial form, end in satisfactory recovery, though this may be long delayed. But when neglected they pass on to caries or necrosis, suppuration, and great deformity, and frequently to a fatal result.

Diagnosis.—Well-established hip-disease may be recognized at a glance; but in the early period, when it is so highly important to form a correct opinion, diagnosis is often attended with great difficulty, first because the symptoms are very slightly marked, and, secondly, because almost all the individual symptoms of hip-disease are also the symptoms of disease either of the spine, or of some neighboring part. Hence, a correct opinion can be reached only by observing and comparing a number of slight signs, any one of which alone would be quite inconclusive.

Symptoms.—*Lameness* is always present, but may be so slight that it is easily overlooked. It is due to the fact that the joint is neither in a stiff nor distorted condition, or is too sensitive to bear any weight. There is, however, no form of lameness that is in the least degree characteristic of hip-disease. The symptom must always be studied in conjunction with other evidences of the disease.

Pain.—This is very variable both in degree and situation. Sometimes it is so slight, or entirely absent, that the disease is not suspected. Sometimes it is severe

from the first. It may be in the joint itself, or transferred to the nerve peripheries, and so be felt either in the knee or the inner side of the thigh or the leg. It must, however, be borne in mind that pain may be referred to these situations in several other diseases, as of the lumbar spine or the sacro-iliac joint, cancer of the rectum, and abscess or aneurism in Scarpa's triangle; in any case, in fact, in which the trunk or higher branches of either the obturator or anterior crural, which both supply the hip-joint, are irritated.

Altered position of the limb.—In a typical case, in the early period of disease, the joint is flexed, abducted, and rotated outward. It is that of greatest ease, which we unconsciously adopt as we sit at rest with the limbs flexed on the trunk, the knees apart, and the heels touching. This position relaxes all the ligaments of the joint. Thus flexion relaxes the front of the capsule, abduction the ligamentum teres and the outer band of the ilio-femoral ligament, rotation outward the inner band of this ligament and the back of the capsule.

This position of the limb, however, is generally not at once obvious when we examine the patient. Instead of it we find that the diseased limb is extended, and parallel with its fellow, that the lumbar spine is arched forward (lordosis), that the pelvis is depressed on the affected side, and that the limb looks longer than its fellow. This attitude is thus explained. Obviously a limb that is fixed in a position of flexion and abduction (which, in other words, is pointed forward and outward) is useless for progression. To overcome this difficulty, the patient, by curving the lumbar spine forward, rotates the pelvis on its transverse horizontal axis, and so makes the femur point downward instead of forward; and by curving the lumbar spine laterally, so that the pelvis is raised on the sound and depressed on the affected side, he brings the femur inward toward the middle line. The apparent lengthening of the limb is due merely to the fact that the pelvis on that side is depressed; in other words, apparent lengthening always indicates that the limb is abducted. As to real lengthening of the limb, this probably never occurs. In the later period of disease, the powerful adductors, under the influence of reflex irritation, draw the limb inward so that it now becomes flexed and adducted instead of flexed and abducted. Here, again, the limb occupies a position

(crossing the opposite thigh) in which it is useless. To meet the difficulty the patient curves his spine laterally so as to draw up the affected side, and so brings the femur outward, till it is again parallel with its fellow, with the result, however, of producing apparent shortening of the limb. This apparent shortening always depends on adduction. At a still later period the limb undergoes real shortening as the upper border of the acetabulum and the head of the femur become absorbed, and the trochanter is carried upward by muscular action, more or less above Nélaton's line (drawn from the anterior iliac spine to the tuberosity of the ischium). Another cause of real shortening is arrest of growth of the limb.

Loss of movement in the joint is the most constant and the most reliable sign of hip-disease. Even in the very earliest stage some loss of motion is so constantly present that completely free movement is in itself almost enough to prove that the joint is sound. Various conditions, however, it must be remembered, may interfere with flexion and extension of the thigh on the trunk, *e.g.*, psoas abscess will often prevent full extension, while abscess under the glutei will limit flexion. It is necessary, therefore, to ascertain whether, when the limb is semiflexed, the femur will rotate freely in the acetabulum. If the ball-and-socket movement is free, it may be concluded that the loss of flexion and extension is due to some impediment outside the joint, but if rotation, as well as the other movements, is lost or distinctly impaired, it must be concluded that the joint itself is diseased.

Muscular wasting, always an important symptom, due mainly to reflex atrophy, but in part to disuse, is constantly present in established disease, and may even be well marked in three or four weeks. It shows itself as flattening of the hip and loss of the fold at the lower border of the gluteus, and also by shrinking of the thigh, accompanied by a flabby condition of the muscles, detected by measuring the two limbs at the same level.

Swelling.—This may be due to general fullness about the joint, perhaps with enlargement of the glands in Scarpa's triangle, and to the presence of abscess, which may be found at any aspect of the articulation.

For examination the patient must be

undressed, and lying on some firm surface, so that the real position of the limb can be made out. The surgeon must see whether the knee can be brought down without producing anterior curvature of the lumbar spine; whether the heels are level; and whether the anterior iliac spines are horizontal. If, when the knee is down, the spine is curved forward, it shows that the thigh is flexed. The amount of flexion will be disclosed by raising the knee till the spine is straight. If the iliac spine on the suspected side is depressed, it indicates that the limb is abducted, and the degree of abduction will be shown by carrying the limb outward till the iliac spines are restored to the same level. If, however, the iliac spine of the suspected side is drawn up, it indicates abduction, the amount of which will be brought out by abducting the limb till the pelvis is again horizontal. The real position of the limb will thus be ascertained. Flexion, and extension of the thigh on the trunk, and rotation of the femur in the acetabulum should now be investigated. This test must be very gently applied, but each movement must be carried to its full natural range, for it is only when the extreme limits are approached that slight restrictions of movement become apparent. Muscular wasting of the limb and swelling about the joint should next be looked for. Sometimes, when the joint is grasped from before backward, between the finger and thumb, enlargement of the upper end of the femur will be detected. Tenderness on carefully applied pressure, either in front of or behind the joint, is sometimes a marked symptom. Jarring of the heel or knee is a worthless test. It makes a timid child shrink, though the joint is perfectly sound, while often it causes no uneasiness, although hip-disease is well marked.

When these various signs have been investigated a conclusion is generally readily formed; but sometimes early diagnosis must rest on two or three slight yet distinct symptoms carefully pieced together, in the absence of some symptoms that are often spoken of as characteristic. Thus, there may be no pain either in the hip or knee, no complaint when the knee or heel is jarred, and, to a casual examination, no flexion and no lameness. Close investigation, however, shows that there is slight apparent lengthening, together with slight

limitations of complete flexion, slight muscular wasting, and slight lameness. In another case the only symptoms are stiffness and occasional pain (which parents regard as a "growing pain" or rheumatism), and limitation of flexion and rotation of the femur in the acetabulum. Thus, a thorough and critical, but always gently conducted examination, is required. The conditions between which and hip-disease mistakes are most frequently made, are disease of the spine accompanied with psoas or iliac abscess, disease of the sacro-iliac joint, abscess under the glutei, from whatever cause, infantile paralysis, congenital dislocation of the hip-joint, and, in young children, lordosis, due to acute rickets, an affection which imitates hip-disease in the circumstance that the limbs are often tender on movement.

Complications.—In a very large proportion of cases in which the disease is allowed to advance, and in some even in which treatment has been at once brought to bear, *suppuration* will occur. Matter is usually formed within the joint, and passes either through the cotyloid notch, or through the bursa under the ilio-psoas, to reach the surface in Scarpa's triangle, or through the thin posterior part of the capsule to appear under the glutei. Some abscesses, however (especially those that appear late in the disease), are outside the joint, and are due to suppuration around the remains of inflammatory exudation. Abscesses may present at any part of the joint, but a common situation is under the tensor fasciæ femoris, on the outer part of the limb. When the acetabulum is affected matter may form within the pelvis and present above Poupart's ligament. Occasionally pus in this situation forms a communication with the intestine, so that fæces escape into the abscess cavity. This complication, happily rare, is usually fatal.

Two serious complications, *amyloid degeneration* of the viscera and *tuberculous meningitis*, must be referred to. Amyloid degeneration, indicated by albuminuria and enlargement of the liver and spleen,* though usually met with only when discharge has been copious and prolonged, is sometimes present when suppuration is still recent. A watch should therefore be kept for it in all cases in which considerable discharge is going on, for if suppuration can be arrested when the amyloid change is recent, the latter

may entirely disappear. At a subsequent period, however, it is not only incurable, but it very greatly increases the risk attending operative interference. *Tuberculosis meningitis* was formerly, when hip-disease was so often allowed to reach an advanced stage, much more common than it is at present. But it is still common, and may occur in cases in which no supuration has taken place, and at any period, even, indeed, after the joint affection has long been cured. This is a complication that always passes on to a fatal termination. *Pulmonary phthisis* is a decidedly rare complication.

Treatment.—In the early period absolute rest, and the removal of any deformity that is present; best secured by extension by means of the weight and pulley. The patient is placed on a firm mattress, with a board beneath it. The weight is applied by means of the well-known stirrup made of stout strapping, the ends of which extend half way up the thigh, so that the ligaments of the knee are not subject to any undue strain. The weight, which takes effect rather by its constant action than by its amount, should not exceed three or four pounds in children under ten, and five to eight in patients from ten to twenty. Heavier weights than these are seldom required. A long splint should be applied to the *opposite* or *sound* side to keep the patient on his back in a horizontal position. As to the affected limb, this must be placed in the position to which the disease has brought it. Lordosis due to flexion must be removed by raising the limb till the spine is straight. If the pelvis is depressed on the affected side, the limb must be abducted till the two iliac spines become horizontal; if, on the contrary, the pelvis is drawn up on the diseased side, the limb must be abducted till the pelvis is again square. When these directions have been carried out, when, in fact, the real has been substituted for the apparent position, the limb must be supported in this attitude (by pillows, or some light framework), and the pulley must be adjusted so that extension is made in the long axis of the thigh. When this principle is carried out, the weight removes undue interarticular pressure, whereas, if extension does not correspond with the long axis of the thigh, the weight acts by leverage, and, therefore, tends to increase, instead of to relieve the pressure of the femur against the floor of the acetabulum. A cradle

should keep the weight of the bedclothes off the foot. As flexion is corrected it is necessary to remove some of the pillows and to shift the pulley, so that the weight may still act in the long axis of the thigh. Though the weight will remove flexion generally in from a fortnight in recent, to two months in old cases, it has little or no influence either on abduction or adduction.

Abduction (showing itself as apparent lengthening) calls for no special treatment. It will gradually disappear if the joint remains movable, while, if the joint becomes fixed, abduction is an advantage, because the apparent lengthening which it produces will tend to compensate for any real shortening that may have resulted, from either absorption of the articular surfaces or arrested growth of the limb. Adduction, on the contrary, as it leads to apparent shortening, must, if possible, be removed. For this purpose a pound, or perhaps two pounds, is added to the amount already applied to the affected limb. A long splint is applied to the sound limb (if this has not already been done), and a cord fastened to the lower end of this splint is run upward along its outside to the head of the bed, where it turns over a pulley and supports the same amount of weight as that appended to the affected limb. Thus, while the diseased limb is drawn down, the sound limb is drawn in the opposite direction. This method will generally remove even a considerable amount of adduction, *i. e.*, of apparent shortening, in the course of from three to five or six weeks.

In cases of long standing the limb may be so fixed, although there is no ankylosis (it should be remembered that bony ankylosis is rare in hip-disease, even when repair has followed long-continued suppuration) that the weight fails to secure extension. In these instances, when the child is under chloroform, the limb may be straightened through two or three degrees, and then the weight may be re-applied. It will now be found that the limb will gradually come down under the influence of the weight. Very slight force only should be used in this proceeding, and anything approaching the old method of forcibly straightening the limb must be entirely condemned.

The period during which treatment should be continued varies with the case.

It must always, however, be remembered that recovery is slow, and that relapses are very prone to occur, so that the main chance of error lies in remitting treatment too soon. Weight extension should be continued for at least three months after pain and all tendency to muscular contraction have completely disappeared, and if the case has been acute a full six months should be allowed. The weight should then be *gradually* discontinued, and, if no symptoms are observed, a proper splint may be applied, and the child be allowed to be up on crutches, wearing a high boot on the sound side, so as to keep the foot of the diseased limb off the ground.

Treatment of abscess in hip disease.—Abscesses, which used to be left to form large collections, should be evacuated as soon as they are detected. When the patient is under an anæsthetic, an incision about an inch long is made, and kept open with dressing forceps, while matter is gently pressed out, so that the abscess is emptied. A piece of drainage-tube, just long enough to enter the abscess cavity, is inserted, and the wound is dressed with "protective" and antiseptic gauze in the usual manner. Subsequently the dressings are changed often enough to prevent the discharge from passing beyond the gauze. By this method abscesses may be opened without any rise of temperature or local disturbance. When this treatment is employed in cases in which the joint-disease has become inactive, no further suppuration will occur, and the wound will be soundly healed in a fortnight to three weeks; while in those in which active disease is still in progress, the abscess contracts, and all that remains is a sinus, which serves to afford exit for any pus that is produced till, as repair advances, suppuration comes to an end. By opening the abscesses early the extensive burrowing of pus, and the formation of numerous sinuses about the joint, formerly so common, is prevented, the tissues are relieved from the prejudicial action of retained pus, fever is avoided, and the period of suppuration is largely curtailed.

Excision in hip-disease.—With the majority of surgeons excision of the hip is a very unpopular operation. There are, however, certain conditions for which it is advisable to perform excision, although

the result of the operation must often be doubtful. These are:

When the whole head of the femur, or what remains of it, has become necrosed and detached, so as to form a loose sequestrum. This proceeding, however, is not, strictly speaking, an excision, but merely an operation for dead bone.

When, in spite of three or four months of complete rest and free drainage, suppuration remains copious, and the general health is giving way, provided, however, that there is no evidence of extensive disease, either of the femur or the pelvis, or wide burrowing of matter in the limb. When the femur is the seat of chronic osteo-myelitis, which sometimes involves the greater part of the shaft, amputation is the only adequate operation; and when the pelvis is largely diseased, excision will be useful only in securing free drainage. The gouging away of carious bone from the pelvis will very seldom be attended with any good result.

When, along with continued suppuration, there is so much displacement of the upper end of the femur that the limb cannot be brought into good position without operation. Here excision may serve the double purpose of removing distortion and of arresting suppuration. In any of the above conditions the appearance of enlargement of the liver, or of albumen in the urine, showing that amyloid disease of the viscera has set in, may be an additional ground for excision, for, if the operation can arrest suppuration, the internal organs may perfectly recover. When, however, amyloid disease is of long standing, the operation will not only be useless, but attended with considerable danger to life.

Operation.—An incision down to the back of the joint is made about four inches in length, and extending from the base of the trochanter upward in the course of the fibers of the glutei. The wound is retracted, and the capsule, if still present, is opened. The finger is then passed in to ascertain the condition of the bones and the relation of the neck; a small saw, guided by the finger, is next introduced; the neck is sawn through where it appears to be sound, and the detached portion is removed, with as little injury as possible to the surrounding parts, by extracting bone forceps. Should it be clear that the trochanter is extensively carious it must be removed, but

this step, it must be noted, largely interferes with the future usefulness of the limb. The floor of the acetabulum must be carefully examined, and any sequestra removed, and should there be perforation and abscess in the pelvis, free drainage should be provided by removing the necessary amount of bone with a gouge. Bone should not, however, be gouged away merely because it is carious. After the operation the limb may be placed either on an outside splint, interrupted opposite the wound, or between sand-bags, with a weight of two or three pounds, suspended from the foot, to prevent undue retraction and shortening.

The conditions adverse to the success of the operation increase so rapidly, as age advances, that excision is very seldom undertaken in patients above the age of twenty. In middle life it is justly regarded as inadmissible.

Amputation.—It is now seen that when the disease has reached a certain stage, it is generally futile to anticipate repair, either from continued rest or from excision. It has often been observed that children show very great rallying power when a source of exhausting suppuration is removed, and it is known that amyloid degeneration, unless it is of long standing, is no bar to the operation, and may be completely recovered from. Obviously, however, amputation must be performed only when the patient's recovery is otherwise hopeless. The operation is called for: 1. When hip disease is complicated with extensive disease of the femur attended with copious and persistent suppuration, and especially if amyloid degeneration is present. 2. When excision has been performed but has failed to arrest suppuration, and the general health is giving way. Here amputation is much simplified by the previous excision. 3. When the patient is steadily losing ground, and it is believed that he has not strength sufficient to secure repair after excision. 4. In some cases of free suppuration connected with advanced disease of the pelvis, amputation may be advantageous, either by securing free drainage not otherwise possible, or by enabling the operator to remove diseased bone that could not otherwise be reached. Generally, however, extensive disease of the pelvis contra-indicates amputation.

As the patient is already in an exhausted condition, it is of the first im-

portance that little blood should be lost, and that the operation should occupy as short a time as is compatible with its careful execution. Hemorrhage must be guarded against, either by the use of Davy's lever or of an efficient tourniquet. The method by transfixion admits of being rapidly carried out, but the resulting stump is too short to allow of the adaptation of an artificial limb. If, however, Jordan's admirable method is used, a long, muscular stump is provided, and the patient will, on recovery, be able to walk well on an artificial limb. Hence the choice of the method in every case will turn on the condition of the patient. If he is in a state to bear a somewhat prolonged operation, Jordan's plan should certainly be selected; but if he is so exhausted that it is necessary to complete the amputation with as little loss of time as possible, the transfixion method had better be adopted.

The knee.—This is not only the largest of the joints, but it is singularly liable to disease. Some affections met with here are rarely seen in any other joint; while if we glance at the various diseases that attack the joints, it is the knee that is, in almost every instance, most prone to be affected. The knee is, after the hip, the joint in which deformity is most likely to occur, and the most difficult to remedy, and in which pain and muscular startings are most frequent, severe, and hard to relieve; in which, while suppuration is frequent, it is the most formidable; in which we are most often driven, in neglected cases, to perform excision or amputation; while, on the other hand, there is no joint in which appropriate treatment is attended with more satisfactory results. It is therefore an articulation which demands special consideration. The features of *strumous disease* are well illustrated in this joint. The affection begins either as a low form of synovitis, often at first circumscribed, but subsequently extending to the whole membrane; or as inflammation of the cancellous tissue (in young subjects epiphysitis) of the lower end of the femur or upper end of the tibia. When disease begins as synovitis, the knee is bent at an angle of about 140° , and though it can be flexed, it cannot be fully extended. If the process is acute the joint may be distended with fluid, so that fluctuation is distinct. Usually, however, swelling is inconsider-

able, or so slight that it can be detected only by careful measurement, and is due mainly to thickening of the synovial membrane, chiefly apparent by the side of the ligamentum patellæ.

In later stages the membrane undergoes pulpy degeneration followed by supuration. The ligaments become softened, and gradually elongated, while, owing to reflex contraction of the hamstring muscles, a remarkable distortion is produced. This is threefold; the bones of the leg becoming flexed, displaced backward and outward, and rotated outward so that the foot is everted. Flexion is due to the action of the hamstrings, while the displacement outward, combined with eversion, is due to the fact that the powerful biceps muscle is inserted into the outer and front part of the head of the fibula, and, as a strong fascia covering the tibialis anticus, into the crest of the tibia, so that it is a strong external rotator. Lameness, due to the position of the limb, or to tenderness of the joint, is present. Pain, and abnormal heat of the surface, though often present, are so frequently absent, or so slightly marked, that they are much less reliable symptoms than flexion and puffy enlargement of the joint.

When disease begins in the articular end either of the femur or the tibia, the symptoms, at first very slightly marked, are local pain, tenderness on firm pressure, puffy swelling of the soft parts, lameness, and inability of the patient to completely extend the limb. It is in this form of disease that startings of the limb, due to reflex muscular contraction, make their appearance early, and often gradually increase in severity. As the disease advances the joint itself becomes involved, sometimes by direct extension of inflammation leading to chronic synovitis; but frequently by the entrance of pus into the cavity of the joint through a perforation of the articular cartilage; when this opening is small and indirect, the symptoms are at first not very marked, but when matter in any considerable quantity bursts directly into the joint, violent and destructive inflammation is at once produced, attended with rapid distention of the synovial cavity with pus, severe pain, high temperature, and constitutional disturbance.

Treatment.—At the earliest moment at which disease can be detected the pa-

tient must be forbidden to put his foot to the ground, and the joint must be placed at absolute rest in splints, made of carefully molded leather. These should extend from the upper third of the thigh nearly to the ankle, so that the whole limb is fixed. They must be worn constantly, day and night, and be removed only twice or three times a week for attention to the skin, and must be immediately reapplied. Thus treated, in the great majority of cases incipient disease will steadily recede, and in the course of from three to six or nine months complete recovery with unimpaired movement will take place. A modification of this plan, when swelling and heat have subsided, is to employ Thomas's knee splint, so that the patient is allowed exercise without throwing weight on the affected joint. If, however, under this method, any return of symptoms is observed, the leather splints and the horizontal position ought to be at once resumed. In cases in which the joint has become flexed, no forcible attempt, either by manipulation or instruments, should be made to straighten it, but the splints should be molded to its present position. With rest, and the subsidence of muscular spasm, it will, in the course of a few weeks, often within a month, spontaneously subside into a posture of extension. In cases of any standing this process is very gradual, and it is necessary to follow it up by adapting splints whose shape must be altered to keep pace with the improved position of the limb. The improvement produced by rest may be advanced by a succession of small blisters, or the application of oleate of mercury, or of gentle pressure by means of Martin's elastic bandage. Friction and douching by salt water, etc., means which parents are often so anxious to employ, are usually harmful, as they involve disturbance of the joint. Night screams are best relieved by the use of the actual cautery, lightly applied, and repeated, if necessary, in three or four days; and by combining, with the splints, the use of the weight and pulley. In this case the limb must be raised and supported in such a position that the tibia is horizontal, and that extension acts in the long axis of the leg. When disease involves the ends of the bones, the treatment just described must be carried out. In these instances, however, it is of the highest importance to prevent the exten-

sion of mischief to the joint itself. Rest must be scrupulously maintained. Should matter be detected, it must be at once evacuated; and even though no fluctuation can be felt, if local pain, tenderness on pressure, and puffy swelling and redness of the surface are present, the existence of pus must be suspected, and an incision through the periosteum should be made, and the bone explored by puncture with a fine drill, and if any matter is found, a free opening should be made, so that the chance of the escape of matter into the joint may be provided against.

Acute arthritis of infants is common in the knee. The joint becomes painful, restricted in its movements, and tender to the touch; and pus, rapidly formed in large quantity, distends the joint, and soon becomes extravasated into the surrounding tissues. If incisions are made, and free drainage is provided, as soon as matter forms, and a posterior splint is applied, complete recovery, with free movement, may often be secured. But in neglected cases the ligaments and ends of the bones are rapidly destroyed; and, if the patient recovers, the joint remains more or less loose, flail-like, and distorted, and the limb is arrested in its growth and useless.

In any form of *blood poisoning* attacking the knee, the joint must, if the patient's condition allows, be at once placed at rest on a splint, in the best available position, and covered with warm lead and opium lotion; or, if pain is severe, with a liniment of opium and belladonna. If the joint becomes distended it should be emptied with a fine aspirator needle. If the fluid is purulent, and soon re-forms, antiseptic incision and drainage will be called for. In many cases in which the patient's general condition is grave, and in which other lesions are present, if the joint is in a quiescent state and not much distended, it is best to postpone active interference, and merely to secure rest.

Osteo-arthritis, of frequent occurrence in persons over fifty, and sometimes found in much younger subjects, comes on with stiffness and pain (especially marked after rest), weakness and creaking, grating, or cracking on movement. Swelling due to effusion, though it may be considerable, and even amount to hydrods articuli, is usually only slight. "Lipping," due to the heaping up of new bone along the articular margins, can

often be felt; and in advanced cases the patella and the articular ends of the bones become enlarged and altered in shape; while in some instances masses of cartilage, developed in the synovial fringes, and subsequently becoming detached, form "loose bodies" in the cavity of the joint; pain is often severe, and the patient becomes crippled by lameness. The disease generally attacks other joints, especially the opposite knee.

Syphilitic disease in the form either of synovitis with effusion, or of gummatous infiltration and thickening of the sub-synovial tissue, often combined with periostitis of the ends of one of the bones, is met with more often in this than in any other articulation.

Ankle.—*Strumous disease* of this joint usually takes the form of an insidious chronic synovitis, though it may arise from extension of inflammation from the lower epiphysis of the tibia, or from one of the tarsal bones. The symptoms are lameness, enlargement of the joint, wasting of the muscles of the calf, and, though these are often absent, pain and heat of the surface, and restricted movement. Swelling, which is frequently in children the most reliable feature, occurs as puffy enlargement by the sides of the tendo Achillis, so that the joint has an appearance of increased width when viewed from behind; but it can also be seen around the malleoli, and in front, beneath the extensor tendons. It is often difficult alike in early and advanced cases, and even when suppuration has occurred and has led to the formation of sinuses, to decide whether disease is situated in the ankle-joint or is confined to the astragalus or the os calcis. In early cases this is not very material, as treatment by complete rest is essential in both instances; but in advanced disease the differential diagnosis is highly important. I have known Syme's amputation performed for what was believed to be destructive disease of the ankle-joint, but which proved to be caries of the tarsus that might have been dealt with without amputation, while the joint itself was perfectly healthy. The foot should never be removed until the surgeon has convinced himself that a probe passed into any sinuses that exist really enters the joint. In strumous disease of the ankle the joint must be at once inclosed in lateral leather splints, and the patient must bear no weight upon the limb. Any

matter that forms must be at once antiseptically evacuated. There are very few cases indeed in which this treatment, combined with cod-liver oil, iron, and good air, will not lead to recovery, usually with restoration of the movements of the joint. *Osteo-arthritis* is usually not confined to the joint, but involves, at the same time, the adjacent tarsal articulations, and is often associated with a very troublesome form of flat foot, resulting from relaxation of the plantar ligaments, a condition which, along with stiffness of the ankle-joint itself, greatly cripples the patient. The local treatment consists in protection against cold and damp, and the use of the hot douche or steam bath, moderate exercise, and some support for the plantar arch. When, however, the joint is swollen and tender, no mechanical support can be borne, and the patient should be provided with boots of very soft leather or cloth, with low heels and wide soles, while warmth and hot douching are persevered with. The ankle and the neighboring tarsal joints, together with the fibrous structures of the sole, including all the ligaments, are not rarely the seat of urethral urethritis of an acute and severe type. In cases of rapidly increasing flat foot in young adults, the presence of gonorrhea must not be overlooked. The affection often assumes a severe form, and the arch is completely lost. It is necessary to keep the patient for a time completely off his feet. And for some months the patient should rest his feet as much as possible, and should wear either the surgical sole, or some equivalent support.

HOWARD MARSH.

Symptomatic Indications.—Strumous disease of the joints will require *calcareo phos.* or *mercurius* if the disease has originated in the bones; *mercurius corr.* when ulceration affects the cartilages. (See SCROFULOSIS OF JOINTS.) *Colocynth* is frequently useful in relieving pain. *Aconite* in rheumatic arthritis, inflammation, and in the commencement of hip-disease, does excellent service. *Benzoic acid* for concretion in the joints resulting from rheumatism or gout. *Argentum metallicum* is valuable in arthritis articularis, and congestion of the bones and cartilages. In hip-disease the principal remedy is *belladonna*, particularly when attended with pain in the knee. When suppuration is inevitable, *calcium sul-*

phide limits and controls the formation of pus. *Silicea* is useful when the pus is thin and unhealthy; *sulphur* in chronic cases.

JOINTS, NEUROMIMESIS, OR HYSTERIA OF.—

Diagnosis from "organic" disease is based on the facts that, in neuromimesis, (1) the subjective symptoms, pain, tenderness, etc., are often great, while there is in the joint no alteration visible to the surgeon; (2) the pain and tenderness are often chiefly in the skin rather than in the joint itself; (3) the patient sometimes describes her sufferings in strong language, but in a cheerful manner, as though the recollection of them was not so very painful after all; (4) stiffness and contractions disappear under anæsthetics; (5) instead of being hotter than the healthy joint, as in the case of inflammations, the affected joint is often colder; (6) other hysterical symptoms, and even a manifest cause for them, may coexist. But bear in mind that hysterical patients are not exempt from organic disease, and that "hysteria" itself even sometimes leads to actual alterations in the joints. This is not surprising, considering the intimate relations, pathologically as well as physiologically, between the spinal cord and the joints.

Treatment.—See HYSTERIA.

C. B. KEETLEY.

JOINTS, KEYS AND GUIDES TO THE.—

The term "keys" is used by Professor Hamilton to indicate certain ligaments, or muscular and tendinous attachments, the cutting of which permits the ready unlocking or opening of the joint, so that its further disarticulation may be readily and easily affected. The term "guides" is employed in the same connection to designate certain superficial anatomical irregularities or protuberances which indicate the situation of the joint.

I. Phalangeal Articulations.—*Key:* the lateral ligaments. *Guide:* the projecting point of the knuckle when the phalanx is flexed at a right angle upon the next phalanx, the knife being applied upon the dorsal surface, about a quarter of an inch beyond the most projecting point of the knuckle.

II. Metacarpo-phalangeal Articulation of the Thumb, of the Great and Ring Fingers.—*Key:* lateral ligaments.

Guide: the projecting point of the knuckle, which is a little more than a quarter of an inch above the joint.

III. Metacarpo-phalangeal Articulation of the Index Finger.—*Key:* *internal lateral ligament.* Ulnar side.

IV. Metacarpo-phalangeal Articulation of the Little Finger.—*Key:* *external lateral ligament.* Radial side.

V. Carpo-metacarpal Articulation of the Thumb.—*Key:* *internal lateral ligament.* Ulnar side.

VI. Carpo-metacarpal Articulation of the Little Finger.—*Key:* *external lateral ligament.* Radial side.

VII. Radio-carpal Articulation. Wrist-joint.—*Key:* *external lateral ligament.* Radial side. *Guide:* lower end of outer styloid process.

VIII. Humero-ulnar Articulation. Elbow-joint.—*Key:* *external lateral ligament.* *Guide:* Head of the radius. To find the head of the radius the patient's forearm should be flexed to a right angle with the humerus. The surgeon takes the wrist or hand of the patient in his right hand, grasping the elbow with his left hand in such a way as to place the thumb upon the external condyle of the humerus. "The thumb is then allowed to slide off from the condyle toward the hand until only the upper margin of the thumb touches the condyle, when its lower margin will be felt resting upon a slight elevation, which is the head of the radius." The space between the condyle of the humerus and the head of the radius is usually about half an inch; just at the upper margin of the head of the radius is the situation of the joint, and the point where the incision should be made to sever the ligament. With the thumb in the position described by slowly pronating and supinating the radius with the right hand, the head of the radius can be felt rotating upon its axis and its position accurately defined.

IX. Scapulo-humeral Articulation. Shoulder-joint.—*Keys:* *coraco-humeral ligament, supra and infra-spinatus and teres minor muscles* near their insertion into the greater tuberosity and the *subscapularis* near its insertion into the lesser tuberosity.

X. Phalangeal Articulation of the Toes.—*Key:* *the lateral ligaments.*

XI. Metatarso-phalangeal Articulations of the Second, Third, and Fourth Toes.—*Key:* *the lateral ligaments.*

XII. Metatarso-phalangeal Articulation of the Great Toe.—*Key:* *external lateral ligament.* Fibular side.

XIII. Metatarso-phalangeal Articulation of the Little Toe.—*Key:* *External lateral ligament.* Fibular side.

XIV. Tarso-metatarsal Articulation.—*Key:* *the dorsal ligament uniting the cuboid and fifth metatarsal bone.*

XV. Medio-tarsal Articulation.—*Key:* *internal lateral ligaments.* *Guide:* Tibial side of the scaphoid bone.

XVI. Tibio-tarsal Articulation. Ankle-joint.—*Key:* *internal lateral ligament.* Deltoid.

XVII. Femoro-tibial Articulation. Knee-joint.—*Keys:* *internal lateral and accessory ligament.*

XVIII. Coxo-femoral Articulation. Hip-joint.—*Key:* *anterior portion of capsular ligament.*

JOINTS, AMPUTATIONS AT THE.—(Phalangeal Articulation.)—

The fingers or phalanges to be amputated should be flexed at a right angle upon the metacarpal bone or proximal phalanx. The knife is then passed across the dorsal surface, about one-fourth of an inch beyond the most projecting point of the knuckle. This will sever the extensor tendon, open the capsule, and expose the joint; cutting the lateral ligaments will now unlock the joint, the articulating surfaces may be readily separated and disarticulation easily completed. The joint being traversed from the dorsum, a flap is cut from the palmar surface.

Radio-carpal Articulation.—Wrist-Joint. *Circular Method.* The arm should be firmly held by an assistant with both hands, the integument drawn back, and the brachial artery compressed by his thumbs. A circular incision is made by the surgeon, upon the radial side about an inch to an inch and a half below the styloid process of the radius, through the skin and superficial fascia, down to the tendons; the external lateral ligament now being divided, the articulation between the radius and scaphoid is readily exposed and disarticulation effected. The flaps should be carefully dissected up to a point above the line of articulation, which flap should be reflected.

Humero-ulnar Articulation.—Elbow-joint. The forearm should be slightly flexed upon the arm and the knife entered at the upper margin of the head of the

radius where a transverse incision will sever the external lateral ligament and expose the joint. If the surgeon desires to perform the operation with a single anterior flap, he may, after having entered the articulation carry, the knife around the back of the arm, to the ulnar side, a little below the head of the radius cutting through the integument down to the bone. The forearm must then be flexed, when the surgeon may rapidly dissect the anterior flap, well up to the articulation; and finally, placing the edge of the knife vertically upon the front of joint, so that its extremity, near the point, rests in the open articulation between the radius and ulna: the remaining attachments of the biceps, the brachialis anticus, the capsule, the anterior and internal ligaments may be served at one stroke. The olecranon process of the ulna may now be sawn through below the point of insertion of the triceps.

Scapulo-humeral Articulation. —

Shoulder-joint. There are a number of methods proposed for the removal of the shoulder, the most prominent being that known as Larrey's, or the oval shoulder-joint amputation. The method recommended by Prof. Hamilton is as follows:

The forearm, at the elbow and wrist, is seized by an assistant, and in order that he may control its motion more perfectly, he flexes it to a right angle with the humerus. He then raises the humerus to a right angle with the body. The surgeon, if it be the right arm, standing on the left side of the body and arm, with his face to the patient's head, grasps with his left hand the muscular eminence formed by the deltoid muscle, and with his right hand, holding a large common bistoury, forms an oval, external flap, the apex of which reaches to within two or three inches of the insertion of the deltoid, and the base of which extends from near the coracoid process in front to a corresponding point below the acromion process behind. This flap is now rapidly dissected up until the outer extremity of the acromion process is fully exposed.

The assistant now lowers the arm nearly or quite parallel to the body, so as to expose more fully the head of the humerus, and especially its capsule and coraco-humeral ligament. The knife, placed with its flat surface against the acromion process and its edge directed toward the head of the humerus, divides

the coraco-humeral ligament, the upper portion of the capsule and, perhaps, the long head of the biceps. This section does little more, however, than to open the joint fairly to view.

The assistant, still holding the forearm at a right angle with the arm, rotates the humerus forcibly inward, while the surgeon, with one sweep of the knife, divides the supra-spinatus, the infra-spinatus, and the teres minor. These muscles constitute the *second* and most important key to the articulation, and it is possible now to open the joint sufficiently to pass a knife between the head of the humerus and the glenoid cavity of the scapula. They are all inserted into the greater tuberosity, and inasmuch as they approach their points of insertion from above, from behind, and from below, the knife must be carried around the tuberosity with a firm hand and in such a direction that the lower half of the incision shall pass down behind the tuberosity, parallel to the axis of the humerus; indeed, the lower portion of the teres minor, having a slight muscular insertion into the humerus below the tuberosity, it is well to extend this incision a little below the tuberosity, and to incline it here slightly forward.

The assistant next rotates the humerus forcibly outward, exposing the lesser tuberosity, and the surgeon, with a similar sweep around this tuberosity, divides the subscapularis. The joint now separates widely, and changing his bistoury for a seven- or eight-inch amputating knife he passes through the joint, dividing the remainder of the capsule and the long head of the triceps. Turning now the edge of the knife toward the humerus, the incision is prolonged downward, hugging closely the posterior surface of the bone to the extent of three or four inches. Another assistant, following the incision made beneath the head of the bone, passes his two thumbs from opposite sides into the wound and seizes the axillary artery between his thumbs and fingers, holding it firmly, while the surgeon completes the section of the axillary tissues. The amputating knife employed in this last step of the operation ought to have a straight, dull back, so as not to endanger the hands of the assistant.

Tarso-metatarsal Articulation.—The outline of this joint is very irregular, and its inner and outer margins should be

carefully defined before beginning the operation. To find the margins of the articulation, the dorsum of the foot should be grasped with the palm of the left hand and extended. With the fingers of the right hand the inner border of the first metatarsal bone may be traced backward, on the inner side of the foot, until a prominence is found. One or two lines in front of this will be found the inner margin of the articulation. On the outer side of the foot the external border of the fifth metatarsal bone is followed until the tuberosity at its proximal extremity is detected; immediately behind this is the outer margin of the articulation.

Having found the margins, the foot should be taken in the left hand, the palm grasping the sole, when a semilunar incision is to be made, with the convexity downward, across the back of the foot, about half an inch anterior to the line of the articulation. The incision should extend to the bones, and the flap be raised with the point of the knife. The dorsal ligaments are now to be divided on a line with the articulation, and the joint of the second metatarsal bone opened by carrying the point of the knife between the internal cuneiform and head of the first metatarsal. Pressure downward with the left hand will now separate the articular surfaces; the remaining attachments may be divided, the knife passed beneath the heads of the metatarsus, and a flap formed from the sole of the foot.

Medio-tarsal Articulation.—*Chopart's amputation.*—The foot should be held in the same manner as for the operation at the tarso-metatarsal articulation, and the articulation found by the same guides. The principal guide in this operation is the tuberosity of the scaphoid bone. Holding the foot in the manner described, the thumb of the left hand should rest upon the external extremity of the joint and the index finger on the tuberosity of the scaphoid. A semilunar incision, with the convexity downward, is then made around the back of the foot, about half an inch beyond the line of articulation. The dorsal integument may then be dissected up about an inch, and the tendons divided down to the bone. The fibrous bands connecting the astragalus and the scaphoid bone are next divided, entering the point of the knife from above, to permit of the opening of the

joint. The foot should now be depressed a little, and the knife, inclined a little forward, carried through the articulation to the sole of the foot. The plantar flap should be quite long and have sufficient breadth at its base. This may be best secured by cutting from the surface and not from within out.

Tibio-tarsal Articulation.—Ankle-joint.—*Piragoff's operation.*—Piragoff's operation differs from Syme's, in that the former the posterior portion of the os calcis is allowed to remain in the heel-flap. The advantages claimed are a longer limb and a more perfect stump. It is performed as follows: The foot being held at a right angle to the leg, the point of a small sharp-pointed amputating knife or bistoury should be entered directly below and a little posterior to the external malleolus, and carried across the sole of the foot, cutting the tissues to the bone to a point directly opposite. The incision is then carried across the dorsum of the foot in front of the ankle-joint until it reaches the place of beginning. The lateral ligaments are now divided, and the foot disarticulated in front. The os calcis is now exposed and is sawn through in the line of the heel. The foot is now removed and the ends of the tibia and fibula sawn off. A modification of this amputation is recommended by Prof. Hayfelder. A curved incision is made, "which, commencing above the posterior edge of the internal malleolus, passes along the dorsal surface of the foot and terminates at the outer malleolus. After this incision (which divides only the skin), and the preliminary separation of the incised parts, the subjacent tissues are completely cut through down to the bone, and the epiphyses of the two bones of the leg are removed by the saw. The soft parts covering the os calcis are next divided, and the bone sawn in the same direction. The sawn surfaces of the bones of the leg and of the os calcis are easily brought in contact, which is impossible by the unmodified procedure even after section of the tendo Achillis."

Tibio-femoral Articulation.—Knee-joint.—The leg being flexed at a right angle with the thigh, an oval tegumentary incision is made around the upper portion of the leg according to the following rule: "Lay the upper face of a single-edged amputating knife, with six or seven inch blade, flat against the lower surface of

both hamstrings, with its edge directed toward the back of the leg; and from this point proceed forward, crossing the front of the leg about four inches below the patella, *i. e.*, about one inch below the anterior tuberosity of the tibia, and terminate the incision at the point of beginning behind the knee. In case of a large limb it may be necessary to drop the line of incision one or even two inches lower in the front, so as increase the length of the anterior flap." The integument is then dissected up, including the fat and areolar tissue, and, in thin persons, the subtegumentary fascia, the lower margin of the patella exposed, and the ligamentum patella divided as close to the patella as possible. Having entered the joint, the knife should be carried inward, dividing in one continuous incision the capsule, with its accessory ligament, the internal lateral ligament and the internal hamstrings. In the same manner the outer half of the capsule, the external lateral ligament, and the outer hamstrings are to be divided. The interarticular cartilages are left attached to the tibia. The leg is now flexed upon the thigh and the crucial ligaments severed. The blade of the knife is then introduced behind the head of the tibia, with its edge directed downward, and a cut made, parallel to the shaft of the tibia, two inches in depth, then, turning it at right angles, the incision is carried to the posterior surface of the leg. The flaps should be large enough to cover the condyles of the femur.

Coxo-femoral Articulation.—Hip-joint. *Dr. Hamilton's amputation*—anterior flap operation.

The thigh is slightly elevated (flexed), adducted moderately, and gently rotated inward—this position having the effect of rendering the head of the femur less prominent, and, at the same time of carrying the femoral vessels and the anterior crural nerve more forward, so that the point of the knife can more securely pass between the head of the bone and the vessels.

The femoral artery being compressed by an assistant as it passes over the brim of the pelvis, the operator, holding in his right hand a straight, single-edged amputating knife, having a twelve-inch blade, introduces its point just above, and one inch in front of the trochanter major; the edge of the knife, being directed downward, in the line of the axis of the

limb. From this point the knife is made to penetrate transversely, and with a slight inclination backward, so as to strike the head of the femur in its upper half and near the upper margin of the acetabulum. By inclining the point, also, as directed, a little backward, the head of the femur will be struck rather upon its outer aspect, and not upon its most prominent and anterior aspect. The point of the knife having now entered the capsule, and penetrated slightly, the head of the femur will be arrested. The handle of the knife being now raised toward the head of the patient, the point will descend over the head to the neck, cutting the capsule as it descends.

Pressing the knife now across the limb, it will penetrate in front of the neck, under the anterior portion of its capsule. Then elevating the handle of the knife in the direction forward, as much as the skin and fascia lata will permit, and at the same time inclining the handle toward the head of the patient, the point, under steady pressure, will continue to descend under the ilio-femoral ligament, and the conjoined tendon of the psoas magnus and iliacus internus, and finally emerge well back and below the tuberosity of the ischium.

With a sawing motion of the knife the surgeon enlarges the incision downward along the front of the trochanter major and neck, until sufficient space is made to allow a second assistant to introduce the four fingers of each hand into the anterior and posterior wounds and to seize the femoral vessels between his thumbs and fingers. The first assistant, pressing upon the vessels over the brim of the pelvis, must not withdraw his pressure until the second assistant has satisfied himself that he has the vessels in his grasp. The surgeon then rapidly completes the section of the anterior flap, raising the edge of his knife a little to overcome the elevation of the trochanter minor, and carrying it down close to the shaft of the femur far enough to make a flap of from five to seven inches in length—more or less, according to the diameter of the limb, and finally bringing the edge of the knife to the surface obliquely.

An assistant grasping the knee and leg rotates the thigh outward, while he forcibly abducts and carries it backward over the corner of the table and toward the floor.

If, in the first step of the operation, the point of the knife has struck skillfully the capsule covering the head of the bone, the disarticulation may be accomplished by the just described maneuver. In other cases it will be necessary to apply the knife to the capsule, and for this purpose a large scalpel is the most convenient—dividing the capsule first transversely over the most projecting portion of the head, and then longitudinally in the direction of the axis of the neck, and extending this last incision well down upon the neck. The round ligament, if not already torn, is then to be cut.

The disarticulation being effected, the center of the amputating knife is to be passed above the head of the bone, and the section of the parts posterior to the articulation completed by a sawing motion, the knife being made to emerge below in the gluteal fold.

KIDNEY, ABSCESS OF.—A collection of pus within the substance of the kidney, which may show itself as one or more large collections of pus, usually limited to one organ, or as numerous small abscesses distributed through the substance of both glands. The latter variety is usually associated with pyæmia.

Symptoms.—The pyæmic abscesses give rise to no diagnostic symptoms in the midst of the other severe symptoms of the pyæmic state. The symptoms described are those of the larger variety of abscess.

The first signs are those of a simple acute inflammation. A feeling of heaviness and pain in the loin is complained of, tenderness is observed over the kidney, while there is more or less rise of temperature, together with the other usual signs of fever.

The urine is scanty and high-colored, depositing urates on standing, and it may sometimes contain blood or albumin. The onset of suppuration is indicated by the occurrence of rigors, and sometimes by profuse perspiration. The temperature becomes higher and more variable, assuming the characteristics of the hectic state. In the loin, on the affected side, pain and tenderness are more acute. A distinct bulging may be seen, and, as the abscess increases in size, a fluctuating swelling may be felt in the usual situation of the kidney. It is to be noted that in certain cases the onset, and even the whole course, of the abscess, may be

latent and unaccompanied by any definite symptoms.

The abscess may attain a considerable size, but its further course is variable. It often bursts into the surrounding parts. The most favorable course which the pus can take is to make its way into the pelvis of the kidney. Large quantities of pus are then discharged with the urine, the swelling in the loin diminishes in size, and after a time recovery takes place. A less favorable event is for rupture to take place into the intestine; pus is discharged with the fæces, but the suppuration is apt to be prolonged. Rupture into the peritoneum is fatal.

The pus may also find its way into the perinephritic tissue, constituting a perirenal abscess, and may thence burrow to distant parts, at length opening externally. The abscess may also open directly on the external surface, usually in the loins, and it has been known to extend into the thoracic cavity, discharging itself into the pleura, or through the lungs into the bronchi. All these are unfavorable; prolonged suppuration ensues, with gangrenous sloughing of the parts over which the pus flows, and the patient dies from exhaustion.

There remain two issues of the abscess which are unfortunately rare. The pus may be entirely absorbed and nothing left but a firm fibrous cicatrix; or the pus may become inspissated and the abscess wall shrunk, leaving a cheesy mass surrounded by a thick capsule of fibrous tissue; calcareous salts may in time be deposited in the cheesy material. Either issue is of course favorable.

Diagnosis.—In the absence of a definite tumor the diagnosis must be based upon the presence of pain and tenderness in the loin, together with fever of a hectic type, rigors, and sweatings. When a tumor has appeared, fluctuation will determine its cystic nature, while the general symptoms of suppuration will distinguish it from other like formations in the kidney. For the distinction between an abscess in the kidneys and one outside the organ, see PERINEPHRITIS. See, also, ABDOMINAL TUMORS.

Ætiology.—Suppuration in the kidney may be caused by blows on the loins, or by crushing and laceration of the renal substance. It may occur after the exhibition of irritant drugs, such as cantharides and turpentine. It may be set

up by the presence of a tumor or tuberculous material, or of a calculus in the kidney substance, or may be the result of the lodgment of an irritating or septic embolism in the kidney, as occurs in states of general pyæmia and in some forms of ulcerative endocarditis. Further, abscess formation is one of the manifestations of the so-called surgical kidney (*q. v.*).

Pathology.—A large abscess may be, from the first, solitary, or may result from the amalgamation of several miliary abscesses. It shows as an irregular cavity, occupying more or less of the kidney substance, having ragged walls formed by pulpy and degenerated renal tissue, and is occasionally bounded by the capsule of the organ. Its contents are pus, mixed with blood and the detritus of the destroyed gland tissue.

The pyæmic abscess appears in the early stages as a wedge-shaped area of grayish color, situated in the cortex of the kidney, with the base at the periphery of the organ. The area is from the first somewhat softened, and is surrounded by a zone of hyperæmia. In a short time suppuration takes place, the area becomes more globular than wedge-shaped, and is still surrounded by a zone of hyperæmia. Later a more or less firm capsule of fibrous tissue limits the abscess.

Pyæmic abscesses are the result of infective emboli, which reach the kidney from some distant septic focus and block portions of the renal vascular system. In ulcerative endocarditis the infective embolus may be of a sufficient size to block a considerable branch of the renal artery, and the resulting abscess may be large from the first. Pyæmic abscesses may heal by inspissation of the pus, or by absorption of the pus and the formation of fibrous tissue by the surrounding parts. Finally, nothing may be left but a small fibrous cicatrix, which occupies the position of the destroyed kidney substance. The suppuration caused by tumors and calculi is localized to the vicinity of the irritating body.

Treatment.—The patient should be kept at rest in bed, and on light fluid diet. The bowels should be kept freely open by enemata or a mild saline purge. In the early stages, wet cupping, or leeches, may be applied to the loins, with advantage, and will occasionally avert the more serious symptoms. Poultices or

hot fomentations to the loins will relieve pain and tension, but opiates may be necessary to obtain rest and ease. As drugs, febrifuges are indicated, the citrate and acetate of potash in half-dram doses, and the liquor ammonii acetatis being the most useful.

When distinct signs of suppuration have appeared, quinine should be freely given. If the abscess has ruptured, the strength should be maintained by a full diet, stimulants, and the various preparations of bark, to ward off as much as possible the effects of prolonged suppuration. The untoward results of leaving the abscess to work its own discharge must be remembered; and whenever it is certain that pus has formed in the kidney, it should be let out by an incision in the loin, and the abscess cavity drained. It is quite justifiable also to make an exploratory incision when suppuration is suspected but not absolutely determined.

ROBERT MAGUIRE.

Symptomatic Indications.—*Mercurius* is useful in early stage, when disease is first suspected; *calcium sulphide*, when suppuration has taken place; *calcareæ* assists healing after suppuration is complete; *silicea* is useful when the discharge of pus is long continued or the discharge is unhealthy; *arsenicum*, for general vital depression, severe burning pain; *cinchona*, for weakness from excessive pus formation.

KIDNEY, CONGESTION OF.—

May be active or mechanical. Active renal congestion, or catarrhal nephritis, may result from: *a.* any pyrexial condition, especially that accompanying the exanthemata. *b.* Exposure to cold and wet. *c.* The use of certain medicines in excess, as cantharides, turpentine, nitre, etc. *d.* Irritating urine in connection with diabetes. *e.* Morbid formation in the kidneys, or emboli. *f.* The early stage of inflammation. *g.* Hypertrophy of the left ventricle; or, possibly, active dilatation of the vessels, as in cases of hysteria. Mechanical hyperæmia is a common consequence of: *a.* some cardiac or pulmonary disease interfering with the general venous circulation. *b.* Pressure upon one or both renal veins, or upon the inferior vena cava above their point of junction, by an abdominal tumor or a pregnant uterus.

Anatomical characters.—At first the

kidneys present the characters ordinarily accompanying congestion, viz., enlargement and increase in weight, increased redness, with points of vascularity, corresponding to the malpighian bodies, and sometimes minute ecchymoses. In many forms of active hyperæmia there is a catarrhal state of the ducts of the pyramids, with shedding of their epithelium. After mechanical congestion has lasted some time, the usual pathological changes are set up, leading to grave disorganization of the kidneys, which become contracted, indurated, and sometimes granular or irregular, while their cortical substance undergoes more or less atrophy. Microscopic examination reveals alteration in the shape of the tubes, with thickening of their walls; changes in the epithelium, which is often destroyed; increase in the intertubular connective tissue, and permanent distention of the minute vessels.

Emboli frequently lodge in the kidneys, and give rise to infarctions, which are almost invariably confined to the cortical portion, differ in size, and are usually well-defined and wedge-shaped, with the base toward the surface. At first they present a dark red color, but become decolorized from the center toward the circumference, leaving yellow masses, which may be ultimately absorbed, depressed cicatrices alone remaining. Rarely an infarction softens and breaks down, forming a pseudo-abscess, or it is said pus may be produced.

Symptoms.—Congestion of the kidneys is ordinarily indicated by the urine becoming diminished in quantity, high-colored and concentrated, and depositing urates abundantly on standing; while it afterward contains some albumin, occasionally a little blood or clear, fibrinous casts, with a few renal epithelium cells. In some forms of active hyperæmia, however, copious flow of pale and watery urine takes place, which is of low specific gravity. There may be a sense of fullness about the loins, or even a certain degree of heavy pain, and tenderness is frequently complained of. If the congestion subsides, the urine assumes its normal character; but if it continues and leads to organic changes in the kidneys, this fluid presents more marked and permanent changes. As a rule, there are no symptoms indicative of renal embolism. If the embolus is large, its lodgment may cause a sudden severe pain in

the renal region, shooting toward the pelvis, followed by albuminuria or hematuria. Should an abscess form in the kidney after embolism, symptoms indicative of this event might set in.

Albumin and blood, appearing at the same time, indicate congestion, while the presence of albumin alone points to an inflammatory condition.

Diagnosis.—Congestion of the kidneys is to be distinguished from the early stage of acute Bright's disease. In both diseases the urinary secretion is scanty, but in congestion it is more highly colored and less liable to contain epithelium and casts, and the specific gravity is, as a rule, normal. The causes of the condition should also be taken into consideration, renal congestion being frequently the result of venous obstruction or cardiac lesions.

Prognosis.—The duration and termination of the disease depend upon its cause; when the exciting cause is transient the prognosis is favorable. Passive congestion resulting from cardiac lesion does not, as a rule, result favorably, owing to the difficulty or impossibility of removing the cause. Congestion of the kidneys, in connection with congestive fevers of hot climates, often promotes a fatal termination, by the interference with the function of the kidneys, particularly when associated with profuse hemorrhage.

Treatment.—If renal congestion calls for any positive interference, the main indication is to remove or mitigate its cause as quickly as possible, especially in the mechanical form. Rest in the recumbent posture; free dry cupping, or the application of heat and moisture over the loins, or in some cases the removal of a little blood from this region; the use of the warm bath; and active purgation, are the chief direct remedies to be employed.

FREDERICK T. ROBERTS.

Symptomatic Indications. — *Belladonna, cantharis.*

KIDNEY, CYSTS OF.—1. Cysts are found with great frequency in connection with granular kidney. They are due to obstruction to the renal passages by the fibrosis of the organ.

2. In otherwise healthy kidneys it is common to find cysts of variable size, but rarely larger than a walnut, filled with usually diffuent, sometimes gelatinous, material. They rarely give rise to symptoms, but may occasionally attain such a

size as to constitute an important abdominal tumor.

3. Congenital Cystic Degeneration.

—As a congenital condition, both kidneys are occasionally found riddled with cysts, which seem to have taken the place of almost the whole of the secreting structure. The kidneys are greatly enlarged, and may constitute an obstacle to delivery. The cysts are lined by tessellated epithelium, and are surrounded by fibrous tissue and by a certain amount of renal tissue.

The fluid contained in the cysts consists of urine, together with albumin, blood, fat granules, and cholesterin. It may be quite colorless and transparent, but more often is cloudy, and colored brownish-red or yellow.

Often other malformations of the genito-urinary organs and other parts are found; and if, as occasionally happens, cystic kidney be present on one side only, the other malformations are also limited to that side.

Pathology.—The cysts are due to obstruction and distention of the urinary passages. Virchow asserted that the occlusion of the tubes was produced by inflammation of the papillary ducts from the impaction of uric acid or urates in the straight tubes. Köster shows that the tubuli uriniferi may not establish their normal communication with the renal pelvis, which is formed from the Wolffian duct, and so may remain impervious. Thorn believes that inflammation of the ducts may spread from the pelvis and calices of the kidney, and so cause occlusion; while Chotinsky has found that proliferation and accumulation of epithelial cells may block the tubes.

A considerable degree of this affection is incompatible with life. As to how far a minor degree may persist to adult age is not known; but such a persistence may possibly be a cause of:

4. Cystic Degeneration of Adults.—

In adults both kidneys are sometimes found converted into immense masses of cysts, occasionally without any definite symptoms presenting during life. Both kidneys are always affected, though not necessarily to the same degree. The cysts vary in size, from a pin's head to an orange. Their walls are lined by flat epithelium, and the fluid within them is either a gelatinous substance, or a clear, yellowish liquid. It contains albumin,

cholesterin, phosphates, uric acid, creatine, and occasionally other urinary ingredients. The cysts are imbedded in a mass of fibrous tissue, in which but little of the true secreting parts is to be found. The lower urinary passages are generally healthy.

The cysts have been thought to be dilated malpighian capsules, but are probably renal tubes, which have become distended in consequence of obstruction to their lumen. The obstruction has probably a similar origin to that occurring in the congenital form.

It would appear that in a large number of cases the interstitial fibrosis is the primary lesion, as in the cysts which accompany granular kidney. Possibly, in some cases, blood clot may cause the obstruction of the urinary tubes.

Symptoms.—Are rarely distinctive, and are always chronic in their progression, and those of chronic Bright's disease. The urine is commonly of low specific gravity and often contains albumin and blood. The heart may be hypertrophied and symptoms of chronic uræmia, such as vomiting and nausea, headache and delirium, may present themselves. In the final stage, if death occur from the kidney affection, there are manifestations of uræmic coma and convulsions, which not unusually are sudden in their onset. In spite of the increased size of the kidneys it is not always possible to feel them during life through the abdominal wall. They lie deep down in the lumbar regions, completely filling up the hollows on each side of the vertebra column.

Treatment.—The treatment must be that of chronic Bright's disease, with which the disease has great similarity.

5. It is sometimes observed after death that the kidneys, together with the liver and sometimes the spleen, are the seat of numerous cysts of about the size of a pea. The organs are not more than slightly enlarged. In some instances the cysts appear to be dropsical distentions of the epithelial cells; in others, mere spaces in the tissue, filled with serous fluid. They must be distinguished from a similar change which is sometimes the result of putrefaction.

6. **Pararenal Cysts** are occasionally seen which take their origin outside the kidney, although they may eventually communicate with its interior. Their origin is unknown.

7. **Hydatid Cysts.**—See KIDNEY, PARASITES OF.

ROBERT MAGUIRE.

KIDNEY, MISPLACED.—As a congenital condition the kidney may occupy a position lower or higher than is normal, and sometimes both kidneys may be situated on the same side of the abdomen. Of these the most common, and the only one which has any clinical interest, is the misplacement downward. In the fetus the kidneys lie near the bifurcation of the aorta, and occasionally one of them remains in this position even in adult life, most commonly resting on the sacro-iliac synchondrosis. The renal artery has a similar low origin, arising from the aorta near its bifurcation, or from the common iliac artery, or from the middle sacral artery. The vein also enters the inferior vena cava at a corresponding level.

The vessels and ureter frequently show abnormalities of number. The kidney itself lies somewhat obliquely, and has a more or less abnormal configuration. The suprarenal body of that side occupies its normal site, but congenital malpositions of the intestine, or peritoneum, may be present. The condition is the more common in men, and most frequently it is the left kidney which is misplaced.

The clinical importance of this condition lies in the fact that, from its prominent situation, the kidney may be mistaken for an abdominal tumor. It is on record, also, that such a kidney lying in the pelvis caused an obstacle to parturition. The size and elastic feel of the mass, possibly its renal shape, the sickening feeling produced by pressure, the apparent emptiness of the normal site of the kidney, the presence of the supposed tumor on the left side, and the male sex of the patient, will serve to establish the diagnosis.

Another congenital deformity, the **Horseshoe Kidney**, may occasionally give rise to pathological changes. In this condition the two kidneys are joined together, generally at the lower, but sometimes at the upper, end by a connecting band, which is composed either of true renal substance, or of firm fibrous tissue. The kidneys are lower in the abdomen and nearer the vertebral column than is usual, and there are always found abnormalities in the distribution of their

blood vessels. The connecting band may be felt during life, and mistaken for a tumor. Any disease, such as pyelitis, attacking such kidneys, would be accompanied by an unusual localization of the physical signs. One case is on record in which a congested horseshoe kidney pressed on the inferior vena cava, and caused thrombosis and death.

ROBERT MAGUIRE.

KIDNEY, MOVABLE (Floating Kidney).—A condition in which the kidney is no longer fixed in its normal position, but is capable of displacement over a certain area of the abdomen, under the influence of its own weight, or of the respiratory or other movements.

Symptoms and signs.—When the abdomen is examined, unless the kidney be, for the moment, occupying its normal position, it can be felt as a firm elastic body of the peculiar renal shape, which can be moved more or less freely, and slips from under the hand with an ease which is characteristic. The movement of the kidney may be very limited, or may extend over several square inches. The normal position of the kidney feels empty, and is more resonant on percussion than is usual. In most cases the kidney can readily be replaced, but in others it seems to contract adhesions which retain it more or less firmly in its unwonted site. The normal bed of the kidney, too, is liable to become filled up with fat, which hinders the replacement of the organ. After replacement, a deep inspiration, or certain movements, frequently known to the patient, such as the raising of the lumbar region on turning to the opposite side, will again displace the kidney. On pressure, a sickening sensation is experienced. During menstruation the organ becomes larger and more tender than at other times.

There may be no symptoms whatever to attract attention. Usually, however, some pain is complained of in the loin of the affected side. The pain is aching and dragging in character, sometimes severe and shooting, and it may be accompanied by neuralgic pains in other parts of the body. The pain is worse when the patient stands or moves, and is relieved, or disappears, when the recumbent position is assumed.

Dyspepsia, epigastric pulsation, and irregularity of the bowels, at one time

diarrhea, at another constipation, are common symptoms. Frequency of micturition has been sometimes noted. The aching pain, and consciousness of the abnormality, after a time induce a condition of hypochondriasis.

While the symptoms usually complained of are vague, there occur, at times, paroxysms resembling those of renal colic, during which the patient suffers great pain, radiating from the kidney downward in the direction of the ureter, and accompanied by vomiting and faintness. The displaced kidney during this attack is swollen, tender, and less freely movable than it was before. Such paroxysms are induced by excessive exercise, or an indigestible meal, and are specially liable to occur at the menstrual periods. The urine, during one of these attacks, may contain blood or pus, whereas its usual condition is normal.

Œdema of the lower limbs, from pressure of the displaced organ on the inferior vena cava, has been observed. Jaundice, also, may occur from pressure on the bile duct. No alteration in the composition of the urine can be observed, as a rule; but the pyelitis, which may appear as a transient phenomenon during the paroxysmal attacks, occasionally becomes permanent, and pus will then be found in the urine.

Pathology.—The peritoneum, which ordinarily passes only in front of the kidney, sometimes envelops it, so as to produce a mesonephron. This is a congenital condition, and it allows of movement of the kidney, which is only restrained by the attachment of its vessels. But any process which loosens the kidney from its bed, or diminishes the support it receives from the other abdominal contents, will tend to produce undue mobility. Thus, blows on the kidney region, muscular strains, absorption of the perirenal fat, a swelling of the kidney from any cause, with subsequent reduction in size, and the lax condition of the abdominal walls, which is induced by repeated pregnancies, are the most usual precedents. Tight-lacing has been recognized as a cause, and it has been suggested that undue heaviness of the kidney from congestion during the menstrual periods may cause the organ to leave its plane and stretch its supports.

The condition is more frequent in

females, and, in the greater number of cases, is situated on the right side.

The nature of the paroxysmal attacks described is not clear. They may be due to pressure of the kidney upon the nerves which surround it, or to a twist of its pedicle, which would cause strangulation of its vessels or of the ureter.

The movable kidney is liable to be attacked by disease, as is the normal organ. Inflammation around it may bind it in a new position. It has been found to show the condition of granular kidney. Pyelitis is not infrequent, and extension of suppuration to the body of the organ has caused death. Hydronephrosis has been met with in a certain number of instances, and is probably due to a bend and obstruction of the ureter when the kidney is displaced downward.

Diagnosis.—The diagnosis of movable kidney is easy. Its peculiar mobility, its shape and elasticity, the ease with which it can be pressed into and out of the lumbar space, and the emptiness and comparative resonance of the lumbar space when the tumor is felt in the abdomen, are signs which, in most cases, are easily detected, and at once suggest the nature of the condition. See ABDOMINAL TUMORS.

Treatment.—If, as frequently happens, no very distressing symptoms be associated with mobility of the kidney, no treatment is required. But the hypochondriasis and neuralgic pains sometimes render life a burden, and hinder the patient from undertaking any active duties. If this be so, an attempt should be made to retain the kidney in its place. This, in a few instances, may be effected by a simple abdominal bandage to give support to the walls, and a pad over the front of the kidney region. The bandage and pad should be applied while the patient is in a recumbent position. An india-rubber belt, with an air pad over the kidney, is more effective. For more intractable cases a spring truss, to press on the kidney region, is very serviceable, but its pressure cannot always be borne.

If all these appliances fail, and the symptoms are still distressing, the kidney may be fixed in its normal position by the operation of nephrorraphy, in which the kidney is stitched to the posterior abdominal wall through a lumbar incision, and is afterward retained in its position by inflammatory adhesions. The

results of this operation are not very encouraging, as in several cases the organ has again become movable. Excision of the kidney has been recommended as a last resource, but is too dangerous, and should not be advised.

The bowels should be maintained in a state of regular activity. If there be anæmia and lassitude, iron and other tonics are indicated. Violent exercise is to be forbidden, and also such movements as have been found to occasion the displacement should be avoided. During the paroxysmal attacks absolute rest in bed must be maintained, poultices and other anodyne applications should be used to alleviate the pain in the displaced kidney, and opiates administered by the mouth or subcutaneously.

ROBERT MAGUIRE.

KIDNEY, PARASITES OF.—I. Hydatids.—The cystic condition of the *tænia echinococcus*, is the most common parasite of the kidney. It is nevertheless rarer in this organ than in the liver and lungs.

The left kidney is the more frequently the seat of the parasite, possibly owing to the fact that as the liver is so frequently the host of the hydatids a larger proportion of embryos, traveling from the intestine, are free to attack the kidney on the left side than on the right.

The cyst may be small or may attain the size of a man's head. It is lodged in the substance of the kidney, or may in some instances lie between the capsule and the organ itself. In either case, as its size increases, atrophy of the kidney substance is caused from pressure. See **HYDATID DISEASE**. Men are most liable to hydatids of the kidney. The mean age at which they make their appearance is thirty-four years.

Symptoms.—As the cyst increases in size it forms a tumor in the lumbar region, tense, elastic, sometimes fluctuating and presenting all the evidence of a tumor of the kidney. It is to be noted that the colon does not always lie over the front of the hydatid cyst, but may be on either the inner or the outer side. The viscera of the neighborhood may be displaced by the increasing size of the cyst.

The cyst sometimes, when percussed, communicates to the hand or stethoscope laid upon it the peculiar vibration termed

the “hydatid fremitus,” which is, however, probably nothing more than the vibration of a tense cyst wall. Local pain and tenderness, which are usually absent, are nevertheless sometimes produced by inflammation of the surrounding tissues. Such inflammation causes transient pyrexial attacks, and occasionally passes on to suppuration.

The symptoms described are merely those of any other cystic formation in the kidney. The hydatid cyst, however, shows a great tendency to make its way toward the pelvis of the kidney and to burst into the urinary passages. This it effects the more readily if it be originally situated in the pyramidal portion of the organ; after a longer time, if localized in the cortex or outside the kidney. By this peculiarity, symptoms are occasioned which are characteristic of the disease. The passage of the daughter cysts contained in the parent sac down the ureter, gives rise to the phenomena of renal colic, similar to those accompanying the descent of a calculus—pain in the course of the ureter, in the groin and the inside of the thigh, retraction of the testicle, vomiting and retching, with sometimes rigors.

These symptoms subside when the small cyst has reached the bladder, but when the cyst afterward attempts the passage of the urethra, it causes blocking of the canal, with frequent efforts at micturition, pain, and retention of urine, until at last it is expelled, often with some force. The urine passed at the same time may contain blood or pus. Not unfrequently the cyst ruptures in its transit, and there are then discharged from the bladder shreds of hydatid tissue, hooklets, and fat globules. The symptoms recur at irregular intervals as more cysts proceed down from the kidney.

The rupture of the parent cyst is sometimes determined by an injury to the side or a sudden exertion. The discharge of vesicles often causes a notable diminution in size of the tumor in the loin, while, again, renal distention may ensue upon obstruction of the ureter by a passing cyst.

Results.—In the majority of cases recovery ensues, the contents of the parent cyst being discharged into the urinary passages. The cyst has also been known to rupture into the lung and into the intestines, but never into the peritoneum. The sac may itself suppurate or may

cause suppuration in the surrounding parts; further, the hydatids may die and the sac shrivel up into a cheesy or even cretaceous mass containing numerous hooklets.

Diagnosis.—Its signs are those of any other cyst of the kidney, except that the colon is more irregularly placed than is the case with other cysts. It most nearly resembles a hydronephrosis, but the history of any possible obstruction to the ureter, which would cause a hydronephrosis, is wanting. In obscure cases puncture of the cyst may be practiced, not only for purposes of treatment, but also to establish the diagnosis. If the fluid withdrawn contain hooklets, or be free from albumin and rich in chloride of sodium, the nature of the cyst is obvious.

When a tumor in the loin is accompanied by the presence of hydatid elements in the urine, no difficulty will be experienced. The urinary appearances may, however, be present without a tumor in the loin, and then the kidney can only be diagnosed as the origin of the hydatids after the pelvis and inguinal regions have been carefully explored with a negative result, or when pain in the loins or nephric colic has been experienced.

Prognosis.—The prognosis is usually favorable, especially if the cyst have ruptured into the urinary passages. Rupture into other parts may be followed by suppuration or gangrene, leading often, but not necessarily, to a fatal result.

Treatment.—It has been suggested that hydatids of the kidney might be destroyed by the internal use of drugs, such as turpentine, iodide of potassium, niter, etc.; but in the cases where good effects have seemed to follow their use, they have probably acted only as diuretics and not as vermifuges. When the cyst has ruptured, the pain accompanying the passage of the vesicles along the ureter should be allayed by the various remedies for renal colic—anodynes, warmth, and diluents. The vesicle has been assisted in its course by a kneading of the ureter in the direction of its length. The catheter may be required to relieve obstruction to the urethra.

Should the cyst remain unruptured its cure may be attempted by tapping, either with the aspirator or a syphon-tube. The removal of only a small amount of fluid often suffices to cause the death of the

parasite and the ultimate obsolescence of the sac. Should these means fail, the sac should be exposed, an incision made, and the edges stitched to the wall of the abdomen, the operation being, if possible, performed in the loin.

II. Bilharzia Hematobia.—This worm, known also by the name of *Distoma Bilharzi*, is a common parasite of the urinary organs in hot climates.

The special habitat of the parasite in the body of man is the small veins, particularly those of the portal and urinary systems. In the bladder, ureter, and kidneys it gives rise to extensive mischief. On the mucous surface of the bladder it produces ecchymotic patches slightly raised above the general surface, sometimes covered by a grayish membrane or by tough mucus. Nodular enlargements, over which the mucous membrane is intact, are also found. Covering the patches a mass of *débris* is frequently seen, consisting of the ova of the parasite, mingled with a deposit of uric acid and other urinary salts. Such an accumulation of eggs and urinary concretion is occasionally the cause of a distinct vesical calculus. In the kidney the presence of the parasite sets up severe pyelitis, and the caliber of the ureter may be narrowed. In certain cases by a combination of these two conditions the kidney has been converted into a mere sac of pus.

Symptoms.—The special symptoms produced are those of severe cystitis or pyelitis, and a recurrent hematuria (endemic hematuria). Such symptoms being observed, the diagnosis of their cause may be made when the eggs of the worm are found as a urinary deposit. The free embryos, and the emptied egg-cases from which the embryos have escaped, also make their appearance in the urine.

Treatment.—A morning draught containing oil of turpentine and male fern (of each m. xv), with m. v of chloroform and ℥ij of tragacanth mixture. Bicarbonate of potash, in freely diluted solution, is of use to relieve renal irritation and to facilitate the breaking up of concretions. Injections into the bladder of a solution of iodide of potassium (20 to 30 grains in 5 ounces of tepid water) used every second or third day, were found beneficial when the parasite was specially localized in the walls of the bladder. As prophylaxis it is recommended that drinking-water should be filtered, and all salads or un-

cooked mollusks and fish avoided. See BILHARZIA.

III. *Filaria sanguinis hominis*.—See FILARIA and CHYLURIA.

IV. *Strongylus gigas*, is of extreme rarity in man, and is only found in the kidney.

It is a nematoid worm, resembling closely the *ascaris lumbricoides*. It is, however, much longer, the male being nearly a foot in length, and the female nearly a yard. It is also redder in color than the round worm, and has six papillæ round the mouth. The symptoms produced by it are unknown.

V. *Erratic worms*.—Various parasites from the intestine, such as the thread-, round-, and tape-worms, occasionally obtain access to the urinary passages, and are discharged in the urine.

ROBERT MAGUIRE.

KIDNEY, TUBERCLE OF.—Tubercle may affect the kidney in three different ways, as: 1. Miliary Tuberculosis; 2. Caseating Tubercle; and 3. Tubercular Pyelitis, leading to Pyelo-nephritis.

Symptoms.—Miliary tuberculosis, as a rule, gives rise to no symptoms by which it can be diagnosed.

The symptoms of caseating tubercle and of tuberculous pyelitis are practically identical. In the early stage there is pain in the lumbar region of one or both sides, often shooting downward in the course of the ureters. The urine contains pus, and occasionally a little blood. In exceptional cases, hematuria may be a prominent symptom at the beginning of the disorder. Frequency of micturition is an early and characteristic symptom; and when this is combined, as it sometimes is, with pain in the region of the bladder, a suspicion of the presence of vesical calculus may easily arise. Yet both these symptoms may be entirely independent of any affection of the bladder itself.

When the disease is fully developed the urine is feebly acid, and contains a large quantity of pus, with often a little blood. On standing for a short time the urine yields a deposit, consisting of pus corpuscles, blood corpuscles, a quantity of granular *débris*. When the pelvis of the kidney or ureter is affected and the disease therein has not proceeded very far, a number of epithelial cells of irregular shape, which have desquamated

from the mucous membrane of those parts, may sometimes be found.

When appropriately stained, the deposit may be shown to contain tubercle bacilli.

Hyaline and, occasionally, granular casts are deposited. Albumin, too, is present in the urine, but not usually in much greater amount than the coexistent pus will account for.

The quantity of urine excreted may be normal or somewhat diminished, but it has been known to be large, and the urine is then of diminished specific gravity. Occasionally, too, while the urine, at ordinary times, presents the abnormal signs enumerated above, it happens that, for short periods, it becomes limpid, copious, non-albuminous, and gives no deposit after standing. Doubtless these variations are indicative of unilateral affection, the ureter of the diseased side becoming occasionally blocked, and thus permitting the passage of an unmixed secretion from the opposite normal, or possibly hypertrophied organ.

Even when tubercle is limited to the kidney itself, the enlarged organ may be felt in the lumbar region on deep pressure. Tenderness in the same region can nearly always be elicited. But when tubercle has attacked the renal pelvis and pyo-nephrosis is established, the customary sign of this condition—painful, tender and obscurely fluctuating tumor in the flank—is manifest. The tumor may vary in size coincidently with changes in the character of the urine.

Meanwhile, constitutional symptoms of tuberculosis, albeit but ill-marked in the early stage, become more and more evident. Hectic fever with chills, rigors, frequent and feeble pulse, and great emaciation are added to the symptoms already described. There may have been, at the first appearance of kidney trouble, evidence of tubercular disease in the lungs, of old standing, but even when the kidney disease has apparently been primary in origin the lungs and the alimentary canal, in the advanced stages of the affection, often show signs of secondary infection.

Destruction of kidney substance, or obstruction to both ureters, may cause death from uræmia. The end may also be induced by exhaustion from prolonged suppuration. Further, a complication, such as an affection of the lungs or intestines, spread of the kidney affection to

neighboring parts, or rupture of an abscess into the peritoneum, may destroy life.

Diagnosis.—The symptoms of chronic tuberculosis are mainly those of pyelitis, and the question of diagnosis is as to the cause of the pyelitis. The presence in the urine of granular *débris*, caseous masses, connective tissue or elastic fibers, is a most characteristic feature of the tuberculous affection.

The discovery of the tubercle bacillus in the urine of course places the nature of the affection beyond doubt. Nevertheless, the detection of the bacillus in the urine is not an easy matter, and it may be absent in undoubtedly tubercular cases, so that too much stress must not be laid upon this method of diagnosis. The bladder symptoms will sometimes create a suspicion of vesical calculus, especially in the early stages, and the surgeon may have to be called in to assist in the diagnosis by the aid of the sound. Affection of the lower urinary tract or of the genital organs, will, if present, differentiate tubercular from calculous pyelitis. Also, in both calculous and cancerous pyelitis there is usually more hematuria than is present in the tubercular form. The hectic fever and wasting of tuberculosis, and especially the signs of tuberculosis elsewhere in the body, afford most valuable aid in making the diagnosis.

Prognosis.—Miliary tuberculosis of the kidney is always part of a general fatal process. The prognosis of chronic tuberculosis of the kidney is exceedingly grave. Nevertheless, evidence of a healing process has been occasionally found in the kidney after death. If one kidney only be affected and the other organs of the body be healthy, it would seem possible that the affected organ might become shut off from the urinary passages and the tubercle become obsolete. This condition is sometimes found after death from other diseases, although unsuspected during life. When both kidneys are affected, or other organs are seriously diseased, only a fatal prognosis can be given. The duration of the disease is from a few months to three years, rarely longer.

Pathology.—Miliary tuberculosis of the kidney is always part of a general outbreak of acute tuberculosis, secondary in many cases to a caseous focus else-

where in the body. Both organs are the seat of nodules, not usually very numerous, of varying size, the largest being about equal to that of a pin's head. The smallest nodules are gray in color and almost transparent, the larger ones are almost opaque, and may present a small yellow spot of caseation in the center. Round each a zone of congestion may usually be seen.

The nodules are most numerous in the cortical portion near the surface of the organ; in the medullary portion but few are to be found. Their position is determined by the distribution of the arterioles with which they have an intimate relationship.

On *microscopic examination*, the nodules are seen to consist of the ordinary elements of tubercle, giant cells, epithelioid cells, and some smaller round cells. The larger nodules are often composed of amalgamated individual tubercles. The interstitial tissue is the favorite seat of the tubercles, but they may also be found in the interior of the urinary tubes and also in the glomeruli.

Tubercle bacilli are found in large numbers in the nodules and have been described as filling the small blood vessels.

Secondary changes are also seen. The epithelium of the convoluted tubes throughout the kidney may show degenerative changes and even necrosis. The center of the nodules is often necrosed and caseous, and the glomeruli and surrounding tissue sometimes share the same fate. Necrosis is occasionally more massive. Small anæmic infarcts, of thrombotic or possibly embolic origin, are frequently observed. Miliary tubercles of the kidney are more common in children than in adults.

Caseating tubercle may be primary in the kidney, and although it is frequently accompanied by tuberculous lesions in other parts of the body, these are, as a rule, less advanced in development than the kidney affection. In its earlier stages the lesion has the form of gray or yellow nodules in the substance of one or more of the medullary pyramids. The nodules enlarge, coalesce, caseate, soften in the center, and spreading at the periphery, make their way into the pelvis of the kidney, and also toward the cortex.

In this way irregular cavities are formed, filled with caseous, putty-like material and communicating freely with the

urinary passages. In addition to the extension from the periphery of a nodule, fresh nodules form in the cortex by infection, through the medium of the lymphatics and blood vessels. Moreover, there is reason to believe that the tuberculous process may be continued in the epithelium of the urinary tubules and thus also proceed toward the cortex. By extension of the tubercle in these ways the whole of the kidney substance may successively be attacked and destroyed.

Associated with this lesion, there are often found tuberculous lesions of the ureters and bladder, and, in the male, of the testes and vesiculæ seminales. These may be secondary to the kidney tubercle, infection being carried down by the discharge of tuberculous material into the urine. But in some cases the tuberculosis of the genital organs or of the bladder appears to be primary, and to be communicated to the kidney by means of the lymphatics.

Tuberculous pyelitis shows itself by the presence of tuberculous matter in the submucous layer of the pelvis of the kidney. The mucous membrane becomes inflamed, the tuberculous mass caseates, softens, and by ulceration makes its way through the mucous membrane to the general cavity of the pelvis. The walls of the pelvis are then converted into ulcerated, pus-discharging surfaces.

The ureter also is similarly affected, and is changed into a rigid tube, the lumen of which may be much narrowed or even obliterated, either by tubercle in its walls, or by thick caseous material conveyed into it from above.

The blocking of the ureter leads to distention of the pelvis of the kidney by the accumulation of inflammatory and degenerated products, and to the formation of a pyo-nephrosis. While the tuberculous pyelitis may be the continuation of a caseating tubercle of the kidney, it may itself lead to destruction of the kidney-substance, partly by invasion of tubercle, partly by pressure of retained pus, and finally nothing may be left of the organ but a sac with thickened fibrous walls, filled with a yellow creamy or putty-like material containing fatty masses, cholesterolin, tubercular *débris*, and sometimes calcareous matter.

As will be seen from the description, caseating tubercle of the kidney and tuberculous pyelitis, by the progress of

each affection, lead in the end to the same condition, which is sometimes termed the "scrofulous" kidney. The microscope reveals the tuberculous nature of the change, and that not only the cellular elements of tubercle, but also the tubercle bacillus, are present in the diseased parts. In certain cases the process oversteps the bounds of the kidney and spreads to the neighboring organs and tissues; the softened kidney may even burst into the peritoneum.

Ætiology.—This form of tuberculosis is a disease of adult life. It may be limited to one side, but frequently affects both kidneys, albeit more advanced in one than the other. It is more common in males than females.

Treatment.—The treatment can in nearly all cases be palliative only, and is the same as that of chronic pyelitis from other causes. See PYELITIS.

Opiates, the warm bath, and anodyne applications may be prescribed for the relief of pain. Iron, arsenic, and cod-liver oil serve to maintain the general strength.

Nephrotomy may be performed when there is considerable pus accumulation in or around the kidney, and the abscess cavity may be drained and treated on ordinary surgical principles. Removal of a scrofulous kidney has been resorted to with the object of relieving the patient from a suppurating focus which would be liable to cause exhaustion and albuminoid disease, or with a view to entirely eradicate the tuberculous disease, when it is confined to one kidney. The applicability of nephrectomy to this class of case is, however, as yet open to question. Before such an operation is performed it is desirable one should know that the opposite kidney is sound. From ordinary physical examination this cannot be certainly ascertained, but Dr. Newman has found it possible to determine the point by catheterization of the ureters and separate examination of the urine from each kidney. But if both kidneys be affected we have no means of estimating surely how much healthy and physiologically available renal structure will remain after removal of one greatly diseased organ. Valuable aid may, however, sometimes be obtained by determining the quantity of urea excreted daily.

ROBERT MAGUIRE.

Symptomatic Indications.—*Calcareo carb., calcium sulphide, silicea.*

KIDNEY, TUMORS OF.—**Malignant Tumors** occur in the kidney and secondary formations. The secondary tumors are not usually large, are generally found in both kidneys, and are seldom of any clinical importance. Their situation in the kidney is irregular, and depends upon the spot in which the infecting matter finds rest.

Primary malignant tumors of the kidney may attain a great size. They attack, as a rule, one kidney only, neither side being especially preferred. The extremes of life, rather than the middle periods, seem to be most prone to their development. The tumor most commonly begins in the cortex of the kidney, but it may originally be situated beneath the capsule, or in the submucous tissue of the pelvis of the organ. Its consistence is nearly always that of an encephaloid growth, and even though large it retains, to a great extent, the rough outline of the kidney. The tumor spreads along the course of the blood vessels, or lymphatics, or by contiguity to the neighboring parts. It very rarely infects the lower urinary passages.

Sarcoma.—Is the most common malignant tumor of the kidney. It may consist of small round cells, occasionally arranged in alveoli (alveolar sarcoma) or, less commonly, the cells are spindle-shaped. The sarcoma is often very vascular, and contains large hemorrhages. It soon makes its way into the pelvis of the kidney.

A remarkable variety of sarcoma found here in rare instances is that containing striped muscular fibers (rhabdo-myo-sarcoma). This, it is believed, develops from remnants of either the protovertebræ or the Wolffian body. Other varieties of sarcoma, which are met with in the kidney, are the adeno and the myxo sarcoma.

Melanotic tumors are sometimes found in the kidney secondary to similar growth elsewhere, and are usually of sarcomatous nature.

Carcinoma is much less common. It starts occasionally in the malpighian corpuscles, or these may be imbedded in the cancerous stroma. Again, the cancerous tissue may be a mere intrusion into the kidney substance, causing atrophy of the proper renal elements, or it may apparently be a conversion of the kidney tissue into malignant growth. Carcinoma rarely communicates with the

pelvis. It may be present in the forms of encephaloid, scirrhus, or colloid carcinoma, or of epithelioma.

Adenoma of the kidney is never large enough to become of clinical importance. It is a tumor nearly allied to carcinoma, and consists of glandular structure, varying in its characters according to the portion of the kidney in which it may arise. Thus it may exhibit the features of either the convoluted or straight tubes. Lymphadenoma also may attack the kidney when it is present in other parts.

Benign Tumors but rarely attain a sufficient size to be of clinical importance. There are found fibroma, angeioma, lipoma, myxoma, enchondroma, osteoma, and villous papillomata, which, however, are often sarcomatous. Further, in leucocythæmia small growths are sometimes found in the kidneys, consisting of accumulations of leucocytes. Lastly, Grawitz and others have described curious small tumors in the kidneys, which have the structure of the adrenal bodies, and are probably instances of aberrant growth.

Symptoms and signs.—An enlargement of the kidney, whatever its cause or nature, has the following characters: It is situated in the lumbar region of the abdomen, its center opposite to, or slightly above, the level of the umbilicus. It projects toward the front of the body, rarely toward the back. It is usually immovable during respiration. Nevertheless, not infrequently, a great enlargement will move downward to an appreciable extent in inspiration, retiring in expiration; moreover, the examiner's hands, placed one in front and one behind the enlargement, can often move the growth over a considerable area. The mass is rounded at all parts; sometimes, according to its nature, presenting rounded knobs on its surface. The hand can detect an interval between the kidney enlargement and the liver or spleen above, the pelvis below. On percussion the tumor itself is dull, but, since it lies behind the large intestine, the dullness is crossed from above downward by a more or less vertical band of resonance produced by the gas-distended colon, and may sometimes be entirely covered by intestinal resonance. See ABDOMINAL TUMORS.

There may or may not be changes in the urine, such as the presence of albumin, blood, or pus, for a tumor of the kidney may not open into the urinary

passages; and, further, the urinary passages of the diseased side may be blocked, and healthy urine from the sound kidney alone reach the bladder.

The enlargement presses on surrounding parts, and thus may cause œdema of the legs, varicocele and superficial venous distention from pressure on the veins, constipation or diarrhea, from pressure upon, and irritation of, the bowel, and vomiting and nausea, from disturbance of the stomach. Such are the usual symptoms and signs of renal enlargement, but, as might be expected, they are subject to occasional variations.

The tumor may be so large as to entirely fill the abdomen. The intestines may be pushed quite to one side. The growth may affect one portion only of the kidney, and thus appear in an unusual situation. Also, enlargement may occur of a kidney abnormally placed.

Practically, the solid tumors of the kidney which come to be of clinical importance are all malignant in nature. Such tumors are characterized by the following special signs in addition to those enumerated above:

Hematuria is a frequent symptom, but its presence must not be relied upon. If present it is usually intermittent and profuse. Albuminuria may also occur. The cells of a malignant growth may reach the urine, but they cannot with certainty be distinguished from the various epithelial cells which may also be present. Pain is experienced, and is sometimes very severe, occasionally shooting down in the direction of the ureter; often it is intermittent. The tumor itself may, however, be not even tender.

In most cases the general health rapidly suffers, but it is sometimes for a long period but slightly affected.

The tumors of clinical importance are generally primary, and therefore are limited to one side only. It must be mentioned that a malignant growth is sometimes so soft, and its consistence may be so much obscured by the interposition of intestine, that a sense of fluctuation is imparted, and the tumor may erroneously be diagnosed as of cystic nature.

Diagnosis.—Uncertainty in the diagnosis of tumors of the kidney will specially arise in connection with tumors of the liver, spleen, and ovary, and accumulations of fæces in the colon.

When changes in the urine are present,

little difficulty will, as a rule, be experienced; albeit, it must be remembered that hematuria need not necessarily be dependent upon a coexisting tumor in the abdomen.

In the absence of this indication, a tumor of the right kidney will be distinguished from one of the liver, by the possibility of passing the hand between the tumor and the liver, and possibly of feeling the edge of the liver, while often a line of resonance can be demonstrated between the tumor and the liver dullness. When the renal tumor is large, such separation from the liver is not to be made, but the position of the intestine in front of the tumor is a very safe indication of its renal origin, while, on the other hand, the presence of jaundice would strongly point to the liver as its seat.

The edge of a splenic tumor is sharp, not rounded, and is often notched. Its dullness is not so absolute as that of a renal tumor, since the resonance of underlying colon may be conveyed through its thin substance. The dullness is not crossed by the colon, it extends upward under the ribs toward the axilla, and downward and inward toward the umbilicus; in both these respects differing from a kidney tumor.

The collateral evidence—leucocythæmia, and a history of malaria in the splenic, hematuria in the renal affection—will assist the diagnosis. Further, in cases of splenic tumor, a resonant area can usually be detected between the growth and the spinal column behind, this being absent in the case of a renal tumor.

An ovarian tumor is first evident below, can be detected in the pelvis, and its growth is upward; a renal tumor grows from above and descends. Moreover, an ovarian tumor very rarely has intestine in front of it, but causes resonance in the flanks, where dullness would be most marked in the case of a renal tumor. Fecal accumulation produces a doughy, often elongated mass, which is removed by copious enemata. One such enema does not always suffice to remove the fæces, and in doubtful cases diagnosis should be suspended for a while. See ABDOMINAL TUMORS.

Prognosis.—The prognosis of malignant growths is unfavorable. They cause death from exhaustion, and occasionally from rupture of the growth or a sudden hemorrhage into its interior. The dura-

tion of life is shorter in children than in adults. Life has been occasionally most unexpectedly prolonged, in one case to seven years, and the disease sometimes passes through lengthened periods of quiescence.

Treatment.—In the early stages of the disease an attempt may be made to remove the diseased kidney, but so far this operation has not been attended with great success. All other treatment must be palliative. Pain may be relieved by opium and warm local applications. Hematuria, if excessive, should be treated by gallic acid, ergot or acetate of lead internally, or by the application of ice to the growth itself. Coagulation of blood in the urinary passages often produces intense suffering from impaction of the clots in the urethra; such clots should be pushed back into the bladder by a catheter, and afterward broken down and washed away by injections of warm water.

ROBERT MAGUIRE.

KIDNEY, OPERATIONS ON THE.—Puncturing the kidney with a trocar or the aspirator is performed for the relief or cure of hydro- and pyonephrosis, large isolated serous or blood cysts of the substance of the kidney, and hydatid cysts. When, from their degree of distention, such swellings cause serious consequences by pressure, or there is risk of the cyst wall rupturing, the contents ought to be evacuated.

The point selected for puncturing will depend on circumstances. If there be any spot over the swelling which is thin, soft, prominent, or fluctuating, the trocar should there be inserted. When no particular spot is suggested, the best place is on the left side, an inch in front of the last intercostal space. The place of selection on the right side is the ilio-costal space two and a half inches behind the anterior superior spine of the ilium.

Nephrotomy is performed for hydro-nephrosis when the cyst refills rapidly after having been punctured, and in cases in which simple puncture is inappropriate; for hydatid cysts under similar circumstances, or when, from the number and size of the daughter cysts, its contents cannot be evacuated through a small tube; for pyo-nephrosis, and for any case in which the kidney has been converted into an abscess sac, whether

from the presence of calculus or tubercle.

The incision is precisely the same as for lumbar colotomy, except that as the kidney is situated a little nearer the median line than the colon, the deep part of the wound should be kept a little posterior to that employed in colotomy. When the kidney is reached, the distended pelvis, cyst, or abscess (as the case may be) should be either first tapped or at once cut into, its contents evacuated, and the cavity well irrigated with some disinfecting solution. If it be thought desirable (as in hydro-nephrosis and cysts of the kidney it is) to stitch the cut edges of the cyst to the edges of the skin, this should now be done. Four or five sutures will be ample for this purpose. A drainage-tube should be inserted into the cyst, and the greater part of the wound left to granulate, though the anterior extremity of the parietal incision may be brought together by one or more sutures with advantage.

Nephro-lithotomy consists of cutting into the kidney for the extraction of a calculus. An incision is made four and a half inches in length parallel with and three-quarters of an inch below the last rib. If the quadratus lumborum be so wide as to contract the deep part of the wound, its outer edge may be incised to the extent of half or three-quarters of an inch. All bleeding vessels having been twisted, and hemorrhage quite stayed, the assistant should stretch the edges of the wound widely apart with suitable retractors, and the operator, with two pairs of dissecting forceps, should then tear through the perirenal fat.

When the kidney has been fairly reached, the index finger should be passed carefully over the whole of the posterior surface of the organ, including its pelvis, and any inequality of surface, or increased hardness, or resistance at any particular spot, should be searched for. During this tactile exploration, indeed throughout the whole of the examination of the kidney, the abdominal walls of the patient should be well supported by an assistant, or by well-arranged pillows, so that the kidney should not be pushed forward by the exploring finger. If nothing suggestive of the presence of a stone is thus felt, the anterior surface should be explored and the kidney should be pressed backward by the finger which

is feeling over its front surface. Next, if needful, the kidney should be freely exposed to view by drawing aside the edges of the wound, and a fine needle should be passed into the renal substance. This should be done in a systematic way, and at several places if the stone be not at once struck, introducing the needle here and there, so as to puncture in succession the several calyces of the kidney, in one or other of which the stone usually rests. Finally, if requisite, an incision may be made into the calyces, and the interior of the kidney examined by the finger tip, or with a probe.

Having detected the stone by one or other of the methods above described, it can be removed with a scooping movement of the finger introduced through the incision. Or a pair of forceps might be passed into the kidney by the side of the knife, and the stone seized and withdrawn. The finger is, however, much to be preferred, and if the incision is small, as it ought to be, the finger serves the purpose of plugging the renal wound, while it lacerates the renal tissue to the necessary extent. By this plan the hemorrhage at the operation is minimized, and the rent made with the finger heals as rapidly as a cut.

After-treatment is simple; a drainage-tube should be left in the back part of the wound, and the rest should be closed by sutures. For a time, of course, the whole or greater part of the urine secreted by the injured kidney will be discharged through the loin, but, after gradually diminishing, this may be expected to cease altogether in from three to four weeks. In some cases it has ceased on the second or third day. The dressings will require frequent changing, as they soon become saturated with the urine. To keep the bedding dry, a large pad of finely powdered German moss peat should be placed beneath the loin to receive and absorb the urine.

Nephrorraphy is practiced in cases of floating, movable, or wandering kidney, in which the organ, besides being mobile, is the seat of frequent, severe, and spasmodic attacks of pain, or of more or less continuous suffering. It consists in fixing the kidney in the loin, and is performed by exposing the organ by an incision, such as that described for nephrotomy or nephro-lithotomy. This done, a strong catgut suture should be passed through

the renal capsule and the edge of the parietal wound. By tightening and knotting the suture the kidney is fixed back against the lumbar parietes. The wound should be stuffed with carbolized gauze or boracic lint, and left to heal by granulations. The removal of the kidney may be by the lumbar or the abdominal method.

The advantages of the lumbar operation are the peritoneum is not opened, and the wound permits of excellent drainage. It is performed most easily by the transverse or slightly oblique incision, as in nephrotomy, made somewhat nearer the last rib than in lumbar colotomy; with this should be conjoined a second incision, running vertically downward from the first, and starting from it about one inch in front of its posterior extremity. In making the first incision, which should be about four and a half inches in length, the operator must not go nearer than half an inch of the twelfth rib, for fear of wounding the pleura, which sometimes descends a little below it. The second incision may be left until the kidney has been reached and explored, and it can then be made by cutting from within outward with a probe-ended bistoury, steadied by the index finger of the left hand. One great advantage of the vertical incision is the increased facility it affords for passing the ligatures around the pedicle. Other incisions have, however, been successfully employed.

The kidney being reached, the next step is to separate it from its surroundings. When no circumrenal inflammation has existed, the colon, peritoneum, and fatty tissue will easily be detached from their connection with the kidney by the index finger of one hand worked close against the capsule of the organ. It will generally be found that even when no inflammation has occurred, some of the renal capsule will be torn off and left behind; in other cases, as when the operation is performed for calculous or scrofulous pyo-nephrosis, and as a subsequent proceeding to nephrotomy, the kidney should be enucleated from its thickened and adherent capsule, and the latter left behind with the pedicle. The next step is to pass a double ligature of plaited silk through the pedicle, between the ureter and the vessels. This is done by means of an aneurism needle, fixed in a long handle, while the kidney is dragged well up into the wound by the left

hand of the operator, one of the fingers of which can at the same time be acting as a guide for the needle. The needle passed and withdrawn, the ligature silk should be divided, and one-half of it should be tied tightly around the vessels and the other half around the ureter. In doing this the ligature should be pressed well inward toward the front of the spine, so as to leave plenty of room between them and the hilus for dividing the pedicle. The kidney should now be drawn quite out of the wound, a proceeding which is sometimes very difficult, but which will be greatly facilitated by dragging the lower ribs forcibly upward with the fingers of the left hand dipped into the wound. Another ligature should be thrown round the whole of the pedicle, and securely and tightly tied before cutting the kidney free, which is now safely done by snipping through the ureter and vessels with a pair of blunt-ended scissors.

Any bleeding points should at once be seized and ligatured or twisted. All the ligatures should be cut off short, and the pedicle dropped into the wound. A drainage-tube should be fixed in the wound, the edges brought together with waxed silk or fishing-gut sutures, and the form of dressing commonly employed for fresh wounds by the particular operator should be applied. The patient should be kept in the recumbent position until healing is complete, and the drainage should be kept up for four or five days. Some surgeons attach importance to the separate ligature of the artery, vein, and ureter; others, again think it is unnecessary to ligature the ureter; and others that the ureter had best be stitched to the external wound. The most important thing, however, is to securely control the vessels without putting too great a strain upon them in doing so.

Abdominal nephrectomy should be performed in cases unsuited to the lumbar method. The best incision is that along the outer border of the rectus abdominis on the side of the kidney to be removed. The mid-point of the incision will probably be on a level with the umbilicus, but this must entirely depend upon the size and outline of the tumor.

All bleeding, which is sometimes considerable in this incision, having been stopped, and the peritoneal cavity opened, the state of the opposite kidney can be ascertained, if need be, by digital exami-

nation. The intestines should be kept from the surface of the kidney to be removed by means of a large flat sponge introduced into the abdomen. The outer layer of the mesocolon should then be opened sufficiently to allow of the introduction of two or three fingers behind the peritoneum and into the fat in front of the kidney; the fingers should then gently tease their way toward the renal vessels, around which ligatures should be secured. If the vessels are tied separately, care should be taken to secure the artery before the vein. The ureter should then be seized by two pairs of ovariotomy forceps and divided between them. Langenbach's object in selecting this incision was to divide the outer layer of the mesocolon, and so avoid risk of hemorrhage; this is more particularly necessary on the right side, since the inner layer of the mesocolon covers the vessels passing to the ascending colon. The enucleation of the tumor should next be proceeded with; lastly, the vessels should be divided outside the ligatures, and the mass removed from the body. The ureter should now be tied with ligature silk, like the vessels. Abdominal nephrectomy is completed like ovariotomy, and the subsequent treatment is the same.

Though in some cases, from size of tumor, the abdominal operation is easier, and therefore safer, the lumbar method is, as a rule, much safer, and to be preferred in all cases where the kidney is not much enlarged, where the tumor can be reduced by puncture, and when the loin space is not too much contracted.

Ureterotomy is the incision of the ureter. It has been suggested that when a calculus is blocking the ureter, the calculus should be removed either by abdominal section, and subsequently closing the incision of the ureter by continuous suture; or by an incision from the bladder when the calculus is impacted at the vesical orifice of the ureter.

KIESTEIN is the iridescent pellicle which sometimes forms on the surface of the urine after it has been allowed to stand for twenty-four hours or more; after a further lapse of time it falls to the bottom of the glass as a thick white flocculent precipitate. It consists chiefly of mucus, fat, and crystals of triple phosphate. It derives its name from its supposed dependence upon pregnancy, in the

later stages of which it is commonly present; but it is not a necessary accompaniment of pregnancy, and has been met with apart from that condition, and even in the urine of men.

KINK-COUGH. — See WHOOPING-COUGH.

KNEE, DISLOCATION.—See DISLOCATIONS.

KNEE, EXCISION.—See EXCISION OF JOINTS.

KNOCK-KNEE (*Genu valgum*).—A deformity in which the knee is bent inward.

Causes.—Rickets; muscular weakness, combined with habits of excessive standing, or of carrying heavy burdens; lazy manner of walking and standing. About puberty a disease is liable to attack the epiphysial cartilages somewhat analogous to the rachitis of childhood. These cartilages are then peculiarly liable to give way from the causes above mentioned. Hence many cases of genu valgum, and even spinal curvature.

Anatomy.—The diaphyses of the femur and tibia grow faster on the inner than on the outer side. Thus the internal condyle is pushed downward, and the inner part of the upper epiphysis of the tibia upward. At the same time the diaphyses often grow curved, with the convexity inward. The patella tends outward, toward the external condyle. The internal lateral ligament is relaxed in cases which commence at or near puberty, but not in the knock-knee of rachitic children.

Treatment.—In early age the most severe cases can usually be cured by judicious and persevering use of splints or irons, and elastic force, combined with tonic medicines and hygiene. But some plan of osteotomy has to be followed when the bones are hard. Such operations are Ogston's, Chiene's, McEwen's, Reeve's, on the femur, and Barwell's, on femur, tibia, and fibula. M. Delore forcibly bends the knee straight during anæsthesia, and then secures it in a movable dressing. He says that this procedure separates the inferior epiphysis of the femur. Ogston makes a small incision through the skin and saws off the internal condyle subcutaneously, and then easily brings the limb straight. McEwen chisels nearly through the femur above the

condyles, and then puts the limb straight. This is a very satisfactory operation. Use antiseptics. Chiene's and Reeve's modes of operation differ from Ogston's in that the former removes a wedge of bone, and therefore alters the joint-surface less, while the latter chisels up to, but not through, the articular cartilage. Chiene uses the chisel.

C. B. KEETLEY.

KOLPOCYSTOTOMY.—*Kolpos*, vagina; *kustis*, bladder, and *temno*, to cut. Applied to the operation making an artificial communication between the vagina and bladder for the purpose of removing stone or other foreign bodies from the bladder, or for securing continued drainage therefrom in case of disease.

KOLPOCYSTOECPETASIS.—*Kolpos*, vagina; *kustis*, bladder, and *ekpetannumi*, to stretch out. An operation for simultaneously distending the vagina and bladder, when there exists a communicating vesico-vaginal or vesico-uterine fistula, with incontinence of urine.

KOLPOCYSTOLITHOTOMY.—*Kolpos*, vagina; *kustis*, bladder; *lithos*, stone, and *temno*, to cut. Signifies the operation for removal of stone from the bladder in women.

KOLPOECPETASIS.—*Kolpos*, vagina, and *ecpetannumi*, to stretch, is applied to the distention or dilatation of the vagina for the relief of contracted, shortened, or distorted vaginal canal.

KOLPOKLEISIS.—*Kolpos*, vagina, and *klio*, to close. The term covers all operations for the occlusion or shortening of the vagina and uterine tract.

KOLPOPROCTOTOMY.—*Kolpos*, vagina; *proktos*, rectum, and *temno*, to cut. A term applied to an operation for establishing a communication between the vagina and rectum at a point below the recto-vaginal reflection of the peritoneum.

KOLPOSTENOSIS.—*Kolpos*, vagina, and *stenos*, narrow. A term applied to contraction or narrowness of the vagina, usually a result of injury at parturition.

KOLPOSTENOTOMY.—*Kolpos*, vagina; *stenos*, narrow; *temno*, to cut. A

term applied to the operation for relief of kolpostenosis.

LABIA, DISEASES OF THE.—

The labia may be the seat of chancres, which are often accompanied by much œdematous swelling. The swelling often remains after the chancres have healed; and the presence of persistent œdema of one labium should arouse a suspicion that there may have been a chancre.

Erysipelas may attack the labia like any other part of the body. An inflammation of the labia is sometimes seen, resembling erysipelas, in the extensive swelling and redness that it produces, but differing in that it does not spread. This affection, in favorable cases, lasts a few days, and then subsides, but it may be so severe as to produce sloughing. It is seen after acute fevers, as typhus and smallpox, and after delivery. The inflammation may follow a wound, the swelling being so great because of the abundance of loose cellular tissue in the part, but it sometimes occurs without a history of violence, or the discovery of a wound, and without pregnancy or previous illness. It is usually bilateral—a fact against its being simply the result of traumatism.

Treatment.—Rest, and the application of an evaporating lotion (liq. plumbi acet. $\frac{3}{4}$ ss, spts. vin. rect. $\frac{3}{4}$ ss, aq. Oj.). If the parts become gangrenous, and the gangrene show any tendency to spread, the slough should be separated, and the part freely cauterized, and then kept clean by frequent washing, with an antiseptic lotion.

Abscess—usually of one labium only—may occur. It is generally in Bartholin's gland, and is often due to gonorrhea, but may be the result of injury. It is easily identified, presenting itself as a tender, fluctuating, non-reducible swelling of the labium. If left alone, an abscess of Bartholin's gland will burst, discharge, close, and refill; and this will be repeated indefinitely until effectual treatment is adopted.

Treatment.—Dissect out the gland. If the surgeon be able to carefully dress the wound himself, it will be enough to cut a large piece out of the wall of the gland; but, even when this is done, unless the aperture be kept open by careful dressing, it may close, and the abscess refill.

Epithelioma is seen on the labium as a

warty growth, accompanied by destructive ulceration, which shows no sign of healing.

Treatment.—Remove the growth and a good margin of healthy tissue with the platinum knife of Paquelin's cautery. If the growth be advanced, the inguinal glands on the corresponding side will be affected. If these, although enlarged, are movable, they should be removed at the same time as the growth. Innocent growths, as lipomata and molluscum fibrosum, are met with in the labia. The labia may also be enlarged by elephantiasis. Growths of this kind can only be treated by removal, and this is indicated if their bulk be enough to cause inconvenience. The labia also may be the seat of various skin affections.

Herpes, when present, runs its usual course, and only requires dry and sedative applications—*e.g.*, powdering with bismuth, or the application of ung. plumbi subacet. co., or, if pain be severe, of bismuth. oxychlor. grs. xxx, morph. hyd. grs. x, vaselin $\frac{3}{4}$ j.

Eczema is often seen on the labia, especially in elderly, plethoric, gouty women, or in the subjects of diabetes. It is best treated by purgation with antacid remedies (mag. sulph. $\frac{3}{4}$ j, mag. carb. grs. x, spt. am. arom. m. xx, aq. $\frac{3}{4}$ j, t. d.), rest, the avoidance of alcohol, and a restricted diet. For local application either ung. plumbi subacet. co. or ung. zinci, or ung. hyd. nit. and ung. zinci, p. æq., may be used, the first being preferred if the parts be very sore, the last if the condition seem a chronic and indolent one.

Warts are often seen on the labia, as well as on the skin around. The non-syphilitic warts are acuminate, not flat and overhanging. They are associated with uncleanness and unchastity; they are proof of the former, but not of the latter.

Treatment.—If small, they should be kept dry by the use of powder of calomel and oxide of zinc. If large, they may be cut off with scissors, hemorrhage being arrested by pressure and perchloride of iron, or with Paquelin's cautery.

Condylomata, Mucous Tubercles, Syphilitic Warts (secondary) are moist, flat, broad, overhanging white patches. They may become ulcerated.

Treatment.—Black wash should be applied locally, and mercury given internally.

The labia may also be the seat of so-called "lupus" (*q. v.*). A labium may be swollen by a thrombus or *hematoma* (*q. v.*). *Boils* occur sometimes on the labia. They are distressing by the pain they produce, and the suspicions that they sometimes suggest; but they are not otherwise important, and require no treatment special to this part.

Hydrocele of the Labium is a tumor formed by patency of the canal of Nuck, so that the labium contains a process of peritoneum filled with fluid. If the canal be largely open a piece of bowel or omentum may come down; if small, the sac only contains fluid. The channel of communication may become closed, so that the fluid cannot be pressed back into the abdomen. It requires to be carefully diagnosed from a hernia. It is usually recommended to treat it like a hydrocele in the male, by injection of iodine. But bearing in mind the possibility of erroneous diagnosis, and also of the peritoneal communication being not quite closed, probably the safer practice is to cut down upon, open, and remove the sac.

G. E. HERMAN.

Symptomatic Indications.—Œdematous swelling of the labia will require *apis mel.*; inflammation, *aconite* or *belladonna*; when following parturition, *arnica*; gangrenous, *arsenicum*; abscess, *calcium sulphide*.

LABOR, PREMATURE.—Premature labor may be justifiably induced when a continuance of pregnancy until full term would seriously endanger the life of the mother or child. The chief indications may be grouped under three heads; pelvic deformity, dangerous diseases of the mother, diseases of the ovum. To these some obstetricians add placenta prævia, previous difficulties in delivery of large children, previous rupture of the uterus, or Cæsarean section. As regards the amount of pelvic contraction which indicates the induction of premature labor a wide diversity of opinion exists, but, as a rule, it may be stated, that if the true conjugate diameter is less than 3, 5 inches, the operation is justifiable. The time for the induction of labor will be decided by the degree of deformity, the smaller the diameter, the earlier the induction.

Disease of the mother. This may be one existing prior to pregnancy and

aggravated thereby, or it may be connected with, or the result of gestation, or a malady occurring during but not connected with pregnancy. Among these may be noted: renal disease, commencing epithelioma, chorea, epilepsy, dropsy, apoplexy, pneumonia, excessive vomiting, etc.

Prognosis.—According to Wyder, five per cent. of the mothers, and fifty per cent. of the children die.

Treatment.—Various methods are in use for inducing labor, the most common being the showering of the os with hot water, and its dilatation with Barnes's dilator. Krause's method is the introduction of a flexible bougie, under thorough antiseptic precautions, between the ovum and the uterine wall. If within twenty-four hours labor does not come on, the bougie is withdrawn and introduced in a different direction. These operations are to be performed with great gentleness and under strict antiseptic precautions.

LABOR, MANAGEMENT OF.—

If the practitioner has been engaged during pregnancy, attention to the hygiene of pregnancy, especially during the later months, is no less important than that of labor and the post-partum period. The rules of hygiene should be enforced, the condition of the general health carefully looked after, and the patient put in as favorable condition as possible for labor. The urine should be examined from time to time, weekly or oftener, during the last two or three months, to ascertain the condition of the kidneys and detect the first indication of any departure from the normal state. In the case of primiparæ he should endeavor to obtain some idea of the character of the labor to be expected. For this purpose the bony pelvis should be carefully examined, its external measurement made, to ascertain if the dimensions are normal. If it is found that the external conjugate diameter is less than $7\frac{1}{2}$ inches or that the intercostal is not an inch larger than the interspinous diameter vaginal examination should also be made.

When called to a woman supposed to be in labor, two questions arise for the physician to answer: First, Is the patient pregnant? second, Has labor begun? In the great majority of cases the woman is cognizant of her true condition, but she may, although rarely, have a false

pregnancy, a fact which the physician should bear in mind. If not satisfied upon this point, inquiry should be made as to the date of last menstruation, the time of quickening, and regarding the premonitory symptoms of labor; also if she has been previously confined and the character of the labor. Inquiry should then be directed to her present condition, the character and duration of the "pains," if regular in recurrence, whether increasing in severity and frequency, where the pains are felt, if there are any other symptoms than those of labor, and if there have been recent free discharges from the bladder and rectum. If satisfied that the patient is pregnant and in labor, he will inquire if the membranes have been ruptured, if there has been any "show," and suggest an examination to ascertain the condition and progress of the labor. He will then retire from the room, while the woman is prepared for examination.

Antisepsis.—*Of the room.*—The room selected for the lying-in chamber should be, as far as possible, large and well ventilated and thoroughly disinfected before being occupied.

Of the patient.—At the beginning of labor it is advisable for the woman to take a warm bath; after which the external genital organs are to be carefully washed with soap and warm water and then with an antiseptic solution (3 per cent. of phenic acid, or creolin and water). Vaginal injection in normal conditions is unnecessary and is indicated only in case of a purulent discharge or when labor is protracted; in the former case $\frac{1}{2000}$ solution of mercury bichloride may be used. In most cases an enema may be given.

Of the instruments.—Every instrument used should be sterilized by boiling or soaking in an efficient antiseptic before using. If a catheter is needed, the nurse must expose the external genitals and wash them carefully and pass it aided by sight. In the absence of a nurse this must be done by the physician. The external genitals should be washed before and after every examination or the use of any instrument.

Of the obstetrician.—Cleanliness of the clothing and of the person of the obstetrician and of the nurse is indispensable. Clothing which has been in the presence of any contagious disease,

of a cadaver, of the *débris* of putrefaction, should never be brought in the presence of a parturient. The physician should also be careful of spots of blood, of amniotic fluid, or other matter which, soiling his clothing, may render it septic. The hands must be washed with hot water, soap, and turpentine, and then soaked in a warm antiseptic lotion, $\frac{1}{1000}$ solution of the bichloride of mercury.

Armamentarium of the obstetrician.—The following articles should be carried by the obstetricist: Soap and nail brush; turpentine, as a disinfectant and deodorant; pure carbolic acid, in solution; crystals of permanganate of potassium; perchloride of mercury in tablets; a flexible catheter; a stethoscope; ergot; solution of morphine, hypodermic syringe, sulphuric ether; chloroform; scissors; curved needles; silk, silkworm gut, or prepared catgut; forceps; vaseline carbolyzed.

Examination.—*Abdominal.*—Inspection shows the condition; undue distention, pendulousness or separation of the recti. Auscultation gives the position, frequency, and character of the fetal heart-sounds, and assurance of the life of the fetus. Palpation, the position of the fetal head, and of the back, showing position. If these are found to be normal, vaginal examination is unnecessary.

Vaginal.—The usual method is to insert the examining fingers during a pain and retain them in position until the uterine contraction is over. The condition of the passages should be noted during the contraction and relaxation of the uterus. The os found, its form and consistence should be examined, and the state of dilatation noted. The smooth surface of the membranes may be recognized, or, the hairy scalp, if the membranes have been ruptured. The fundus may be depressed by the other hand so as to bring the uterus within reach of the fingers. The condition of the vagina, if normal in form and size, whether the walls are soft and relaxed, and if there is free secretion of lubricating mucus, should also be noted, as well as the condition of the perineum and the size of the vulvar opening. If the internal os has been obliterated, and the head rests upon the os externum, the examination may be continued during the interval, and the pelvis explored by running the fingers around it, noting if there is anything abnormal in

its form and if the rectum is empty. Before completing this part of the examination the tip of the middle finger should be applied to the promontory of the sacrum, and if this is readily felt, the distance be marked upon the first finger by the finger of the other hand. This will give the conjugate diameter. This is not so readily obtained in the lateral as in the dorsal position, which is the best for the purpose of examination and for manipulation.

It having been found that the patient is pregnant and in labor, that the child is living and that the head presents, the patient may be assured that it is all right. In case of any abnormality, it should be quietly told to some relative or friend, not to the patient.

Having given the proper directions, the obstetrician, having due regard to the condition of the patient, the regularity, frequency, and strength of the pains, the softness and moistness of the vaginal walls, and the condition of the os, may consider the propriety of leaving the patient for a time. A second examination, made a half hour or so later, will show the progress labor is making and afford a basis for estimating its probable duration. If the os is not dilated beyond the size of a half dollar in primiparæ the patient may be left for a short time, with the understanding that the physician is to be sent for if the membranes rupture or if the character of the pains change. During the first stage the patient should be encouraged to walk about and to assume whatever position is the most comfortable. Only light nutriment should be taken and the rectum and bladder kept empty. The patient should be encouraged to cry out during the pains and advised against straining downward. If there is pain in the sacrum it may often be relieved by pressure by the attendant or nurse. Nausea and vomiting and other distressing symptoms should be palliated. During this stage the membranes should be left intact until the os is fully dilated.

Second stage.—With the beginning of the second stage the character of the pains change, becoming more expulsive. Examination shows the complete dilatation of the os. If spontaneous rupture of the membranes has not occurred they should be broken or torn by pressing on the tense bag of waters with the finger,

or any antiseptic instrument which will expedite the labor. The usual posture during delivery in this country and England is the left lateral, in France and the continent of Europe the dorsal. The Walcher position, the hips upon the edge of the bed, with the legs hanging down, slightly increases the antero-posterior diameter of the pelvis. During the second stage of labor, some firm object placed near the patient's feet for her to press against and a towel strongly fastened within her reach to pull upon will assist the expulsive efforts. During the pains the patient should hold her breath and aid herself by pressing down.

The position should be accurately diagnosed and errors corrected. Thus, in occipito-posterior positions, flexion should be aided in order to secure the rotation of the occiput to the front. This can be done by pressing the occiput upward, and is the sufficient and correct treatment. If the position is correct further examination is unnecessary. A little chloroform, just sufficient to dull the pains, may now be administered. If the pains are infrequent they may be stimulated by kneading the uterus through the abdominal wall, which should be done at regular intervals.

Preserving the perineum.—This is an important and necessary duty. If the perineum does not soften and relax early in labor, time should be allowed for it by doing nothing to hasten labor and by the use of chloroform. Hot fomentations, rubbing the perineum with carbolized vaseline or creolinated lard will assist in softening it. When the head is passing the perineum the parts should be exposed and watched and the head not allowed to escape too rapidly. It must pass the vulva with its smallest plane parallel to the plane of the outlet; that is, flexion must be preserved and extension prevented; the occiput must continue to lead. To preserve the perineum the physician will, therefore, control the movement of the head with his right hand, the fingers being placed on that part which is exposed, avoiding direct pressure on the distended tissues. The head can thus be pressed against the pubic symphysis, and flexion maintained, while at the same time its too rapid advance is checked. The thumb may be placed in the dilated anus, and may press upon the sinciput through the an-

terior rectal wall. Pressure on the tissues behind the anus may also be made with the left hand. The head may also be squeezed out between two pains by fingers or a thumb placed in the rectum, a good and safe method under some circumstances. It is also important to remember that flexion of the legs at the hips tightens the skin all over the buttocks and the back of the thighs. Therefore, when there is any tightness of the skin round the vulvar aperture, it can be greatly reduced by extending the legs at the hips and keeping them in a straight line with the body, for the skin thus set free from the buttocks slackens the tension round the vulva to a great extent. To save the perineum, then, the left leg should be straight down the bed, the right leg should also be straight and held up by the nurse (Fothergill).

As soon as the head is expelled, the cord if around the neck should be slipped over the head. Failing this, it should be pushed up over one of the shoulders; and if this cannot be done it should be tied in two places and divided between the ligatures, as a shortened cord may prevent birth and asphyxiate the child. The eyes should next be wiped clean. The shoulders should be prevented from too rapid passage. The child's face naturally becomes congested during pains; if it remains reddened between the pains the birth must be hastened. This is done by forcing the child out by pressure on the uterus by the abdominal wall. When a finger can be passed into one axilla, traction may be used, the fundus being depressed and made to follow the advancing breech. This is done with the left hand, which should rub and knead the uterus to encourage good contraction and retraction, and so prevent undue bleeding when the placenta is separated. At this time it should be ascertained that there is not a second child in the uterus.

Third stage.—This is perhaps the most difficult stage of normal labor as regards management. Although the uterus is able to separate and expel the placenta if sufficient time be allowed, it has been found advisable in practice to assist the expulsion of the placenta. With Credé's method, one hand is kept upon the uterus, grasping the fundus with the finger and thumb, and gently manipulating it to promote contraction. After allowing a few min-

utes to elapse, the uterus is compressed during contraction to assist expulsion, while maintaining gentle traction upon the cord with the other hand. This entire procedure should be done carefully and without force and should not be resorted to in less than twenty to thirty minutes after the birth of the child. When the placenta has been expelled from the uterus it can easily be drawn through the vagina, turning it around a few times to twist the membranes into a rope. If they do not come away without difficulty, the finger should be passed upward, gently loosing the membranes if attached. If the placenta cannot be expelled from the uterus in about an hour, it should be looked upon as adherent, and the hand should be introduced into the uterus to separate and remove it. In case of hemorrhage after the birth of the child, if it cannot be stopped by compression of the uterus, the placenta should be removed at once.

Ergot should never be given during labor, as it is perhaps the most frequent cause of retention of the placenta, nor after delivery unless in case of hemorrhage or marked relaxation of the uterus. If there is hemorrhage after labor which cannot be checked by compression of the uterus over the pubis, a very hot douche should be given, and ergot may be administered.

Post-partum hemorrhage.—Treatment.—1. Manipulation. The uterus is to be actively rubbed, grasped and compressed with both hands, the patient lying upon her back. If the hemorrhage continues, one hand must be passed into the uterus while the other compresses the fundus. The uterus must be quickly emptied of blood clot and any remains of placenta or membranes. The hand is then withdrawn from the uterus, the fingers are slipped behind the cervix, which is held firmly in the hollow of the hand. The external hand holding the fundus and the internal one the cervix is now squeezed between them with all the force the operator can command. This pressure is continued until a hot douche is ready. 2. Heat. The douche must be at a temperature of 120° F., or as near it as the operator's hand can bear. The buttocks may be brought over the edge of the bed and a mackintosh arranged to direct the back-flow into a pan on the floor, or, the patient being on her back, a douche pan or wash bowl may be

used. The stream of water must be carried to the fundus. For this a long tube is necessary, such as Budin's uterine tube, which is grooved to allow of free back flow. A large catheter may be used if the finger is passed beside it through the cervix. The injection of air into the uterine cavity must be carefully avoided, and it must be remembered that, if a free back-flow is not provided, the injected fluid will distend the uterus, and some of it may even be forced through the fallopian tubes into the peritoneal cavity. Five or six syringefuls at a time should be injected with some force, as the mechanical impact of the fluid is useful. The addition of vinegar (1 in 5) to the hot water is of great value when a second douche is needed.

Packing the uterine cavity.—There are a few cases in which hot water fails to check post-partum hemorrhage. In these rare cases tightly packing the cavity of the uterus with an antiseptic substance exerts pressure upon the bleeding surface and stimulates contraction. Iodoform gauze is the best material for packing. Long strips should be introduced with the help of a speculum and a long pair of forceps. Several yards of gauze will be required as the packing must be firm and carried up to the fundus.

Styptics.—Styptics are not regarded as good practice, as they act by killing the superficial tissue of the uterus. When, however, hot water has failed and no material suitable for packing is at hand, perchloride of iron, one part of the salt by weight to eight of water, may be used. The fluid may be injected to the fundus with an intra-uterine tube, and allowed to flow over the walls of the cavity; or swabs may be dipped in the solution and rubbed all over the uterine surface. A speculum should be used and the uterine walls protected. Before the styptic is applied, the uterus should be carefully washed out with hot water to remove all clots and blood. Iodine and various other substances are recommended, even vinegar being useful. Iron is the only styptic, however, that it likely to succeed after hot water has failed. To aid in the removal of the destroyed tissue, intra-uterine douches should be freely used during puerperium.

After-treatment.—The head should be kept low. Alcohol, beef tea, and other warm fluids may be given by the mouth, and hot water placed around the patient.

In worst cases the administration of stimulants and fluids per rectum is invaluable. Three ounces of fluid at 100° F. can easily be retained. Peptonized beef tea, with 3 i or 3 ij of brandy or whisky, and perhaps a little strychnine, is a good mixture for this purpose and may be repeated at short intervals, allowing time for absorption. In cases of more immediate need 20-40 *m* of ether may be injected well into a fleshy part. When injected subcutaneously it often kills the skin over it, causing a huge ulcer. Brandy may be given in the same way with good result. Strychnine and strophanthus are also invaluable for hypodermic use. When the quantity of blood lost is very great it is necessary to replace it in some way (*see* TRANSFUSION) (Fothergill).

If there is no hemorrhage the uterus should be frequently palpated during the half-hour or so following delivery to see that the contraction is maintained, and the placenta and membranes examined carefully to see that it is entire and that no portion of the placenta or membranes has been left in the uterus. Any deficiency in either requires an examination of the uterus and removal of the retarded portion. A binder may then be applied which should be pinned tightly below but more loosely above.

Ligature of the cord.—When pulsation has entirely ceased, from five to fifteen minutes after the birth of the child, unless the condition of the mother should require the immediate ligation of the cord, the cord should be tied about an inch and a half from the umbilicus and cut about half an inch beyond the ligature. Several strands of linen thread tightly drawn about the cord makes perhaps the best ligature. A second ligature at level of the vulva is advised by Auvard to serve as a guide to the separation and descent of the placenta.

LACHRYMAL APPARATUS, DISEASES OF.—See EYE, DISEASES OF.

LACTATION.—The functional activity of the mammary glands.

These glands become more vascular, grow, and secrete, early in pregnancy (*q. v.*). In the two or three days after delivery their development rapidly increases, and the secretion of milk becomes abundant. The older authors supposed that the development of mammary activity was accompanied with

fever, which they called "milk fever." But accurate observation of the temperature has shown that the secretion of milk is not attended with fever.

It is common for the breasts to be painful and tender during the fullness which precedes the complete establishment of the secretion, but this pain and tenderness pass off when the flow becomes abundant.

The milk first secreted is called *colostrum*. It is less homogeneous than that produced afterward, looking like a serous fluid with yellow streaks and spots. On microscopical examination, it is seen to contain "colostrum corpuscles," which are the epithelial cells of the mammary glands full of oil globules. After about the third day these cells burst and set free the fat globules before they leave the gland, and thus the true milk, a bluish-white, homogeneous fluid, is formed. It is generally believed that the colostrum has a slight purgative effect on the child, but, according to Depaul, the same purgation results if the child be put at once to the breast of a wet-nurse who has ceased to produce colostrum.

Milk contains about 11 per cent. of solid matter. This consists, roughly, of butter $2\frac{1}{2}$ per cent., casein 4 per cent., sugar $4\frac{1}{2}$ per cent.; besides this there is about 0.15 per cent. of salts. The amount of milk secreted daily when lactation is fully established is about three pints. During lactation menstruation is commonly suspended, but it is, nevertheless, possible for conception to occur at this time. The secretion of milk spontaneously ceases if the breasts are not regularly emptied by sucking.

After spurious labor in extra-uterine gestation (*q. v.*) the secretion of milk begins just as after a normal delivery.

There is no drug that has any specific effect either in promoting or checking the secretion of milk. The former purpose is best attained by a diet liberal in quantity and containing plenty of meat and milk; the latter, by a restricted diet, combined with saline purgation.

Hindrance to lactation may arise on the part of the mother from general debility, so that the breasts soon cease to produce milk. Or the milk may be poor in quality, so that the child does not thrive. It is not possible to estimate the nutritive power or digestibility of a mother's milk by any kind of chemical analysis. The

effect on the child is the only test of the suitability of the milk for it.

Lactation may also be hindered by diseases of the nipple, which may be small, flat or sunken. By pulling out the nipple with the fingers (by which erection of the nipple is provoked) it may usually be made prominent enough for a healthy child to seize. In the worst cases its prominence may be increased by Kehr's operation. Soreness of the nipple may hinder suckling. This usually comes on in the first few days, and, if properly treated, gets well within the first fortnight. It usually commences with the formation of small vesicles at the apex of the nipple. These quickly break and dry into brown crusts, underneath which, when detached by sucking, excoriations are found. There are also sometimes deep fissures running transversely round the nipple. These are rarer, they are more painful, and take longer to heal.

The treatment is to apply glycerin of borax to the sore nipple, to protect it during suckling by a nipple shield, and to carefully dry it after suckling. To prevent sore nipples, it is well to wash the nipple night and morning during the last few weeks of pregnancy with equal parts of brandy or whisky and water, and to carefully dry it after suckling.

LARYNGISMUS STRIDULUS
(**Spasmodic Croup; Spasm of the Glottis**).—A spasmodic affection of the larynx.

Symptoms.—The essential feature of the disorder is a sudden attack of complete arrest of breathing, lasting a few seconds, and followed by a crowing inspiration. The affection is almost peculiar to the first two or three years of life. Attacks are most liable to come on as the child awakes from sleep; perhaps, more correctly, the attack awakens him, and although supposed always to take place at night, they are almost as common in the daytime. The child may be playing, apparently in usual health, when he suddenly stops, perhaps makes a little noise in the throat, and struggles for breath, the head is thrown back, the mouth is open, the hands are clenched, and the chest fixed. In this state he remains a few seconds, according to the severity of the attack. The face meanwhile becomes livid and then of an ashy hue, while the lips and tongue become more or less

black. The spasm terminates as suddenly as it commences, with one or more long, loud, crowing inspirations, and the child may at once resume his play or be fretful or sleepy. There is no loss of consciousness.

The length of the attacks and the frequency of their recurrence depend upon the severity of the case; sometimes the child will have one every few minutes, both night and day, at others a single nocturnal attack will constitute the whole malady. In the mildest form the spasm is not complete, one or more labored inspirations with crowing being all that is observed. On the other hand, the attack may be so severe that the child dies suffocated. A fatal result would, doubtless, be more common were it not that, just as in asthma, the state of asphyxia, when advanced, causes a relaxation of the spasm, and allows the glottis to be reopened. The attack may terminate in a general convulsion, but this is rare. Laryngismus is a constant accompaniment of tetany (*q. v.*), and is also closely associated with "facial irritability," a condition in which contraction of the facial muscles is obtained when the finger is lightly brushed over the cheek, where the facial nerve spreads out just above the zygoma.

Pathology.—Spasm of the adductors of the larynx is the actual condition during the attack, and is probably of central origin; but whether primary, and therefore a species of epilepsy, or secondary, and consequent on reflex irritation, is a matter of dispute. In fatal cases, the post-mortem appearances are those of death from asphyxia (*q. v.*).

Ætiology.—Laryngismus is said to be more common in male children. It is seldom seen before the age of six months or after three years. It is much more common during the winter months. The subjects of the affection are always rachitic in some degree, and are often neurotic, there being also a history of neurotic tendencies in the parents. The exciting cause of an attack is usually to be found in some error of diet or digestive disturbance, or outburst of passion; indeed, the mothers sometimes describe the seizures as "passion fits." The existence of facial irritability betrays an unusual degree of excitability to stimulation on the part of the seventh nerve, and it is a justifiable assumption that a similar condition of the laryngeal nerves exists.

Treatment.—At the moment of an attack there is not much to be done except to see that the clothes are not too tight around the child's chest. An attempt may be made to relieve the spasm by pushing up the chin, as this would tend to raise the larynx, and possibly to open it; but as a rule the attack is over before much can be attempted. When asphyxia is threatened, tracheotomy may be resorted to, followed by artificial respiration, and the other measures proper to restore suspended animation.

General treatment is all-important; the child should be taken out every day unless the weather be exceptionally bad. The sleeping and day rooms should be thoroughly ventilated, the window being left open for an hour or two at a time; he should be warmly clothed, but the clothes should not be too tight; every night and morning he should have a tepid bath, and the front of the neck should at the same time be sponged with cold water. The diet should be regulated, and any digestive disturbances corrected by appropriate treatment. If the child be rickety, cod-liver oil should be given with steel wine. If the treatment be carried out on these lines the liability to the attacks will certainly diminish.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Aconite* is nearly specific for this disease, checking the spasm and relieving the croupous breathing. *Belladonna* is sometimes useful when the spasm is associated with congestive condition, red face, dilated pupils. *Belladonna* or *gelsemium* may be required when convulsions are present. *Spongia* for hard, dry cough, voice weak or hoarse between the attacks.

LARYNGITIS, ACUTE.—Acute inflammation of the mucous membrane of the larynx.

Symptoms.—When occurring in the adult, the first symptom complained of is, usually, a sense of discomfort and irritation referred to the larynx, accompanied by a dry, tickling cough, and hoarseness or loss of voice. Pain on pressure over the larynx and some discomfort in swallowing, and in severe cases dyspnoea is present.

These symptoms are sometimes preceded by those of an ordinary nasal or pharyngeal catarrh, and are ushered in by chilliness and rise of temperature;

the pulse is frequent and full, and the face flushed. If the disease advance unchecked, especially if serious infiltration (œdematous laryngitis) occur early, the countenance becomes anxious, pale, or somewhat livid; the pulse feeble and irregular, and the usual signs of carbonic acid poisoning appear. The amount of obstruction to the entrance of air is indicated by the noisy, stridulous breathing, marked respiratory excursions of the larynx, and the great activity of the muscles of respiration.

In children, owing partly to their tendency to laryngeal spasm, and partly to the narrowness of the glottis, dyspnoea is usually present, and comes on in paroxysms, so that a child who goes to bed with only slight catarrhal symptoms and a little hoarseness, may awake in the night with a start, in great terror and distress, from difficulty in breathing, a condition constituting one variety of the *croup* of the old authors.

On making a laryngoscopic examination, the mucous membrane of the larynx, especially that covering the ary-epiglottic folds, is found to be swollen, forming, in some cases, pyriform swellings, sometimes reducing the rima glottidis to a mere chink; the epiglottis in such cases is found to be swollen and erect; the vocal cords are also swollen and much congested, and usually their mobility is impaired, either from inflammatory infiltration of the muscles acting upon them, or from swelling of the soft parts. If the inflammation goes on to suppuration, a more or less localized tumor may be detected, and the coloring of the pus, which has formed, may be recognized through the mucous membrane.

Diagnosis.—In the adult the diagnosis is easily made, but in the child there may be considerable difficulty, as just in those cases in which a laryngoscopic examination is most required is there the greatest difficulty in making one with any degree of success. Acute catarrhal laryngitis in the child has to be differentiated from spasmodic croup or laryngismus stridulus and from laryngeal diphtheria. From the former it is to be distinguished by the presence of fever and hoarseness, and by its onset being usually ushered in with coryza, and by the absence of carpo-pedal contractions. The diagnosis from laryngeal diphtheria is more difficult, but in that affection there is generally some

membranous deposit to be seen on the pharynx, there is swelling of the lymphatic glands beneath the angle of the jaw, and albuminuria; the symptoms are of a more asthenic type, and the disease usually occurs in epidemics. It is well, however, not to give a definite opinion at the commencement of a case.

Prognosis.—Simple catarrhal laryngitis usually runs a favorable course in the adult; and even in the child, though the symptoms are more urgent, recovery takes place in most cases. In œdematous laryngitis, on the other hand, the prognosis is extremely unfavorable, especially in the form associated with erysipelas.

Pathology.—Acute laryngitis differs in its pathology in no respect from inflammation occurring in other mucous membranes.

Ætiology.—The mild form of acute laryngitis usually comes on from catching cold, or may result from the over-use of the voice. More severe forms may be met with in connection with the exanthemata, especially measles, or may result from the spread of inflammation from neighboring parts, such as the pharynx. Œdematous laryngitis has been met with in Bright's disease, but its frequent connection with this disease is denied. Traumatic laryngitis, as its name implies, depends on injuries to the larynx, such as may occur from scalds, from corrosive poisons, or from the impaction of foreign bodies.

Treatment.—The most important factor is the attainment of functional rest. In endeavoring to fulfill this indication, the twofold functions of the larynx (*i. e.*, phonatory and respiratory) must be borne in mind. A patient will readily understand the necessity of abstaining from talking, so that one function of the larynx can be held more or less in abeyance. Only very partial rest can be obtained for the other function, but this is to be sought for by keeping the patient as quiet as possible; in severe cases he should be confined to bed, so as to diminish the frequency of the respirations. The temperature of the room should be about 65° F. and the air moistened by means of steam from a bronchitis kettle, and the addition of a teaspoonful of the compound tincture of benzoin to the water in the kettle has a sedative effect; or an inhaler may be used with the same quantity of the tincture in a pint of water.

The diet should be of an unstimulating nature and semi-solid, so as not to cause trouble in swallowing—bread and milk, rice, sago, tapioca, beef-tea, and mutton broth are the best. If the bowels be confined, a saline aperient is indicated. A diaphoretic, such as half an ounce of solution of acetate of ammonium, with twenty minims of the spirit of nitrous ether, made up to an ounce with camphor water, may be given every four hours. If the patient be very feverish, twenty minims of antimonial wine, or four or five of tincture of aconite may be added to the mixture. If cough be a troublesome symptom, the addition of half a dram of the compound tincture of camphor and the same amount of the oxymel of squills will generally give relief. Should signs of œdema of the larynx manifest themselves, the patient should have ice to suck, and an icebag collar should be placed round the neck; if, in spite of these precautions, improvement does not set in, the œdematous tissue should be scarified. This procedure is facilitated by previously spraying the larynx and pharynx with a ten per cent. solution of the hydrochlorate of cocaine. If scarification fail to relieve the patient, or only does so temporarily, tracheotomy should be performed without delay.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Aconite* is very valuable, especially in the beginning, with symptoms of inflammatory fever; often the only remedy needed. *Kali. bich.* is useful when expectoration is tough and stringy. *Bromine* is valuable when voice is hoarse and husky, provoking cough, scraped sensation in the throat. *Causticum* and *aconite* are useful in recent cases of laryngeal catarrh of professional singers; *carbo veg.* in more chronic cases.

LARYNGITIS, CHRONIC.—Chronic inflammation of the mucous membrane of the larynx.

Symptoms.—A sense of uneasiness and tickling in the larynx which causes a frequent desire to clear the throat; the expectoration is usually scanty, consisting chiefly of small pellets of mucus. The voice is always more or less affected, varying from slight degrees of hoarseness up to complete aphonia. The hoarseness is generally worse when the voice is first used, especially in the morning; after a

little use it regains some amount of power, but fatigue is soon felt if talking be continued for any time.

On making a laryngoscopic examination, the cords will be found to have lost their normal whiteness and to vary in color from a pale pink to a bright red, but the color is never so intense as in acute laryngitis. Sometimes only one cord is affected; indeed, the congestion may be confined to a portion of one cord. Viscid mucus will usually be found adhering to the laryngeal membrane, especially in the arytenoid commissure, and on phonation the cords may stick together momentarily. Accompanying the congestion there is occasionally loss of mobility in the cords, or defective tension, so that on phonation the cords do not come into apposition, but leave an oval gap between them.

Diagnosis.—As laryngeal tuberculosis in the early stages usually presents the appearances of a chronic laryngeal catarrh, it is important that in cases of any standing the lungs should be carefully examined, and the sputa submitted to microscopic examination for bacilli. The diagnosis from malignant disease is at times very difficult, but the occurrence of thickening and congestion of one cord, with defective mobility of the same, in persons over forty, should give rise to serious suspicion that a growth may be present.

Pathology.—The changes ordinarily met with in chronic inflammation of mucous membranes are found in chronic laryngitis.

Ætiology.—The causes are practically the same as those of the acute form of the disease; indeed, chronic laryngitis is commonly preceded by an acute attack. Over-use of the voice, excessive smoking and drinking, are predisposing conditions. Impeded nasal respiration has only recently attracted attention as a cause of chronic laryngitis, yet it is a potent one. Atrophic rhinitis, which is so frequently accompanied by a dry and glistening condition of the pharynx (pharyngitis sicca), also leads to chronic catarrh of the larynx. Persons whose occupations expose them to the inhalation of irritant particles, to sudden change of temperature, or who are called upon to use their voices in the open air, are especially liable to chronic laryngitis.

Treatment.—The only treatment of

avail in the more obstinate forms is the direct application of astringent remedies to the larynx by means of the brush. A solution of chloride of zinc, 15 to 30 grains in an ounce of water, with the addition of 20 minims of dilute hydrochloric acid, which renders the salt more soluble, is the best; this should be applied daily. In the event of spasm being excited by the application, the patient should be told to hold his breath and then to breathe through the nose; if this is not sufficient, sipping a little cold water will usually have the desired effect. If the chloride of zinc fail to cause improvement, a stronger astringent must be tried; for this purpose there is nothing better than a solution of nitrate of silver. It is customary to begin with a solution of 10 grains to the ounce, and to gradually increase the strength, if necessary, up to 90 grains to the ounce. The writer has used nitrate of silver solution with some degree of caution since he saw a case of argyria resulting from the application, extending over some weeks, of a solution of nitrate of silver to the pharynx. In cases in which it is not possible to use the brush an astringent spray may be tried—the hand-ball spray apparatus being employed to generate the spray. The following solution is one of the best: \mathcal{R} Zinci chlor. grs. xij, acid. hydrochlor. dil. m. xv, tinct. limonum 3 iij, aquam ad. $\frac{2}{3}$ vj; ft. sol. Or 3 grains of tannic acid in an ounce of water, or 1 to 3 grains of the perchloride of iron to the ounce of water may be used. Inhalations of creosote, or of the oil of the Scotch fir, are sometimes found of use. Attention should be directed to any of the causal conditions, such as excessive smoking or drinking, the over-use of the voice, or constipation.

If, after the removal of congestion, the voice remain feeble, the use of electricity, either in the form of the continuous or of the interrupted current, is to be recommended.

As regards general treatment, the patient's health must be improved as much as possible; coddling undoubtedly increases the tendency to laryngeal catarrh, so that the neck should not be wrapped up; at the same time allowing the beard to grow has often a very beneficial result. Sponging the chest and neck with cold water in cases where a cold bath is not taken, is of great service; regular exercise

should be enjoined, and hot and crowded rooms avoided.

When the laryngeal secretion is scanty and viscid the chloride of ammonium inhaler is of use, and compressed tablets of chloride of ammonium with borax or chlorate of potassium may be advantageously sucked in the intervals.

The necessity for free nasal respiration should not be overlooked, as many cases of chronic laryngitis result from obstruction to the nose by polypi, or other morbid conditions; as a consequence air enters the larynx without having been previously warmed and moistened by passing through the nostrils.

F. DE HAVILLAND HALL.

Symptomatic Indications.—In chronic laryngitis, with sensitiveness of the larynx to pressure, dry cough, congestion to the head, *belladonna* is useful. Long standing cases in elderly people are relieved by *carbo veg.* Chronic follicular laryngitis may require *iodine*. When attended with copious and easy expectoration, catarrhal form, *antimonium tart.*; glutinous expectoration, *kali bichrom.* For dry and irritable condition of the larynx *phosphorus* is valuable.

LARYNGOSCOPE.—Some physicians prefer the reflecting mirror fixed to a band which encircles the head; others have a preference for the form in which the reflector is fixed in a spectacle frame; the latter is perhaps the most convenient.

The lime-light is the best means of illuminating the interior of the larynx; a duplex lamp will answer ordinary requirements. In making an examination, the patient is seated opposite the physician; the light on the right side of the patient, level with his ear; and the reflector adjusted to throw a cone of light directly upon the pharynx. The under surface of the laryngeal mirror is heated to prevent moisture condensing on it, and its temperature should be tested with the hand before introducing it into the patient's mouth. The patient should be directed to breathe quietly during the examination, and to say *eh*, *ah*, or *e* when told. The physician then grasps the patient's tongue, which should be enveloped in a handkerchief or piece of linen, with his left hand, the thumb being above. The mirror should now be introduced and passed to the back of the mouth, so that it presses backward and upward against the

uvula, care being taken not to touch the surface of the tongue. The patient may now be told to vocalize. Thanks to the introduction of cocaine, it is possible to examine with ease patients who have very irritable fauces, as, after painting a ten per cent. solution of this drug on the soft palate and adjacent parts, the sensibility of the mucous membrane is, in about two minutes, almost entirely lost.

It must be borne in mind that the image which is seen on the laryngeal mirror is inverted, so that the anterior part of the larynx is seen at the posterior part of the mirror, but that there is no lateral change—that is to say, the vocal cord which is seen on the *patient's* right is the right cord.

It is desirable that a laryngoscopic examination should be made methodically. The first glance should be directed to the color of the mucous membrane, as the mere presence of the mirror sometimes sets up congestion. Having satisfied one's self as to the color, attention should now be paid to the motility of the cords, and, finally, note should be taken of the presence of new growths, ulcers, or other morbid appearances.

F. DE HAVILLAND HALL.

LARYNX, LUPUS OF.—This somewhat rare disease would be discovered more frequently if the larynx were examined in all cases of lupus of the face. The result of systematic examination goes to prove that the larynx is affected in about six or seven per cent. of the cases.

Symptoms.—As lupus of the larynx is not, in its early stage, a painful affection, it may be overlooked, unless a laryngoscopic examination be made. Usually, however, there is hoarseness, sometimes going on to complete aphonia, and, when the soft parts become infiltrated, dyspnoea may supervene. If the epiglottis be destroyed, there is difficulty in deglutition, cough being excited by the entrance of food into the larynx. On examination, in some cases, the mucous membrane of the pharynx and epiglottis has been found extremely pale. The epiglottis is usually irregularly enlarged, and frequently shows a considerable loss of substance. The general appearance of the interior of the larynx is rough, thick, and granular, and has a worm-eaten appearance.

The *diagnosis* of primary lupus of the

larynx is difficult, some laryngologists saying that one can never be sure of lupus of the larynx unless one finds lupus elsewhere. It requires to be distinguished from epithelioma, syphilis, and phthisis of the larynx, but in this there is usually no great difficulty except as regards the latter. The greater age of patients with epithelioma, the more unequal surface and harder character of the growth, and the fact that it is commonly unilateral at the commencement, will aid in the diagnosis. Syphilitic affections of the larynx generally run a more rapid course, partake more of the nature of loss of substance than of new formation, and are usually speedily benefited by iodide of potassium. The slow progress of the case, the absence of pain, and the little effect it has on the general nutrition will serve to differentiate lupus from syphilis and phthisis of the larynx.

Prognosis.—Apart from the risk of suffocation, either from acute oedema, which is exceedingly rare, or from gradual infiltration of the soft parts, lupus of the larynx is not of immediate danger to life, since it increases slowly, and may remain stationary for years; but, though not a very fatal disease, its complete and permanent cure is extremely rare.

The *pathology* and *etiology* of this disease are the same as for lupus of the skin. The larynx may be affected primarily, but usually the affection is secondary to lupus of the face, nose, or mouth.

Treatment.—See LUPUS. Applications of a solution of perchloride of iron, 120 grains to the ounce, have been attended with great success. Semon has employed the galvano-cautery for burning down the lupoid tissue, and has obtained permanent cure. Solutions of lactic acid (twenty to sixty per cent.) have also given good results.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Aurum mur.* has frequently given good results. See, also, LUPUS.

LARYNX, NEUROSES OF.—Nervous affections of the larynx may be due to (A) **Altered Conditions of the Motor Nerves**, including *paralysis* and *spasms*.

(1) **Paralysis** may affect the abductor, adductor, and tensor muscles of one or both sides of the larynx.

Bilateral Paralysis of the Abductors (*crico-arytenoidei postici*).—This is a

very grave condition, and may at any moment cause imminent peril to life.

Symptoms.—The breathing is markedly affected, inspiration being prolonged and stridulous, while expiration is comparatively easy. Any slight exertion causes dyspnœa, and may render the patient more or less cyanosed. The voice is not much altered, though there is often slight hoarseness. The larynx is seen to move up and down with respiration—the so-called “respiratory excursions” of the larynx. Laryngoscopically, the cords are found to be sucked together during inspiration, leaving between them a chink of two or three millimeters in width; during expiration the glottis is wider than during inspiration. The cords are generally somewhat congested.

Diagnosis.—The symptoms given above, together with the laryngoscopic appearances, suffice for the diagnosis. In some cases ankylosis of the crico-arytenoid joints may simulate bilateral paralysis of the abductors, but in these cases there is usually some alteration in the configuration of the parts.

Prognosis.—Eliminating hysterical cases, paralysis of central origin is generally incurable. Tracheotomy may prolong the patient's life, but, as a rule, he will be unable to dispense with the canula.

Morbid anatomy.—Semon has pointed out that there is a distinct “proclivity of the abductor fibers of the recurrent laryngeal nerve to become affected sooner than the abductor fibers, or even exclusively, in cases of undoubted central injury, or disease of the roots or trunks of the pneumogastric, spinal accessory, or recurrent nerves.”

Degenerative changes may be found in the brain, or in the recurrent nerves, and the striation of the posterior crico-arytenoids may be indistinct, and the muscles pale in color and infiltrated with fat.

Ætiology.—In some instances the paralysis is myopathic in origin, and arises from a chill. Pressure upon both pneumogastric or both recurrent laryngeal nerves may produce the condition, and the pressure of an aneurism upon one pneumogastric nerve has been known to cause bilateral paralysis of the abductors.

This paralysis has been found associated with tabes in several instances; it may be an indication of commencing

bulbar paralysis, and has been met with in syphilitic and other affections of the brain.

Males are more frequently affected than females. This form of paralysis is rare until adult age has been reached.

Treatment.—Galvanism, massage, and the subcutaneous injection of sulphate of strychnine have been recommended, but are almost always ineffectual. Syphilis and aneurism, the two most common causes of this condition, are both benefited by large doses of the iodide of potassium, and this drug may often be given with advantage. If attacks of dyspnœa occur, tracheotomy should be performed, and even in cases in which the subjective symptoms become less marked, tracheotomy is necessary, unless the improvement be accompanied by an increase in the diameter of the glottis.

Unilateral Abductor Paralysis.—

Symptoms.—Paralysis of one abductor is usually accompanied by a certain amount of hoarseness or roughness of the voice. Though the breath may be short on exertion, dyspnœa is not a marked symptom.

Laryngoscopically, the affected vocal cord will be seen to be immobile in the median line. After a time the abductors not uncommonly also become paralyzed; in this event the cord will occupy the cadaveric position—*i. e.*, midway between abduction and adduction. This is followed by relief of the dyspnœa, but the voice undergoes further deterioration.

Diagnosis.—This condition requires to be distinguished from fixation of the cord as a result of disease of the crico-arytenoid joint.

Prognosis.—The affection does not in itself endanger life; the gravity depends upon the fact that it is so frequently due to some grave organic disease.

Morbid anatomy.—This has been already described under bilateral paralysis of the abductors.

Ætiology.—The most frequent cause of abductor paralysis is pressure upon one pneumogastric, or recurrent laryngeal nerve. On the right side this may be brought about by pleural thickening, and on the left, which is more commonly affected, the chief cause is an aneurism of the transverse aorta.

Bilateral Paralysis of the Adductors (*crico-arytenoidei laterales* and *arytenoideus*).

Symptoms.—Aphonia, which usually

comes on suddenly, and as suddenly disappears. The patient may, however, cough and sneeze quite naturally. When phonation is attempted during a laryngoscopic examination, it is observed that the cords fail to approach the middle line.

Prognosis.—This affection is not attended with any risk to life, and almost invariably terminates with complete restoration of the voice. The writer, however, knows of one case which has resisted the most persevering and energetic treatment, although the vocal mechanism was proved to be perfect by the fact that, when the patient was faradized, while under the influence of ether, she called out loudly, but immediately lost her voice on regaining consciousness.

Ætiology.—Anæmia and neurasthenia are the chief causes of bilateral abductor paralysis. It is almost exclusively met with in females, and may occur as a precursor of laryngeal phthisis.

Treatment.—Attempts should be made to improve the general condition of the patient by the administration, for one or two weeks, or longer, if necessary, of iron in combination with strychnine. When this has been done, and not until then, the cords should be faradized by means of Morell Mackenzie's electrode, or, if this is not available, by passing the current through the larynx externally.

Unilateral Paralysis of the Abductor Muscles is an extremely rare affection.

Paralysis of the Internal Tensors of the Vocal Cords (*thyro-arytenoidei*) is shown by hoarseness and by the elliptical condition of the glottis on attempted phonation. The cords are seen to be relaxed, and are usually congested. Overuse of the voice, laryngeal catarrh, and anæmia are the chief causes of this condition.

Treatment.—The application of astringents are directed under CHRONIC LARYNGITIS, and the use of the continued or interrupted current and of tonics are the measures from which most benefit may be expected.

Paralysis of the External Tensors of the Vocal Cords is said to give rise to a rough, deep voice, which the patient is unable to modulate in the production of high notes.

(2) **Spasm.**—Although theoretically spasm may affect any of the muscles of the larynx, it is chiefly in connection with the abductor muscles that it is brought

under the notice of the physician. The abductor muscles are more commonly involved in organic disease, whereas the adductors succumb to functional affections.

Symptoms.—A spasmodic contraction of the abductor muscles, with consequent closure of the glottis, is the essential part of laryngismus stridulus, an affection of common occurrence in infancy, which, when met with in the adult, gives rise to much the same symptoms. The patient, usually a young woman, has attacks of difficulty of breathing accompanied by stridor, the voice remaining unaffected. In some cases the spasm persists long enough to cause cyanosis, and, as in childhood, may even cause death. The laryngeal crises which occur in tabes are due to a spasm of the adductors, but the affection is here usually complicated with paresis of the abductors.

Treatment.—When of functional origin, the cold douche, combined with some sternness on the part of the friends, will often suffice to stop the spasm, and the tendency to it may be presented by the use of the bromides in combination with the ammoniated tincture of valerian or other antispasmodics. If these measures fail, the inhalation of chloroform almost invariably succeeds. There are, however, rare cases in which, to avert death, recourse must be had to tracheotomy.

(B) **Altered Conditions of the Sensory Nerves.**—(1) *Anæsthesia*, (2) *Hyperæsthesia*, (3) *Paræsthesia*, (4) *Neuralgia*.

Of these, **Anæsthesia** is the most important condition. It occurs in diphtheritic and bulbar paralysis, in lead poisoning, in epilepsy, and in hysteria. Accompanying diphtheritic paralysis, it may cause serious results, as food may enter the air-passages in consequence of the loss of sensation in the laryngeal mucous membrane. In these cases, patients must be fed by means of the esophageal tube, care being taken to insure the tube passing down the esophagus, and not down the larynx. The administration of iron and strychnine, the latter, if necessary, subcutaneously (gr. $\frac{1}{50}$ to $\frac{1}{10}$), almost invariably has a good effect.

Hyperæsthesia and **Paræsthesia** frequently occur together in neurotic patients, and sometimes alternate with one another. It must be borne in mind that there may possibly be some underlying cause—*e. g.*, granular pharyngitis, a con-

dition which gives rise to uncomfortable sensations, which may be referred to the larynx. Both hyperæsthesia and paræsthesia of the larynx are aggravated by disordered conditions of the stomach, and may be the expression of irritation reflected from other organs—*e. g.*, the uterus or ovaries.

Treatment.—Attention should be paid to the general health, stomach and other visceral disorders should be appropriately treated, and any local cause of irritation removed, if possible. The bromide of potassium is usually of service; locally, sedatives such as cocaine or morphine may be applied in solution.

Neuralgia of the larynx is a rare complaint, and requires the treatment employed for neuralgic affections of other organs.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Gelsemium* is the most generally useful remedy in paralysis of laryngeal muscles. See PARALYSIS. Spasmodic affections require *belladonna* or *nux vomica*. In all neuroses of the larynx, Page's Tonic Tablets (Williams, Stiger & Co., New York) will do excellent service.

LARYNX, ŒDEMA OF.—A serous or purulent infiltration of the connective tissue of the larynx in general, and of the ary-epiglottic folds in particular. The term "œdema of the glottis" is a misnomer; the glottis is a *space*, and cannot therefore become œdematous.

Symptoms.—Difficulty in breathing, which may increase with such rapidity as to threaten life in two or three hours, is the characteristic symptom of œdema of the larynx. There is usually also the feeling of a foreign body in the larynx, and there may be difficulty in deglutition; this is the more marked when the epiglottis is much swollen. The voice also becomes weak, or there may be aphonia.

On laryngoscopic examination, the epiglottis may be found to be erect, tense, enormously swollen, and nearly touching the back of the tongue; it is usually of a bright red color. The ary-epiglottic folds are frequently obscured by the swollen epiglottis, but, if they can be seen, they form plum-like bodies, and may nearly meet in the middle line. In those rare cases in which the œdema is confined to the connective tissue below the cords,

red fleshy swellings may be seen bulging from beneath the cords. In the absence of the laryngoscope, the swollen condition of the epiglottis and ary-epiglottic folds may be recognized on making a digital examination.

Diagnosis.—If a laryngoscopic view can be obtained, this is very easy; in its absence it is at times impossible to state with certainty the cause of the obstruction. The *prognosis* is always grave, except in the cases in which the œdema is limited in character.

Morbid anatomy.—As already stated, the disease consists in an infiltration of the cellular tissue of the larynx with a serous, sero-purulent, or purulent fluid. This occurs where the cellular tissue is most lax—*i. e.*, into the epiglottis and the ary-epiglottic folds. The œdema is occasionally limited to the part below the level of the cords, constituting the subglottic variety. The vocal cords themselves are hardly at all affected.

Ætiology.—Two forms, primary and secondary. The former comes on suddenly in persons previously healthy, and may arise from a chill, from over-use of the voice, the application of caustics, the use of the galvano-cautery, the presence of foreign bodies in the larynx, injuries, swallowing boiling water, and from septic poisoning, the result of defective drainage.

The causes of secondary œdema of the larynx are of an inflammatory, mechanical or dyscrasic nature. It occurs as a complication of infectious diseases, such as erysipelas, smallpox, measles, scarlet fever, typhus, or cholera. It is met with in chronic diseases of the larynx, such as tuberculosis, syphilis, and carcinoma, and may result from passive congestion in heart and lung affections—*e. g.*, emphysema. The connection of œdema of the larynx with Bright's disease, though insisted on by most writers, is not confirmed on careful examination. It is probable, however, that an irritation too slight to cause œdema of the larynx in a healthy individual may suffice to bring it about in an albuminuric patient.

Treatment.—Absolute rest should be enjoined, and the patient forbidden to speak. The writer has found that feeding patients per rectum promotes recovery. Ice pills to suck and an icebag to the outside of the larynx should be tried. Bromide of potassium in 20-grain doses every two or three hours has been advo-

cated. Free scarification will often give immediate relief; a twenty per cent. cocaine spray to the pharynx and larynx will facilitate the operation, and may even by itself suffice to give relief. If other measures fail, tracheotomy should be performed, and this should not be deferred until the patient is *in extremis*, but should be had recourse to immediately after the first attack of suffocation experienced by the patient.

F. DE HAVILLAND HALL.

Symptomatic Indications.—The most generally indicated remedy is *apis*, burning, stinging pains. *Sanguinaria* is useful when expiration is easier than inspiration; *arum*, swelling, pricking pains.

LARYNX, PERICHONDritis OF.

—Inflammation of the perichondrium of the larynx, leading to death and detachments of a part or the whole of the affected cartilage.

The affection may be primary, but is more often secondary to some other laryngeal disease.

Symptoms.—In primary perichondritis, the first symptom to suggest that the perichondrium is affected is a dull, aching pain, which is increased upon pressure over the larynx. There will be some difficulty in swallowing, especially if, as is usually the case, the cricoid cartilage be implicated. Cough and hoarseness are constant symptoms, and there is dyspnoea in proportion to the degree of obstruction.

At an early stage, laryngoscopic examination may only disclose some swelling of the mucous membrane and perhaps immobility of one vocal cord, and, even when an abscess forms, it is difficult to determine whether or no the perichondrium is affected unless portions of cartilage be expectorated, or a rough area of necrosis be detected by the aid of the laryngeal probe.

In secondary perichondritis the symptoms are less marked, and a diagnosis is often impossible until portions of cartilage have been expectorated, or until perchance a sudden attack of dyspnoea has resulted from the cartilage, suddenly dislodged, becoming impacted in the glottis.

The *prognosis* is very gloomy, as this affection almost always supervenes in the course of some grave disease. If death be not brought about suddenly by spasm of the glottis, by œdema of the larynx, or

by the impaction in the glottis of the extruded cartilage, it is due to gradual exhaustion, the pain and discharge giving rise to hectic fever.

Ætiology and pathology.—Perichondritis is almost invariably secondary to some other affection of the larynx, such as tuberculosis, syphilis, malignant disease, or the ulceration attending typhus and typhoid fevers. The perichondrium is attacked in the progress of the original affection, and is eventually separated from the cartilage by a layer of pus, necrosis being thereby brought about. Perichondritis of the cricoid has been met with in bedridden persons of low vitality. In such cases it has resulted from the pressure of the cricoid against the vertebræ.

Treatment.—This must be directed to warding off the consequences of the inflammation. If an abscess form, it should be opened, and the surgeon must be ready at any moment to perform tracheotomy. In some cases it may be necessary to feed the patient by means of a soft rubber tube or by the rectum.

F. DE HAVILLAND HALL.

LARYNX, SYPHILIS OF.—Syphilitic disease of the larynx may accompany the secondary or tertiary manifestations of the disease, or it may be the result of inherited syphilis.

Symptoms.—In the secondary stage the patient may complain of hoarseness, which sometimes passes on to complete loss of voice, and a feeling of discomfort in the throat. In a few cases there is an irritating cough.

The laryngoscopic appearances are those of a chronic inflammation. The disease usually runs a tedious course, but presents no characteristic features, so that the diagnosis rests on the discovery of syphilitic lesions in other parts of the body. Condylomata are met with in the larynx, although their occurrence is denied by some writers. They have been seen on the epiglottis, vocal cords, and inter-arytenoid commissure, appearing as oval whitish elevations about three to five millimeters long. They run a rapid course, and are doubtless often overlooked.

Tertiary Syphilitic Affections of the larynx are of much more grave import than those met with in the secondary stage, and not unfrequently bring about a fatal termination.

Ulceration is the most common manifestation of tertiary syphilis in the larynx. The ulcer may commence as a superficial loss of substance with a deeply inflamed margin, showing a great tendency to spread laterally. More rarely an ulcer results from the softening and breaking down of a gumma, and the process then extends deeply into the subjacent structures, and may lead to perichondritis with caries, necrosis, and subsequent exfoliation of the cartilages. The epiglottis is frequently the seat of ulceration and may be entirely destroyed, and, as a result there may be attacks of suffocation from food entering the larynx. This, however, rarely happens, as patients are usually able to take food without discomfort in spite of the entire loss of the epiglottis.

A grave danger arises from the formation of cicatrices, consequent upon the healing of the ulcers, a process which may eventually end in stenosis of the larynx. The occurrence of œdema, which may take place at any period during the progress of the disease, may also give rise to alarming symptoms.

Another danger is the tendency to the formation of adhesions between the vocal cords; a web-like membrane may form and unite the cords throughout the greater part of their length, the process in some cases commencing by the cord becoming adherent in the center. Tracheotomy may become necessary for the relief of this condition.

Sometimes the ulcerative mischief sets up changes in the crico-arytenoid joints, as a result of which ankylosis may occur and the vocal cord may become fixed.

Gummata are but rarely met with, they occur as smooth, roundish swellings, generally only to be distinguished from the surrounding mucous membrane by their elevation, their usual seat being the posterior wall of the larynx.

In some instances perichondritis occurs without previous ulceration of the mucous membrane; if it proceed to suppuration, the abscess which forms may burst in any direction.

In **Inherited Syphilis** the larynx is most commonly affected during the first six months of life, but the symptoms may not manifest themselves until about the period of puberty.

The classification of lesions into secondary and tertiary, as in the acquired disease, does not hold good. Three forms

of laryngeal inflammation may be met with. The first is a chronic superficial laryngitis, in which the changes are limited to the mucosa and submucosa; this may go on to ulceration. In the second form, deep, destructive ulceration occurs, similar to that met with in the tertiary stage of acquired syphilis; and the third variety is characterized by the gradual deposit of dense fibrous tissue, which by its contraction may cause stenosis of the larynx.

Diagnosis.—There is usually nothing in the laryngeal affection of secondary syphilis which would enable one to make a diagnosis in the absence of collateral information; it, therefore, rests on the presence of luetic affection of the skin and mucous membrane and eye.

In the tertiary stage the diagnosis has to be made from phthisis and from cancer. (*See TUBERCULOSIS OF THE LARYNX.*) From cancer the diagnosis is at first sometimes a matter of difficulty, but in the latter a new growth usually precedes the ulcerative stage, the progress is a much slower one, and pain is a more common symptom; still, some doubt so often exists that it is advisable to subject the patient to a course of specific treatment before definitely deciding against syphilis and in favor of malignant disease. But even if the patient improve under treatment, it must be remembered that syphilis and cancer are occasionally associated, and specific treatment may thus produce marked improvement for a time.

Prognosis.—This varies with the stage of the disease. The secondary affections of the larynx, though occasionally troublesome from their chronicity, give no other cause for uneasiness; on the other hand, tertiary syphilis of the larynx may cause death from acute œdema, or the glottis may become suddenly obstructed by portions of cartilage which have exfoliated, or deep ulceration may extend into a large vessel and give rise to fatal hemorrhage. Lastly, the dangers incidental to stenosis of the larynx, which will necessitate tracheotomy, must be borne in mind.

Even after tracheotomy has been performed, a hyperplastic process may extend from the larynx down the trachea, and eventually cause death; nevertheless, marked improvement may take place in cases, apparently desperate, when they are subjected to anti-syphilitic treatment. Ul-

ceration is often arrested, swelling disappears, and the normal outline of parts can again be recognized. In young children suffering from congenital syphilis there is an additional element of danger in the small size of the glottis, and the consequent great risk of death from asphyxia.

Treatment.—As a rule, local treatment is of little avail, but astringent applications, such as 10 to 30 grains of chloride of zinc or 15 grains of sulphate of copper to the ounce of water, may assist in clearing up a syphilitic laryngitis; and in tertiary ulcers of the larynx the insufflation of iodoform or iodol (as advised for laryngeal tuberculosis) has given good results. Constitutional treatment is all-important. In the laryngeal phenomena accompanying the secondary stage of syphilis, it is generally advisable to commence with mercury, which can be given either by inunction of $\frac{1}{2}$ dram of blue ointment daily, or, internally, in the form of blue pill (grs. j-ij), or gray powder (grs. j-ij), or the solution of the perchloride in dram doses in a bitter infusion. The doses of any one of the three should be taken two or three times a day.

After some weeks of the mercurial treatment, the addition of 5 grains of the iodide of potassium to the mixture containing the solution of the perchloride is generally indicated.

Cases of tertiary syphilis of the larynx sometimes require the most energetic treatment in order to prevent death from asphyxia due to occlusion of the glottis. Though, as a rule, iodide of potassium in doses of from 5 to 30 grains, or even more, every six hours, will effect a speedy improvement, there are cases, and these usually the most threatening, in which the administration of mercury as well as of iodide of potassium is necessary. The patient should remain in bed, the room being kept at a uniform temperature, and every four or six hours he should take 10 to 30 grains of the iodide, and twice daily 20 grains of blue ointment should be rubbed into the axillæ or inner sides of the thigh.

Tracheotomy must, of course, be performed if life be endangered by laryngeal stenosis, but the subsequent removal of the canula is usually a matter of great difficulty. Cases of laryngeal stenosis, consequent on cicatricial contraction, have been cured by means of gradual dilatation by bougies, etc. Too much

stress cannot be laid on the importance of preventing the formation of adhesions between the cords; this can be done by the daily application, by means of the laryngeal brush, of an astringent such as 10 to 30 grains of nitrate of silver or 10 to 20 grains of the sulphate of copper to the ounce of water, or, if necessary, by the introduction of Schroetter's hollow bougies.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Merc sol.* is the main reliance.

LARYNX, TUBERCULOSIS OF (Tubercular Laryngitis, Laryngeal Phthisis).—A chronic disease of the larynx depending on the presence of tubercle, usually associated with pulmonary tuberculosis.

Symptoms.—The symptoms of tuberculosis of the larynx are so intimately blended with those of the pulmonary affection that it is difficult at times to assign the due share to each organ; even hoarseness, which might be considered essentially a laryngeal symptom, may be owing to an implication of one of the recurrent laryngeal nerves (more commonly the right), in a lesion of the lungs or of the bronchial glands. Hoarseness is an early symptom of the disease, and frequently passes into complete loss of voice; cough and expectoration are invariably present as the result of the combined laryngeal and pulmonary affection. One of the most painful and characteristic of the symptoms of laryngeal phthisis is dysphagia, due to the swollen and ulcerated condition of the larynx. If the epiglottis, from destruction or otherwise, be unable to close the glottis, distressing attacks of coughing and suffocation ensue upon attempting to take food, so that the patient may suffer greatly from malnutrition. The shortness of breath usually observed in laryngeal phthisis is, in many cases, due to the pulmonary mischief. Dyspnoea of sufficient moment to necessitate tracheotomy is rare, but it may come on at any time from œdema of the larynx, or more gradually from fixation of the vocal cords in the median position, a condition simulating bilateral abductor paralysis, and brought about by changes in and around the crico-arytenoid joints.

Laryngoscopically, one of the earliest signs of tubercular disease is pallor of the laryngeal mucous membrane. This may be due to general anæmia, but should

suggest the necessity for a thorough examination of the lungs. Frequently laryngeal tuberculosis is ushered in with the signs of a chronic laryngitis, and it is only the presence of lung mischief or the further development of the case which leads to the diagnosis. A suspicious condition is a serrated appearance of the inter-arytenoid fold of mucous membrane; later this may be the seat of an ulcer.

The later stages of laryngeal tuberculosis are characteristic; the epiglottis becomes thickened and turban-like, and the ary-epiglottic folds form pyriform tumors, the mucous membrane covering the swollen parts being pale. Later small ulcers appear, and may coalesce and give rise to a large patch of ulceration, usually covered with a milky-white secretion. In a few cases tuberculous tumors have been recognized in the larynx, and removed, during life.

As regards the condition of the vocal cords, it is common to find some congestion and thickening and, in the later stages, ulceration. Loss of mobility in one or both vocal cords is also frequently observed. This may be due to functional causes, as is the case in hysteria, or degenerative changes may have taken place in the laryngeal muscles themselves; there may be paralysis from pressure upon the motor nerves to the larynx; or lastly, there may be some mechanical condition, such as swelling of the soft parts, preventing the approximation of the cords, or ankylosis or other disease of the crico-arytenoid joint.

Sluggish action or *lameness* of one cord has been thought to point to tubercular disease in the corresponding lung, but this is problematical.

Diagnosis.—In the early stages, when there is merely pallor of the mucous membrane or congestion of the cords, the diagnosis must, to a large extent, depend upon the result of an examination of the lungs, as there is at this time nothing characteristic in the appearance of the larynx. The pale, puffy swelling of the epiglottis and ary-epiglottic folds is pathognomonic. Where ulceration is the chief feature, syphilis and cancer have to be excluded. The withdrawal of some of the secretion from the larynx by means of a brush under guidance of the laryngeal mirror, and the discovery of bacilli, will settle the point in favor of tuberculosis. As a rule, the ulcerative process is slower

in tuberculosis than in syphilis; the ulcers are smaller, more numerous, and are seated on a paler base. In making a diagnosis, however, it must be borne in mind that syphilis and phthisis may co-exist, and that a case originally syphilitic may take on a tubercular transformation. Ulceration attacking *one* cord alone is in favor of syphilis. Tuberculosis of the larynx may usually be differentiated from malignant disease by the presence of pulmonary phthisis, the pallor of the pharynx and larynx, the pale, puffy swelling of the arytenoids, and by the fact that, as a rule, both sides of the larynx are implicated. The ulcers of laryngeal phthisis are usually small and multiple, a single large ulcer being more characteristic of malignant disease. The age of the patient will often aid in the diagnosis, as malignant disease is rare under thirty-five, whereas laryngeal phthisis is most common between the ages of twenty and thirty, and three-quarters of the cases, according to Morell Mackenzie, occur under the age of forty.

Prognosis.—Though cases of arrest and even cure of tubercular ulceration of the larynx have from time to time been recorded, and especially within the last few years, as the outcome of the recent advances in the local treatment of the disease, nevertheless it must be confessed that the outlook of a patient with laryngeal tuberculosis is a gloomy one. Statistics show that of one hundred cases submitted to post-mortem examination twenty-six died in the first twelve months, fifty-six within eighteen months, and seventy-five within two years, and only twelve lived upward of two and a-half years.

Pathology.—At the autopsy there will usually be found swelling of the mucous membrane, due to cellular infiltration of the mucosa and submucosa, associated with tubercles, which, in rare cases, have been described as constituting small nodules on the surface of the mucous membrane. The tubercles soon break down, forming superficial ulcers, which, by extending into the deeper tissues, lead to perichondritis, with necrosis and exfoliation of the cartilages. Tubercle bacilli are found in the secretion bathing the surface of the ulcers, and in the giant-cell systems.

Ætiology.—Laryngeal tuberculosis is met with in about thirty per cent. of the

cases of pulmonary tuberculosis, and is usually secondary to the disease of the lung. Ulceration of the larynx may predispose to laryngeal tuberculosis by affording a good nidus for the development of the tubercle bacillus.

Treatment.—The constitutional treatment is the same as that found useful in cases of pulmonary tuberculosis, except that high altitudes are not suitable to sufferers from laryngeal phthisis. The local treatment is important, and of late years encouraging advances have been made in this department, especially in the direction of the destruction of the morbid tissues and the promotion of cicatrization of ulcers. Sedative and antiseptic inhalations are often beneficial. Cocaine has almost superseded morphine as a remedy for dysphagia; it may be applied in a five or ten per cent. solution, by means of either a spray apparatus or brush, five minutes before a meal is taken. The difficulty in swallowing liquids which attends loss of the epiglottis by ulceration may be obviated by placing the patient prone across the bed, with the head hanging over the side, and allowing him to suck milk by means of a piece of india-rubber tubing from a mug placed on the floor.

Painting the ulcerated surface with a five to twenty per cent. solution of menthol in olive oil causes but little discomfort, while it relieves pain and dysphagia and promotes the cicatrization of the ulcers.

The insufflation twice daily of a powder composed of iodol (or iodoform) and boric acid, of each one grain, and of hydrochlorate of cocaine and hydrochlorate of morphine, of each $\frac{1}{6}$ to $\frac{1}{3}$ grain, after cleansing the surface of the ulcer with an alkaline spray, can be recommended. Lactic acid, in a twenty to sixty per cent. solution, has been found very useful in destroying the infiltrated tissues and causing the formation of a cicatrix. The application is very painful, but the pain may be lessened by painting a twenty per cent. solution of cocaine over the mucous membrane previously, and by the use of gargles of ice-water and cold compresses.

Curetting the infiltrated tissues and bases of ulcers has been tried, and the operation may be followed by the application of lactic acid.

Tracheotomy as a curative measure has not received much support; by the great majority this operation is restricted to

cases where life is immediately threatened by laryngeal stenosis.

F. DE HAVILLAND HALL.

Symptomatic Indications.—The most frequently indicated remedy is *arsenicum*, particularly when there is much emaciation and weakness, dry cough, scanty, blood-streaked sputa, burning pain, and flat, bluish, or red ulcers. *Iodine* has also a special affinity for this disease and may be useful in all stages. The indicative symptoms are ulceration, tightness and constriction, soreness of the larynx, constant hemming, muco-purulent expectoration. *Kali bichrom.* is useful in controlling the cough and toning the mucous membrane. The cough is loose and croup-like, with stringy expectoration containing lumps of tough muco-purulent sputa; much hoarseness, excoriating pain, yellow, oval, corroding ulceration. *Calcarea carb.* may be useful when the tubercular diathesis is marked; gluey, putrid sputa. *Nitric acid* is valuable in relieving severe laryngeal coughs, spasmodic choking and exhaustion, great irritation of the throat, anæmia, or redness of membrane.

LARYNX, TUMORS OF, MALIGNANT.—*Intrinsic* malignant disease of the larynx includes tumors growing from the ventricular bands, the ventricles, the vocal cords. The term *extrinsic* is applied to growths taking their origin from the epiglottis, the ary-epiglottic folds, the inter-arytenoid fold, etc. The intrinsic form occurs in the greater number of cases.

Symptoms.—Hoarseness is one of the earliest symptoms of intrinsic cancer of the larynx, and generally increases with the progress of the disease, though the voice is hardly ever entirely lost. Pain in many cases comes on early, but may be absent, of so trivial a nature, or so temporary, as not to form an important feature of the disease. Extension of pain to the ear is in no way pathognomonic of cancer, as it is also present in other chronic laryngeal diseases. Cough is not a constant symptom; there is usually, however, an increased secretion of mucus, and late in the disease the expectoration as well as the breath of the patient may be offensive.

Hemorrhage, especially if abundant, points to malignant disease. The degree of dyspnoea will depend on the amount of

obstruction to the lumen of the larynx, whereas dysphagia is affected by the situation of the growth, being present when the posterior wall is attacked or the epiglottis implicated. Cachexia, such as is met with in malignant diseases of other organs, is not a marked feature of the laryngeal affection. Objectively, though there is nothing absolutely distinctive in the appearance of laryngeal cancer, still the experienced observer will generally be able to form a correct opinion from an examination of the parts.

Cancer of the larynx is eminently a polymorphic disease; thus it may simulate a papilloma or a fibroma, and in rare cases the growth is even distinctly pedunculated. A fringe-like growth attached to nearly the whole length of a cord, and even extending to the ventricular band, the arytenoid cartilage and the ary-epiglottic fold, the other half of the larynx being healthy, is, according to Semon, very suggestive of cancer when it occurs in a patient above fifty. The same observer has rightly emphasized the importance of impaired mobility of the affected cord as a diagnostic sign of cancer.

Malignant growths most frequently spring from the ventricular bands, and the posterior part of the larynx is attacked by preference. In the later stages of the disease the soft parts of the larynx may become infiltrated, and finally perichondritis may result, and the malignant growth may even penetrate the skin and appear externally. Enlargement of lymphatic glands is very rare with intrinsic, common with extrinsic cancer of the larynx.

Diagnosis.—Age is an important factor; thus, in a patient above thirty-five, in whom a laryngeal growth is detected, the *possibility* of this being of a malignant nature should be contemplated, and after the fiftieth year the *probability*. The position of the growth at the posterior part of the larynx, and the immobility of the affected cord, are diagnostic points in favor of cancer. Microscopic examination of portions of the growth, removed for the purpose, or expelled by cough, is only of decisive value when the growth is found to be malignant; a merely negative result is of little or no significance. For the diagnosis of malignant disease of the larynx from syphilitic and tubercular affections of that organs, see SYPHILIS and TUBERCULOSIS OF THE LARYNX.

Prognosis.—Intrinsic carcinoma of the larynx is not so quickly fatal as the extrinsic form; still, death may occur within the year, but on the other hand it does not usually occur under eighteen months, and may even be delayed three, four, or more years. In extrinsic carcinoma the duration of life is considerably shorter.

Morbid anatomy.—Malignant tumors of the larynx include the sarcomata and the carcinomata, the latter occurring much more frequently than the former. The anatomical peculiarities of these growths in the larynx differ in no respect from similar growths elsewhere, and it need only be said that epithelioma (squamous-celled carcinoma) is the most common form of malignant disease affecting the larynx.

Treatment.—When the diagnosis of malignant disease has been established it is not advisable to attempt to remove the growth *per vias naturales*, though in a few in which this procedure has been carried out the patients have been free from recurrence for upward of two years, and Schnitzler has recorded a case in which the patient was alive and well twenty-one years after the intra-laryngeal removal of a tumor diagnosed clinically and microscopically to be epithelioma.

In cases which are not suited for more radical treatment, and in which dyspnoea is an urgent symptom, tracheotomy will, in a large number of instances, prolong the duration of life.

Partial excision of the larynx for malignant disease, if undertaken at an early period, promises to be a very successful operation, and is attended with but slight immediate risk to the patient, whereas complete removal of the larynx has yet to justify its performance, as the mortality due to the operation is very great, and the after results have not been satisfactory. Many of the patients, so far from being bettered by the operation, were placed in a worse position by it.

In the event of no operative treatment being depended on, attempts may be made to relieve the pain and dysphagia by insufflations of morphia, gr. $\frac{1}{6}$ to $\frac{1}{2}$, or the application of a twenty per cent. solution of cocaine by means of the spray or brush. In some cases it may be necessary to feed the patient per rectum.

F. DE HAVILLAND HALL.

LARYNX, TUMORS OF, NON-MALIGNANT.—All the growths met with in other organs of the body may have their counterpart in the larynx. Papillomata are by far the most frequent, sixty-seven out of a hundred cases being deemed to be of this nature; fibromata come next in frequency with eleven cases. Cysts are comparatively rare.

Symptoms.—The most common symptom is alteration in the voice. This may vary from slight hoarseness up to complete aphonia. The degree of loss of voice does not depend upon the size of the growth; a small sessile tumor will often cause much greater hoarseness than a larger tumor, which, by being pedunculated, does not interfere with the vibration of the cord to the same extent. Should the pedicle be long, and the polyp freely movable in the respiratory current, the condition of the voice will vary very much, according to the position of the polyp; at one moment the patient may be able to speak in a natural voice, at the next he may be almost aphonic, on account of the growth being caught between the cords. Cough is not a constant symptom. The majority of patients with laryngeal growths are free from it, but in a certain number it is a troublesome complaint, being hacking or irritating in character. Dyspnœa depends mostly on the size of the growth, and to a less extent on its position. For example, tumors springing from the margin of the glottis are much more likely to cause dyspnœa than those originating from the epiglottis, and which consequently obstruct the air-passage less. Dysphagia is only met with in cases where, on account of the size of the growth, there is some mechanical interference with the act of swallowing, or when it is seated on the epiglottis. Pain is usually absent.

Diagnosis.—Is usually to be effected by means of the laryngoscope, and may be confirmed by the microscopic examination of portions of the growth expectorated by the patient or removed by the surgeon. The condylomata of secondary syphilis are to be distinguished by the rapidity which they disappear under treatment. Gummata and the excrescences met with in tertiary syphilis might possibly mislead, but attention to the general condition of the larynx, and the help furnished by constitutional symptoms, should prevent error; the same holds good in

the case of tubercular infiltration or tubercular tumors. But the possibility of the coexistence of tertiary syphilis or phthisis and an independent papilloma, or other growths in the larynx, should be remembered. In a case of phthisis with hoarseness observed by the writer, the appearances were at first those of a chronic laryngitis with thickening of the left vocal cord, and were compatible with the diagnosis of laryngeal tuberculosis, secondary to pulmonary phthisis. After an interval of three years a growth the size of a small cherry was found attached to one of the vocal cords, occupying about two-thirds of its length. The results of treatment proved that the laryngeal condition was quite unconnected with that of the lungs.

Prognosis.—This has to be considered with regard to (1) the danger to life and (2) the state of the voice. The danger to life is small, as even in those rare cases in which the growth cannot be removed *per vias naturales* there is always the possibility of recourse to tracheotomy, and if this operation be not unduly postponed the risk to life is small.

As regards the voice, caution is needed in expressing an opinion. Some growths may after a time remain stationary, and cease to give trouble. A distinguished singer, who had a sessile growth (probably a fibroma) seated on the left cord, is known to have pursued his profession without any apparent damage to the voice. A simple growth, especially if pedunculated, can generally be so completely removed that the restoration of voice may be confidently predicted; but, in the case of multiple and recurrent papillomata, the prognosis is much less favorable. Thanks to the introduction of cocaine, the operative procedures for the removal of laryngeal growths have been greatly facilitated.

Pathology.—Papillomata are composed of a basis of connective tissue supporting blood vessels, and covered with epithelium. They may be sessile or pedunculated, and either single or multiple. They often present a cauliflower-like appearance, and most commonly grow from the vocal cords. Papillomata are generally of a pinkish color, but they may be grayish or white.

Fibromata consist of firm, dense, fibrous tissue but sparingly supplied with blood vessels. The surface is usually smooth,

and the color varies from white to pink. When growing on a local cord a fibroma can often only be recognized by its shape, as in color it is indistinguishable from the cord. Fibromata may be sessile or pedunculated, and are usually oval or round.

Cysts generally spring from the epiglottis, or from the laryngeal ventricles, and vary in size from a pin's head to a bantam's egg. They may be classed among retention-cysts.

Ætiology.—Any cause of irritation seems sufficient to serve as the starting-point of non-malignant growths in the larynx, hence chronic laryngitis is the most frequent precursor. Congenital growths have been described.

Treatment.—Every benign laryngeal tumor ought, if possible, to be removed *per vias naturales*, and only if an experienced laryngologist has established the inexpediency of this method may the extra-laryngeal operation be adopted. Of the various methods of removal, Mackenzie's cutting forceps are most generally serviceable, but the galvano-caustic loop will at times render valuable assistance. Painting or spraying the pharynx and larynx with a twenty per cent. solution of the hydrochlorate of cocaine greatly facilitates intra-laryngeal operations. All caustic applications to benign growths in the larynx are to be condemned; they can do no good, and may, by exciting spasm or inflammation, render tracheotomy necessary. Some growths, notably fibromata, after a time remain stationary, and may not require treatment. The fear, which has been expressed by some writers, that repeated attempts at the removal of benign new growths by the nedo-laryngeal method may result in the conversion of benign into malignant growths, in consequence of the irritation to which they may have been exposed, has been shown to be utterly groundless.

F. DE HAVILLAND HALL.

LARYNX AND TRACHEA, FRACTURES AND SCALDS OF THE.—

Scalds of the larynx and pharynx rapidly produce œdema of the glottis. The boiling water taken into the mouth from a kettle is not swallowed, but ejected by the violent spasm of the pharynx. However, the scalded membrane instantly becomes violently congested, and œdema sets in. Tracheotomy must be performed

if the symptoms of asphyxia rapidly increase, and if hot inhalations have proved useless. Syncope is also common in these cases owing to the acuteness of the asphyxial condition. Often, if the child escape the primary evils the pharynx and larynx become the seat of a fibrinous exudative inflammation which has been called croupous, since the mucous membrane is covered with a white fibrinous false membrane. Precisely the same condition may arise from a person swallowing strong acids.

Larynx, fractures of the, are fatal accidents. The thyroid cartilage is usually separated into its two halves, and the hyoid bone is not infrequently broken at the same time, under which circumstance movement of the tongue becomes very painful, and the voice so altered as to be unintelligible. Fracture of the larynx may be immediately fatal from dislocation of the vocal cords, and consequent asphyxia from spasm of the glottis. Or, again, if the mucous membrane is torn the person may be choked with blood, evidence of wound of the membrane being afforded by coughing up bloody mucus. Finally, œdema glottidis may set in at any time, soon after the accident. Tracheotomy should therefore be performed as a prophylactic measure in all cases of bad fracture of the larynx. Treatment should be limited to relieving symptoms, and attempting to fix the fragments together by strapping the neck lightly; or if the displacement is severe, they should be cut down upon and united with catgut.

Foreign bodies in the air passages.—The substances which may find their way into the air passages are various and numerous, but the symptoms produced are so much alike that a diagnosis, in most cases, is comparatively easy. First, as regards their entry into the air passage, it will not be forgotten that, in order to reach the trachea, a foreign body must pass through the rima glottidis, the least touch of either side of which naturally excites a severe spasm of the glottis, and, consequently, such a body can get into the trachea only when the glottis is widely open. This happens when a person holding a body loosely in the mouth gives a sudden violent inspiration. The foreign body is then sucked into the air passage. A foreign body may be impacted in the larynx above or between the vocal cords,

very commonly above, being caught in the mouth of the laryngeal pouches or sacs on either side. Next, it may be loose in the trachea, and finally, may drop down into a bronchus, usually the right one, because that is in a more direct line with the axis of the trachea than is the left. The symptoms of a foreign body in these different regions of the air passage vary, as does also the treatment.

Impaction in the larynx.—The presence of a foreign body in the larynx usually causes violent spasm of the sphincter-like muscles of the larynx, so that the patient just after the accident is in immediate danger of death from asphyxia; in fact, the majority of patients die at once if the mass impacted is cylindrical and too large to go through the rima glottidis. Such instances are seen in cases where a person has "bolted" large pieces of meat and one has slipped beneath the epiglottis. If, however, the foreign body is thin and flat, albeit very angular and sharp, the patient will probably recover from the first severe spasm of the glottis, and, as air can pass freely past the body, he will survive the accident, having, however, severe attacks of spasm at intervals, with exhausting cough, and expectorating blood-stained mucus. This accident is to be feared, as specially tending to asphyxial syncope from failure of the heart, a very fatal form of fainting. Examination of the larynx with the laryngoscope must be made at once, and, if the body is seen at the top of the larynx fixed in the ary-epiglottic fold, it should be seized with laryngeal forceps and withdrawn. If deeply impacted, laryngotomy must be performed, and thyrotomy carried upward for half an inch or so, and the foreign body extracted with as little laceration of the mucous membrane as possible. After thorough cleansing of the parts a laryngotomy tube should be kept in for twenty-four to forty-eight hours, until danger of œdema glottidis has passed away.

Under certain circumstances, *e. g.*, narrowness of the foreign body, etc., persons may tolerate the pressure of a foreign body in the larynx for months.

Foreign body loose in the trachea.—This condition of things is perhaps the most trying to a patient, for two reasons. Firstly, the body, being loose, is coughed up against the lower surface of the rima glottidis; this excites powerful spasm of

the glottis, with accompanying asphyxial symptoms of greater or less severity. Secondly, the presence of the loose body excites free secretion from the air tubes of a quantity of frothy mucus, which also suffocates the patient. In one instance I saw a plug of tenacious mucus itself produce urgent symptoms by being driven against the glottis, until it was removed by tracheotomy. A patient suffering as above sits propped up, the air entering the chest badly, owing to the filling up of the tubes, so that the face is livid and the respirations labored. On auscultation little air will be found to get to the bases of the lungs, and the air tubes will be full of loud mucous rattling râles. Simple acute bronchitis being excluded by the history, tracheotomy must be done at once; and, instead of a tube being inserted, it is best to pass a carbolized silk loop through each side of the tracheal wound, so that it can be drawn open and the escape of a foreign body facilitated, thus avoiding the hindrance necessarily offered, to a large extent, by the presence of a tube. A dilator is also used for the same purpose. The mucus should be aspirated or sucked out of the trachea as soon as the latter is opened. *When* the air passage is fairly free the patient may be inverted gradually and encouraged to cough; the body, if loose, will probably then be expelled through the larynx or wound. It is imperative obviously to perform tracheotomy when the symptoms of laryngeal spasm are recurring, but it must be stated that the operation should always be performed as a prophylactic measure if the diagnosis is clear; and a paroxysmal attack of laryngeal spasm is unmistakable. It should be performed because the expulsion of the body is rendered quite safe, since the patient can breathe in spite of the spasm above. This treatment is strongly supported by statistics, which have considerable value in a question like the present. Foreign bodies have been expelled naturally even as long as nine months after the accident, but usually the end of the case is much less favorable.

Impaction in a bronchus, usually the right one.—This condition will be preceded by such symptoms as have been just described. Special symptoms are: Pain at seat of lodgment, no breath sounds in lung, whistling râles at seat of impaction, especially if the body is tubular,

purulent bronchitis, followed by abscess in the lung very frequently, and more rarely phthisis. An attempt should be made to extract the body by passing down the trachea a wire hook and fine forceps, the patient being fully anæsthetized.

Thyrotomy.—The patient being anæsthetized, the shoulders raised, and the neck stretched, the anterior border of the thyroid cartilage, and the crico-thyroid membrane are exposed by free incision. All bleeding having been stopped, the crico-thyroid membrane is opened for a short distance, and the thyroid cartilage is split up to the top quarter-inch, which is left intact, to prevent gliding displacement of the two halves. The two halves being now separated, the interior of the larynx is inspected, and all growths removed. As the mucous membrane is very sensitive, and reflex action vigorous, it is best to first paint it with cocaine solution, ten to twenty per cent., and then snip off the growths. All bleeding can be arrested by pressure, and then the sides of the thyroid stitched together with fine catgut, and the wound closed, except opposite the crico-thyroid opening. A light dressing of carbolic gauze should be applied.

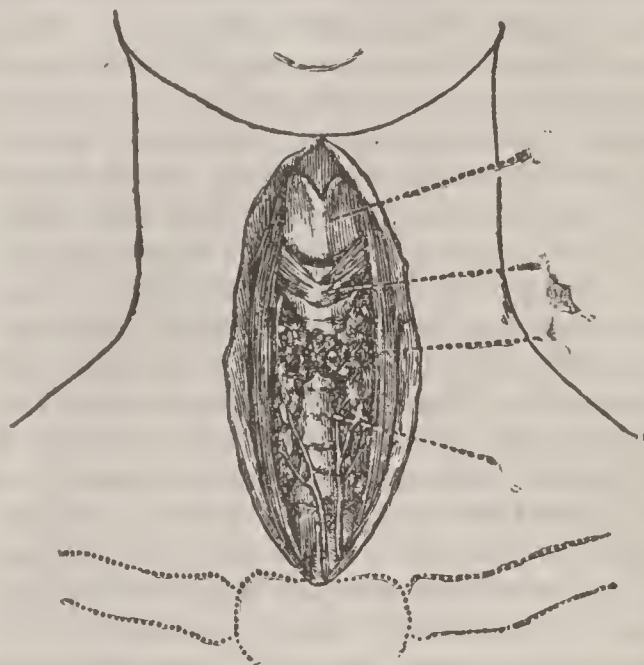
LARYNX, EXCISION OF THE.—

A free incision is made through the superficial structures, and through the deep fascia from the hyoid bone to opposite the third tracheal ring; the trachea is then laid bare above the isthmus of the thyroid gland (which is drawn downward), freed from the esophagus, and finally cut across at the second ring, and the open lower end plugged with a tampon tube, through which the anæsthetic can be administered, and which, at the same time, allows no blood to trickle into the windpipe.

The larynx is then freed on each side, the edge of the knife being kept turned toward the part to be removed. In doing this the superior laryngeal arteries will require ligature. The larynx is now separated from the hyoid bone, and, finally, from the front of the pharynx. The wound should be mopped out with chloride of zinc (40 grs. to $\frac{3}{4}$ j) and dusted with iodoform. The dressing should be a light one of gauze or wool. The patient to be fed by nutrient enemata as long as possible, and then by a tube.

When the wound is healed, Gussenbauer's or Foulis's artificial larynx is inserted into the gap so that the patient can talk distinctly.

Tracheotomy is one of the most important "emergency" operations, and, therefore, one always to be done with every precaution and deliberation that time will allow. The shoulders are to be raised on a firm, small pillow, the neck and head thrown back, the former resting in a hollow in a sand-bag, which fixes it, and prevents it rolling from side to side.



MEDIAN LINE OF NECK.

First line, larynx; second, cricoid cartilage; third, thyroid gland; fourth, trachea.

An assistant, holding his forearms on each side of the child's head, is ready to open the wound with blunt hooks. An incision is then to be made, extending from the crico-thyroid membrane to a variable distance above the sternum. The anterior jugular vein being avoided (Fig. 1), the deep fascia is opened to the same extent as the skin, the depressor muscles of the hyoid exposed, and the muscles held apart by the hooks. The loose connective tissue covering the isthmus of the thyroid is divided, and the isthmus drawn downward with a blunt hook, the trachea being exposed between it and the cricoid cartilage by a few more touches of the knife. A small sharp hook is now stuck into the front surface of the windpipe to steady it, while it is opened carefully with the scalpel, the back being toward the thyroid isthmus. Directly it is opened, the sides of the wound in the trachea must be held apart, and all mucus and false membrane cleared out by

feathers, or aspirated by a soft catheter and syringe. When clear, the tube is to be inserted, and tied in. A little carbolized vaseline may be rubbed gently on the wound before the tube is put in.

Complications.—The operation is usually much more difficult than just described, the patient struggling for breath, vessels oozing, etc. Chloroform prevents such struggling (but very little is required), serious bleeding is stopped by forceps as the operation proceeds, oozing always ceasing when respiration is re-established. After the operation the tube wants constant attention. The wound may become sloughy, the neck emphysematous, œdematous, or erysipelatous. Attempts should be made to do without the tube, beginning, on the fifth day, by stopping the mouth of the tube, and then leaving it out for a few minutes, increasing the interval every day. The operation is of value, not only by relieving the asphyxia, but because it enables the operator to thoroughly clear out the larynx, this being done by passing a feather up from the wound, or passing a string into the mouth and drawing small plugs of antiseptic wool up, as sponges. If the tube and wound tend to dry, so that the discharge blocks it, then the steam-kettle must be used to keep the air moist, and, at the same time, the membrane must be softened with solution of carbonate of soda and glycerine.

LATERAL SCLEROSIS, AMYOTROPHIC.—A combined system-lesion of the lateral columns and anterior gray matters characterized clinically by motor weakness and rigidity of limbs, with early supervention of muscular atrophy and involvement of the nuclei in the medulla oblongata.

Symptoms.—The disease begins with weakness and rigidity of the arms, followed by general wasting of the muscles, with fibrillar twitchings. Contractions rapidly supervene in the upper limbs. The arm is applied to the side of the body, the forearm semi-flexed and pronated, and the hand and fingers flexed. Much force is required to overcome this permanent rigid state, and it excites pain.

In a few months the wasting becomes extreme, but the spasm still persists, possibly to a less degree. The muscles of the neck sometimes become stiff and then feeble, so that the head is flail-like, falling

forward or backward, or to one or the other side.

Within a year the lower limbs become weak and rigid, presenting the usual features of spasmodic paralysis. Wasting of the lower limbs, however, is by no means constant, as is the case with the upper extremities. In the third stage bulbar paralysis supervenes, the face, lips, tongue, pharynx, and larynx becoming involved. Throughout the disease the tendon reflexes are much exaggerated, and clonus is readily elicited. The bladder and rectum remain unaffected, and sensation is unimpaired.

Diagnosis.—It may be remarked that Charcot's contention, that the grouping of symptoms just mentioned constitutes a definite morbid state, has not been universally accepted. Leyden and others are of opinion that cases of amyotrophic lateral sclerosis belong to the category either of lateral sclerosis with consecutive muscular atrophy or to progressive muscular atrophy with degeneration of the pyramidal tracts, and that the extension of the lesion in one or the other case is accidental.

It is, however, generally admitted that symptoms referable to disease of the lateral columns and of the anterior gray matter occur in the order described, and that in such cases early implication of the medulla oblongata takes place.

The clinical account above given indicates the points of difference between amyotrophic lateral sclerosis and the two affections with which it may be confounded—viz., lateral sclerosis and progressive muscular atrophy. As regards the disease under consideration, it should be stated that the loss of power precedes the wasting, and that the atrophy attacks all the muscles of a limb simultaneously. In progressive muscular atrophy, the weakness and muscular wasting occur together and are proportional; the atrophy, moreover, attacks the muscles according to their physiological grouping.

Prognosis.—According to Charcot death ensues within three years from the commencement—sometimes earlier.

Morbid anatomy.—The direct and crossed pyramidal tracts in the cord, the anterior pyramids of the medulla, and the pyramidal tract at some level higher up have been found sclerosed. The anterior gray matter of the cord and the nuclei in the medulla are atrophied, and the nerves

proceeding from them degenerated. The affected muscles undergo great atrophy, with degenerative changes.

Treatment.—No remedies seem to have any influence on the course of the disease. The treatment can only be palliative.
W. B. HADDEN.

LATERAL SCLEROSIS, PRIMARY (Spasmodic Tabes Dorsalis; Spasmodic Spinal Paralysis).—A disease characterized clinically by paralysis of the limbs, with rigidity and increased tendon-reflexes, and absence of sensory and nutritive disorders.

The anatomical change is a primary sclerosis of the pyramidal tracts.

Symptoms.—The disease begins gradually with weakness of the legs, followed by dragging of the feet, muscular twitching, and later by muscular rigidity. The spasm, at first intermittent, finally becomes permanent. The lower extremities become fixed in a position of extension, the thighs being strongly adducted, and the feet in the position of talipes equino-varus.

The characteristic spastic gait is now evident. During progression each lower limb is brought forward as a whole, the knee being stiff and the toes dragging along the ground. As the ball of the foot rests on the ground, clonus of the limb is set up by extension of the calf muscles. In this way the gait has imparted to it a peculiar jerking or hopping character.

As the disease progresses, the lower limbs become weaker and stiffer, and walking may become impossible.

In occasional cases, the extensor spasm gives way to flexion, temporary at first, and finally becoming persistent. The affected limbs are from an early period liable to spasmodic contractions and tremblings, and later on clonus of the limb can be readily excited by slight stimuli, and may even occur spontaneously. Increased tendon reactions, with ankle and knee clonus, are present throughout, though in the later period they are often difficult to obtain in consequence of the intensity of the spasm. The plantar reflex is either normal or slightly increased. Not uncommonly the weakness and rigidity extend upward, involving first the muscles of the back and abdomen and then the upper extremities. When the latter are implicated, the rigid condition is that of

flexion. The arm is fixed to the side of the body, the forearm pronated and semi-flexed, and the wrists and fingers strongly flexed. It must be mentioned that the muscles do not undergo atrophy, and that their electrical reactions are either normal or slightly diminished.

Subjective feelings of numbness, tingling and the like, are frequent, but sensory disorders, properly speaking, are absent. The sphincters are rarely affected, and sexual power is as a rule preserved. The progress of the disease is liable to many variations, and its course is essentially chronic. Sometimes the lower limbs alone are involved, and the affection may never become extreme. In rare instances the disease has a hemiplegic distribution, and now and then the upper limbs are attacked before the lower.

Diagnosis.—Slowly increasing weakness of the lower limbs with rigidity occurs in various morbid states, and it is often impossible to determine the exact nature of the lesion. A careful inquiry should be made into the mode of commencement of the attack. An acute onset followed by slowly advancing paraplegic rigidity suggests a focal lesion followed by descending degeneration of the pyramidal tracts.

An examination of the back should always be made. The presence of an angular curvature would of course be practically conclusive against a primary lateral sclerosis. The existence of localized tenderness or of rigidity of the spine, apart from irregularity, should excite the suspicion of caries. Again, in disseminated sclerosis a spasmodic paraplegia is not uncommonly the first indication of the disease, and it may be the sole condition for a long time. Sooner or later, however, other symptoms usually arise, such as nystagmus, tremors of the hands, head or tongue, or affection of speech, which will enable one to pronounce a definite diagnosis.

Hysterical paraplegia with spasm may be mistaken for lateral sclerosis. In the former, however, ankle and knee clonus, although sometimes present, have not the same persistency as in organic disease, and the contraction is more fixed than in lateral sclerosis. Practically, however, there is often considerable difficulty in diagnosing between these conditions, and the difficulty is increased by the probability that in prolonged cases of functional

spasms of the lower limbs organic change occurs in the lateral columns.

The diagnosis of a primary system lesion of the pyramidal tracts is often a matter of great difficulty, and the presence of this condition should not be entertained until all other morbid states, of which spasmodic paraplegia forms a part, are excluded. This, however, is frequently impossible, and hence the existence of primary lateral sclerosis often cannot be positively affirmed. The difference between primary lateral sclerosis and amyotrophic lateral sclerosis will be found under the description of the latter.

Prognosis.—The disease is usually slowly progressive, and extends over many years. In rare cases improvement to a considerable extent has been recorded, and it has been asserted that recovery has taken place.

Morbid Anatomy.—The direct and crossed pyramidal tracts are sclerosed, and their upward prolongations in the medulla, pons, crura, and cerebral hemispheres as far as the motor cortex, have been found degenerated.

Etiology.—Males are more commonly affected than females, and the onset usually occurs between the ages of twenty and fifty. Syphilis, injury to the back, exposure to wet and cold, are alleged to have some share either as predisposing or exciting agents.

Treatment.—Prolonged rest, massage of the limbs, and Turkish baths are useful. Bromide of potassium, cannabis indica, opium, and belladonna, have little effect, and that merely temporary. Electricity, nux vomica, and strychnine are contra-indicated, as they tend to cause increased spasm. The treatment by suspension (*see* LOCOMOTOR ATAXY) deserves a trial. W. B. HADDEN.

Symptomatic Indications.—*Phosphorus* may be serviceable when there is incomplete paralysis of the lower extremities, or fatty degeneration of the muscles; *argentum nit.*, for paraplegia, with rigidity of affected muscles; *plumbum met.*, in complete paraplegia, with general atrophy; *aluminum*, paralysis of the lower extremities.

LEAD, POISONING BY (Plumbism; Saturnism).—Acute Poisoning by Lead.

A. Accidental and suicidal.

B. Acute poisoning of lead workers.

Chronic Poisoning by Lead.

Acute Poisoning by Lead.—A. Accidental and suicidal.—The salts of lead are not often chosen by the would-be suicide, and cases of accidental poisoning are not common. The acetate or sugar of lead is the salt most often taken, but its poisonous properties are feeble, and recovery has followed when an ounce has been swallowed.

Symptoms.—The chief symptoms are a metallic taste, with dryness and burning in the mouth, followed by vomiting and pain in the abdomen. The pulse is small and frequent, the urine scanty, and cramps and pains in the limbs are complained of.

Prognosis.—Recovery is usual.

Post-mortem appearances.—The mucous membrane of the stomach and intestines is generally coated with a thick layer of whitish or yellow mucus, and may show traces of inflammation. Lead may be found in various organs on chemical examination (*vide infra*).

Treatment.—Vomiting should be encouraged, and the stomach washed out. Dilute sulphuric acid (m. xxx in water) or the sulphate of magnesia or soda ($\frac{7}{3}$ ss) should be at once administered, freely diluted with water, or all three may be given together. The patient should be allowed to drink freely of milk, or white of egg and water. If there be severe pain, a hypodermic injection of morphine (gr. $\frac{1}{3}$) should be administered, and poultices applied to the abdomen. Subsequently a course of iodide of potassium is advisable with a view to eliminate the metal from the system.

B. Acute poisoning of lead workers.—Although the common effect of the absorption of the metal upon those engaged in lead works is to produce the symptoms described under Chronic Poisoning, nevertheless cases of acute and fatal character are occasionally met with.

Symptoms.—The first symptom observed is anæmia, which rapidly increases in degree, and is followed by vomiting, colic, and headache. A blue line quickly appears on the gums. Optic neuritis is often present, and there may be neuroretinitis, and either diplopia or amblyopia. The temperature may be slightly raised. After an illness perhaps of only a few days' duration, the patient may be suddenly seized with acute cerebral symptoms, such as convulsions of an epileptiform character and delirium. On

recovery from the fits, the mental condition may simulate that produced by taking an excess of alcohol. The convulsions may recur, and be followed by coma and death.

Prognosis.—Grave in cases marked by acute cerebral symptoms, especially convulsions and coma, but recovery has been known to take place after convulsions even when double optic neuritis was present. Recovery is usually complete in the non-fatal cases.

Morbid anatomy.—In the most acute cases no alterations of the viscera can be found after death other than a hydræmic condition of the brain (*see also* CHRONIC POISONING).

Ætiology.—All observers agree that there is in these acute cases a predisposition on the part of the individual, and probably the predisposition runs in families. Those recently employed in lead works are much more likely to suffer than old hands. Dr. Stephen Mackenzie has suggested that the attacks of acute toxæmia are more frequent in the winter than in the summer. Such cases have been more often met with in females than males, but it is somewhat uncertain whether, for equal numbers, women employed in lead works are affected more or less than men.

Treatment.—The sulphates of magnesia and soda should be freely administered, with opium or morphine by subcutaneous injection if colic be present. When the symptoms are acute, iodide of potassium should not be given, as the toxic effects may be thereby increased, owing to the sudden liberation of lead which has been fixed in the tissues and which then passes into the blood.

The subsequent treatment is given below.

Chronic Poisoning by Lead.—Persons engaged in lead works, and those who handle the metal, or its alloys, in the course of their occupation—such as painters, compositors, typefounders, and white enamelers—naturally suffer most frequently; but, in many cases of chronic poisoning, the occurrence may be described as accidental.

The drinking water may be contaminated in passing through leaden pipes; and the first pint of beer drawn in the morning, if it have remained all night in lead pipes, will, in time, poison the regular early tippler. Wines or beverages

(*e. g.*, cider) may contain the metal from the use of leaden presses in the process of manufacture; fine particles of lead may become mixed with the flour if the cracks in the stones of a corn-mill have been filled up with the metal; and acid foods may dissolve it out of the glaze on vessels in domestic use.

Symptoms.—The primary effect of the presence of lead in the body is the production of anæmia, which is followed later by a cachexia, to which the name of “saturnine” has been given.

Digestive system.—The so-called *blue line* on the gums is due to the deposit of fine particles of sulphide of lead in the papillæ of the gums, and first appears as a single row of distinct black spots, which subsequently increase in number. The metal is absorbed from the blood, and, after conversion into a sulphide by the action of the sulphuretted hydrogen in the albuminous matters which are either contained in the tartar, or deposited between the gum and the tooth, it is fixed in and around the vessels of the papillæ. A similar deposit of sulphide of lead may form in the mucous membrane of the upper or lower lip where it comes into contact with an accumulation of tartar on the teeth. The blue line may form very rapidly—in a few days, even. The line, when once formed, remains for a considerable time—possibly, for as long as a year; but on this point there is some divergence of opinion. When absent, the blue line may sometimes be produced by the administration of iodide of potassium if lead be present in the system, as this salt combines with the metal to form a soluble iodide.

Constipation is one of the early symptoms of this condition, and is usually associated with such signs of dyspepsia as vomiting, a furred tongue, and foul breath.

Colic (*colica pictonum*), perhaps, comes next in order of frequency; but, in acute cases, vomiting usually precedes colic and constipation. The attacks are marked by excruciating abdominal pain, which is, as a rule, relieved by firm pressure. The abdomen is hard and retracted. The pulse is slow, and the arterial tension is raised. Although doubted by some observers, the pain is probably actually due to spasmodic contraction of the colon, and the attack is, therefore, truly “colic.”

Nervous and muscular systems.—Pains in the limbs are of common occurrence,

and are often neuralgic in character; the muscles may be tender on pressure. In the ætiology of neuritis (*q. v.*), or, as it is generally termed, "peripheral neuritis," lead plays an important part.

Dr. Gowers distinguishes two varieties of lead paralysis—the "degenerative," and the "primary atrophic" forms. In the former, which is the one most frequently met with, the loss of power precedes the wasting, and the muscles present the reaction of degeneration. In the latter, the weakness and wasting come on simultaneously, and proceed *pari passu*, and faradic and voltaic irritability are both lessened in proportion to the wasting.

The musculo-spiral nerve is usually the first attacked, the result being a paralysis of the extensors and supinators of the forearm—an affection commonly known as "wrist drop," or "dropped hand." The affected muscles are wasted and paralyzed; the hand hangs from the wrist; the fingers are flexed, and cannot be extended; if placed with the palm downward on the table, the patient is unable to turn the hand over. It is especially to be noted, however, that the supinator longus—which is also a flexor of the forearm when the elbow is bent to a right angle—and, when the leg is affected, the extensor ossis metacarpi pollicis, usually escape.

It is not uncommon to meet with cases in which the paralysis has not advanced to the extent described, and which are only marked by a certain degree of weakness of the affected muscles.

In the "primary atrophic" form the muscles forming the thenar eminence, the interossei, and the lumbricales, are especially likely to become involved, and fibrillary tremor may be present, as in progressive muscular atrophy. Both arms are commonly affected; but the right, probably because it is the one most employed by a painter in his work, usually suffers most.

Sometimes the muscles about the shoulders are the first to be attacked; the deltoids, the dorso-scapular muscles, and the trapezii then become atrophied and paralyzed. The legs may also become affected, the extensor longus digitorum, and the peronei, the analogues to the muscles of the arm, which chiefly suffer, being most often attacked. The tibialis anticus muscle usually escapes. In rare

cases the affection may be widespread, and involve nearly all the voluntary muscles.

Melancholia, mania, and, especially, epileptiform convulsions, are prone to occur in advanced degrees of the chronic affection, and such cases may end fatally with delirium and coma.

The *electrical reactions* in the "degenerative" form are those of peripheral neuritis. To faradism the reaction with both nerve and muscle is absent, while the galvanic current applied to the muscle gives reactions which are more marked than in health—*i. e.*, the reaction of degeneration is present.

In the "primary atrophic" form the muscles still act to faradism; although the irritability is lowered in proportion to the wasting, the voltaic irritability is lowered in a similar manner, but is sometimes more marked than the faradic, and there may be qualitative change.

Circulatory system.—If gout be present as a complication—and it is a very common one—the high arterial tension will necessarily entail a liability to degenerative changes in the myocardium and the walls of the arteries.

Respiratory system.—A marked tendency to attacks of asthma has been observed.

Urinary organs.—The liability to gout involves a corresponding proneness to chronic interstitial changes in the kidneys.

Diagnosis.—In doubtful cases, the blue line on the gums is the most important evidence of the presence of lead in the system. The "primary atrophic" form of lead paralysis is often closely simulated by progressive muscular atrophy, but the more common variety—*i. e.*, the degenerative—may be distinguished from progressive muscular atrophy by the absence of the fibrillary tremor of the muscles, and by the marked difference in the electrical reactions. In progressive muscular atrophy, the galvanic and faradic irritability of the muscles usually diminishes as the atrophy progresses, and, when this is extreme, no reaction may be obtained with either form of stimulation, even with the strongest currents, but these conditions are not invariable. Again, in the former disease, the muscles are affected according to their physiological grouping; while in the latter, the paralysis corresponds to the anatomical distribution of the nerves. Lastly, in this form of plumb-

ism, the paralysis precedes the atrophy; whereas, in progressive muscular atrophy, the loss of power is usually in proportion to the wasting of the muscles.

Prognosis.—This is almost invariably favorable in lead colic; but there is a marked liability to subsequent attacks, unless the cause be removed.

Cases of lead paralysis of the “degenerative” form, and limited to the muscles of the forearms, if submitted to electrical treatment in the early stage of the affection, usually recover completely. If, however, the wasting and degeneration of the muscles have advanced in degree, and the affection be widespread, the loss of power may be permanent, and, as already stated, the presence of cerebral symptoms adds greatly to the gravity of the prognosis in such cases. The course of the primary atrophic form is very chronic, and such cases may never recover completely.

Pathology and morbid anatomy.—It is now generally recognized that the explanation of the various paralytic affections met with in lead poisoning is chiefly to be sought for in the condition of the peripheral nerves—certainly in the common, or “degenerative” form of the affection. The “primary atrophic” form is possibly dependent upon changes in the spinal cord.

On microscopical examination, the nerves present the appearances generally met with in peripheral neuritis, for which the article on NEURITIS may be consulted. The degenerative changes sometimes affect the anterior roots of the nerves. The changes in the spinal cord are usually limited to the anterior cornua, the ganglion cells of which have, in several cases, been found to have undergone atrophy. The changes observed in the brain in cases marked by cerebral symptoms have not presented any uniformity. The affected muscles are wasted, brittle, and of a pale yellowish color. The fibers are narrower than normal, and, in advanced stages, all traces of muscular tissue may disappear.

Treatment.—Prophylaxis is of the first importance. The medical examination of persons recently employed in lead works is of importance. Absolute personal cleanliness, extending to the condition of the finger-nails, the use of a working suit of clothes, a daily warm bath after work, provision for the taking of meals outside

the works, and the use of respirators where the air is charged with particles of the metal, are the chief preventive measures which should be enforced in all lead works. “Treacle beer” and sulphuric acid lemonade as beverages are of service in preventing the effects of the metal.

Constipation should be relieved by occasional doses of sulphate of magnesia.

Colic is best treated by the application of hot dry fomentations to the abdomen, frequently renewed. The bowels should be cleared by castor oil, with each dose of which from 5 to 10 minims of tincture of opium may be usefully combined, the dose of the latter being in proportion to the severity of the pain. Sulphate of magnesia is also an excellent purgative in such cases, and may be administered, after the more acute symptoms have subsided, in combination with iodide of potassium, the soluble iodide of the metal which results being eliminated by the action of the purgative.

Lead paralysis is best treated by massage to the affected muscles, and the application for about ten minutes daily of the constant current. The treatment should be persevered with for long periods. J. K. FOWLER.

Symptomatic Indications.—The chronic symptoms occasioned by lead may require, for the constipation, *opium* or *alumina*; for the colic, *nux vomica* or *belladonna*; paralysis, *nux vomica*; epilepsy, *belladonna*.

LEPROSY (Lepra).—A chronic transmissible specific, bacillary, and exclusively human disease, characterized by the formation of neoplasms, which develop in definite elective sites, especially in the skin and certain mucous membranes, in the nerves, in related lymphatic glands, and in certain viscera.

When the leprosy formations exclusively or mainly affect the skin, mucous membranes, and corresponding lymphatic glands, the disease is spoken of as *cutaneous* or *tuberculated leprosy*; when the neoplasms are localized in the nerves, the terms *nerve*, *non-tuberculated* or *anæsthetic leprosy* are employed. These two phases are rarely met with in pure forms, and the terms are usually applied according as one set of symptoms predominates.

In many cases the two phases are present in fairly equal proportions, or both are well marked, constituting the com-

plete manifestation of the disease process; to this condition the term *mixed leprosy* is applied. Sometimes nerve leprosy follows upon the tuberculated form, and more rarely the latter supervenes on the former.

The term "anæsthetic" is not a good one, since anæsthesia is always present in tuberculated leprosy. So also with regard to the name "eruptive, macular, or spotted" leprosy; a macular eruption is common to both tuberculated and nerve leprosy, though each phase of the disease has its own pathognomonic macular eruption.

The exact methods and channels of the introduction of leprosy into the system are to a great extent undetermined. There is no definite form of *primary or initial lesion* known, comparable to that of syphilis.

The *incubation or latent period* has remarkable features, and may be very prolonged—up to twelve or twenty years or more. It commonly lasts from three to six years. The bacillus, even when introduced into the body, appears to remain quiescent until suitable conditions, not at present understood, arise for its germination, and the evolution of the disease is then irregular.

Tuberculated Leprosy.—*Prodromal Stage.*—The most constant premonitory symptoms are dyspeptic troubles, marked drowsiness, lethargy, and pyrexia, but such symptoms are too indefinite to be of any value for diagnostic purposes.

The *eruptive stage* is characterized by the evolution of a pathognomonic macular eruption of an erythematous type. The maculæ are rounded or oval in outline, abruptly limited, hyperæsthetic and of any size from a shilling to a saucer. They are situated most frequently on the cheeks, temples, or forehead, where they may excite considerable œdematous swelling, or on the anterior aspect of the forearms or the outside of the thighs. The earliest maculæ may disappear and be succeeded for some weeks or months by fresh crops.

On the sites where these maculæ existed or still remain, or elsewhere, tubercles then commence to form. They occur either singly or in groups, and slowly enlarge to the size of a pea or a hen's egg, gradually becoming anæsthetic. They may also coalesce to form more or less extensive areas.

Tubercles may remain practically unchanged for a long time, only deepening notably in color and acquiring a more or less admixture of a brown tint, or becoming livid or slightly desquamating; or they may resolve, soften, and disappear spontaneously, leaving pigment stains; suppuration or necrosis may occur, and indolent, sharply-cut, shallow ulcers form, which discharge a thin pus, and eventually leave, when they heal, more or less anæsthetic scars. This suppuration and ulceration of the tubercles occurs more especially in half-starved and unhealthy subjects, and in the latter stages of the disease, when the ulceration may take on a phagedenic character.

Outbursts of such tubercles occur in successive crops at irregular intervals, several times yearly as a rule, but, with diminishing frequency, and after five or six years they cease to occur.

These outbursts are preceded by the *acute* softening of some tubercles, and a systemic infection takes place, characterized by signs quite peculiar to the tuberculated form of leprosy, viz., rigors, swelling and tenderness of the lymphatic glands; symptoms which the lepers regard as their sentinels. The temperature sometimes rises to 105° F., the pulse is quickened, there are subjective skin sensations, with pain, tenderness, and swelling of the joints and limbs, tenderness over the liver and spleen, and gastrointestinal disturbances, such as thirst, vomiting, and irregularity of the bowels. The discharges from ulcers dry during this period. In a few days these symptoms subside on the outburst of a crop of tubercles.

Though tubercles may occur anywhere, the sites of predilection for the earlier deposits are the face, forehead, ears, and nostrils.

The tuberculated leper presents a highly characteristic physiognomy, which is first expressionless and aged, and later from the loss of eyelashes and eyebrows, fierce and staring.

The eyebrows and other parts of the face and ears become greatly thickened, and there is accompanying œdema. The cheeks and chin are pendulous, the nose broadened and depressed, the lips swollen and everted, the ears stuck out, the eyelids ectopic, and the skin generally becomes greasy.

The hair on the face, as on the pubis

and elsewhere, falls out only where the neoplasms form, so that the hair on the scalp is preserved. Tubercles form on the back and sides of the fingers and hands, the feet and toes, and extensor aspect of limbs. The extremities become much swollen, more or less livid, the hands spade-like and clumsy, and the legs œdematous and eventually hypertrophic, simulating elephantiasis arabum. The palms and soles are dry, scaly, fissured, but not anæsthetic, and the growth of the nails is interfered with in various directions by the formation of the neoplasm in the bed of, and around, the nail.

The related lymphatic glands enlarge, often to a great extent, and become the seat of leprous neoplasms.

The mucous membranes of the nose, lips, cheeks, tongue, palate, fauces, pharynx and larynx may become studded with tubercles, which may ulcerate.

As the disease progresses the leper acquires a characteristic snuffling, and the voice becomes harsh, toneless, nasal, and croaking, and later aphonia may result.

After several years of progress the velum, palate, and epiglottis may be destroyed and the cartilages of the larynx involved, leading to dangerous laryngeal stenosis. The destruction of the nasal cartilages causes much deformity. The exposure of the eyeball and the formation of neoplasms in the cornea, sclerotic, and iris lead to various lesions of the globe, which often result in loss of sight.

The visceral mucous membranes, with the exception of the rectum and large intestine, are scarcely at all involved, the lesions there giving rise in the later stages to a dangerous form of diarrhea, simulating dysentery. In all advanced cases of tuberculated leprosy, changes associated with the presence of the bacillus have been found in the larger viscera, such as the lungs, the liver, the spleen and the bowels, and the testicles. The central nervous system remains intact, or is only rarely involved, and secondarily to the peripheral nervous system.

It is important to notice that when the disease commences before puberty the mental and physical development is retarded, menstruation is long delayed, and the testes atrophy. The testes seem to be peculiarly prone to attack in tuberculated leprosy, even from an early stage of the malady. So the disease, as a rule, progresses, until death ends the scene.

Nerve Leprosy is characterized by the progressive formation of the special neoplasm in the peripheral sensory nerves, and to some extent in the motor branches also. The implication of the peripheral nervous system is probably primary.

Prodromal Stage.—Vague pains, rendered more intense by pressure, are experienced along the course of certain nerves. Feelings of numbness of the extremities, a want of grasping power, tremor and the formation of small and numerous bullæ as distinguished from the large and solitary ones of later stages are symptoms occasionally met with in this stage. For some months these symptoms may be the only evidence of the onset of the disease.

Eruptive Stage.—Gradual evolution on the back, shoulders, nates, extremities, and the face, of fairly well-defined persistent maculæ, mostly circular in shape, but not raised above the surface. They vary in diameter from $\frac{3}{4}$ inch to 3 inches, and are often symmetrically placed. They do not disappear on pressure.

Nerve leprosy is a chronic disease, and the macular eruption may remain in this condition for one or two years, and certain cases apparently abort at this early stage. Later, the maculæ begin to spread and tend to coalesce into irregular patches, which, as they enlarge, become *anæsthetic*; the center pales and the borders may, by comparison, be raised, dark, and wrinkled. Independently of the anæsthesia of the maculæ, large tracts of the surface may also become anæsthetic from implication of the cutaneous nerves.

There will be distinct loss of feeling in the extremities, and the characteristic impairment of nerve influence which is first evidenced in the terminal and preterminal segments of the extremities, spreads centrally. Meanwhile, tropho-neurotic changes appear in the extremities, and almost invariably first by a contraction of the little finger.

The subsequent progress of the case is an intensification and wider distribution of these changes. The anæsthetic macular eruption spreads over the body and limbs, and analgesia, more or less deep, sets in. Distinct enlargement may usually be felt along the course of various nerves. Large solitary bullæ form on the extremities, and often leave an ulcer or a white scar. The various tropho-neurotic lesions increase; for instance, a

characteristic intractable ulcer appears beneath the foot and at the heel, and the well-known distortions and mutilations proceed in the hands and in the feet. Necrosis and caries of the phalanges and other bones of the hands and feet are not uncommon, gangrene may occur, and in these ways all the toes and fingers may be lost. Later various muscular paralyses occur.

The skin generally becomes atrophied, the glands in the groin sometimes enlarge, and the temperature is much depressed, especially in the advanced stages. The mucous membrane of the mouth and pharynx is rarely, but that of the nose is occasionally, implicated, and absorption of the nasal bones may occur. The testes do not show the same tendency to be affected as in tuberculated leprosy, but they atrophy if the disease commences before puberty. Nerve leprosy is a much milder and less exhausting affection than tuberculated leprosy; it commences earlier as a rule, and the duration averages fifteen years or more.

Diagnosis.—Animal and vegetable parasitic diseases, elephantiasis arabum, yaws, malarial fevers, syphilis, and tuberculosis are frequent complications of leprosy. Syphilis, tuberculosis, and tuberculated leprosy are absolutely distinct affections, and the one cannot be evolved out of the other. Tuberculated leprosy may easily be confounded with sarcoma of the skin, mycosis fungoides, and especially syphilis, and it should be remembered that the color of a syphilide is no guide in dark races, and that syphilis, leprosy, and tuberculosis alike lead to deformities of the nasal region.

Prognosis.—Although not invariably fatal, in the majority it ends in death, either directly during the febrile paroxysms, or indirectly from exhaustion, lardaceous disease, or intercurrent affections. Tuberculated is far more severe than nerve leprosy, and has a greater tendency to complications.

Pathological anatomy.—The characteristic new formation met with in the various organs and tissues in leprosy has the ordinary structure of "granulation tissue," consisting of cells separated by a sparse fibrillary framework and freely permeated by blood vessels. The cells are persistent, and do not readily undergo changes ending in the ulceration of the neoplasm. The younger ones are mostly

rounded, and like lymph-corpuscles. After a time they undergo degenerative changes, and in the process of softening and absorption of the neoplasm the cells vacuolate freely, acquire several nuclei, and tend to enlarge to the extent of four or five times their original volume. Pale granular cells form, and may become irregular in shape. The changes are best seen in the more superficial parts. Finally, they disintegrate and leave deep-brown pigmentation and thickening of the connective tissue, which is probably a result of secondary irritation.

In the peripheral nerves, irregularly distributed, grayish, semi-translucent, fusiform swellings are formed, chiefly where the nerves are most exposed. The new formation is present in the interstitial connective tissue of the nerves, and even beneath the neurilemma and around and between the primitive nerve fibers. If this be absorbed early enough, function may be re-established, but, if not, parenchymatous neuritis and atrophy of nerve fibers result.

The "tubercle" of the skin consists of tracts of granulation tissue extending from the subcutaneous fat to near the rete, following the direction of the framework of the blood and lymph vessels, and especially concentrated around them, and giving rise to secondary irritative or atrophic changes in the papillæ, skin glands, hairs, and nerves.

The bacillus lepræ closely resembles in appearance the bacillus tuberculosis, and differs only in some slight details of design, measurement, conduct with coloring reagents, and in the greater numbers present. Unna concludes, from his special method of preparation, that the bacilli lie in the lymphatic system.

Ætiology.—Leprosy is a widespread disease of hot countries, but occurs under the most diverse conditions of climate, soil, diet, race, and unfavorable hygienic surroundings. There is no evidence that it arises *de novo*. It is not engendered in the air, soil, water, or in aliments, nor, as far as observation has gone, do any of these ever contain the specific bacillus. All theories to the contrary have been completely demolished by the collection of facts from various parts of the world. The discovery of the bacillus lepræ, the analogies of leprosy with the infective granulomata, and the fact that the disease is only propagated by transmission

from man to man have caused a general acceptance of the parasitic theory.

Leprosy has been, and is, most prevalent among those races and nations where the freest communication with lepers is allowed by public opinion and law.

The exact method and site of its introduction into the system is unknown, but there is no difficulty in imagining its entrance through the skin or mucous membrane by means of discharges containing bacilli, and coming directly from the neoplasms or from coincident eruptions of the leper's skin, as syphilides, vaccinia, scabies, yaws, etc. Careless and indiscriminate vaccination may be a medium. Possibly the bacillus may also be inhaled. Heredity can only play a small part in the propagation of leprosy, as it acts probably only in the limited sense applicable to syphilis.

Treatment.—No specific has been discovered. A liberal diet, cleanliness, exercise and good hygienic surroundings are essential, and a residence in a healthy, temperate climate is said to retard the course of the disease and mitigate its severity. Tonics are useful at times, and quinine in large doses is serviceable in the febrile attacks. Sulpho-ichthyolate of sodium or ammonium has not met with much favor. The Gurjun and Chaulmooga oils are unquestionably of service. The latter should be given at first in doses of from 5 to 10 minims in capsules, or in emulsion with milk thrice daily, after a meal, and gradually increased as long as it is tolerated. The drug may be continued over a long period. In a similar manner an emulsion of Gurjun oil, made with an equal part of lime-water, should be persistently given, commencing with 2-dram doses.

Local Treatment.—Warm baths, plain or medicated, should be systematically used, and the prolonged rubbing in of bland or stimulating oils or liniments containing carbolic acid, salicylic acid. Obstinate neoplasms may be dissipated by the application of stronger remedies, such as salicylic acid as a ten per cent. paste or ointment, or in solution with oleic acid. Unna strongly advocates the use of ichthyol, pyrogallol, chrysarobin, and resorcin. The choice of the strength of the application will vary with the site of the neoplasms, the degree of reaction of the skin and the extent implicated. Pyrogallol must be used with caution and

to limited surfaces. These substances can be applied as ointments, pigments, or plasters. In leprosy surgical operations are constantly required for the removal of disfiguring neoplasms about the face and ears, and especially the eyes, and in various secondary affections of the eyeball; for necrosed bone or cartilage, abscesses, sinuses, or ulcers; for amputations of digits and even greater portions of the extremities; and for the relief of pain and tropho-neurotic deformities by nerve-stitching. The obstinate and extensive ulcerations that so maim and enfeeble the leper should be treated on ordinary surgical principles. Electricity is also of signal service in the tropho-neurotic conditions of nerve leprosy. Lastly, the distressing symptoms in the nose, mouth, and throat must be attended to by the daily use of tampon ointments, medicated sprays and steam inhalations, gargles, and collunaria, and the constant swallowing of infective material prevented. The discharges from the bowels and from ulcerations, unless properly dealt with, may prove the source of contagion to others. As to the practicability of isolating lepers, it is evident, on the one hand, that a bad case of leprosy in a poor man can only be suitably treated when the patient is under control, and, on the other, that the isolation of the leper under suitable conditions must be for the advantage of the community.

T. COLCOTT FOX.

Symptomatic Indications.—*Anacardium Orientale* is said to have given excellent results, but the principal remedy is *arsenicum*, which should be continued for some time. *Hydrastis*, internally and externally, is useful in ulcerative stage. *Antimonium crudum*, when foul-smelling, pus-secreting sores are present, with gastric derangement.

LEUCIN is one of the products arising from the decomposition of nitrogenous bodies. It may be extracted from almost any of the viscera by the action of caustic alkalies or by boiling with sulphuric acid. It is present in the urine of persons suffering from acute yellow atrophy of the liver, appearing under the microscope as round balls like drops of oil, with or without radiating marks or concentric rings.

LEUCOCYTHÆMIA (*Leukhæmia*; *Leukæmia*).—A comparatively rare dis-

ease of the blood, characterized by a disproportionate increase of white corpuscles, differing from leucocytosis in being a permanent and progressive change, and in being associated with a corresponding (but not necessarily proportionate) diminution of red corpuscles.

Leucocythæmia was discovered in 1845 by Hughes Bennett and Virchow. The latter applied to it the term "leukhæmia," or "white blood;" the former first described it as "suppuration of the blood," and subsequently gave it the name leucocythæmia.

The condition is marked by symptoms referable in part to the anæmic state thus induced, and in part to the mechanical effects of the accumulation of leucocytes in the blood vessels. It is associated in the majority of instances with marked enlargements of the spleen, and, according to many authorities, this splenic variety is the only true form of the affection. But there are cases where the spleen is not enlarged, but where there is a general hyperplasia of lymphatic glands and lymphoid tissue. These cases differ from lymphadenoma (Hodgkin's disease) only in the characters of the blood, and hence, according to the view taken of the relation of this to the glandular change, they may be regarded either as cases of Hodgkin's disease with leucocytosis or else as lymphatic leucocythæmia.

Changes in the Blood.—The blood is paler than normal, having in bulk almost the tint of strawberry cream. On microscopical examination it is found to contain a great excess of leucocytes. Instead of the normal proportion to the red of about 1-300, there may be as high a proportion as 1-20, or even higher, the white corpuscles sometimes outnumbering the red. Cavafy has observed that most of the leucocytes lose their power of amœboid movement, as if they were no longer living, which suggests an explanation of their retention within the blood vessels. Further, if, as seems probable, the red corpuscles are derived from leucocytes, the increase in the number of the latter may account for the diminution in that of the former.

The leucocytes vary considerably in size, and these variations have been employed to differentiate the various forms of the disease; for example, a predominance of large cell-forms is said to char-

acterize splenic leukhæmia, while a preponderance of small (lymphoid) corpuscles is thought to indicate lymphatic leukhæmia. An interesting fact is the presence in the blood after death of colorless pointed crystals. Similar bodies were detected in the sputa of patients suffering from spasmodic asthma, and are known as Charcot-Leyden crystals (*see* EXPECTORATION).

Changes in Viscera.—In a vast majority of cases the spleen is enlarged, and with the advance of the disease this organ continues to increase in size, so that at death it may reach downward as far as the pubes, and to the right considerably beyond the middle line. On section, the organ has a mottled appearance, being paler than natural, while there is often no evidence that the malpighian bodies are more affected than the rest of the splenic pulp. Occasionally, however, these bodies stand out as prominent white nodules. The change appears to be a hypertrophic one, and the sinuses and blood vessels are filled with leucocytes. Generally there are scattered through the organ numerous hemorrhagic foci. In advanced stages the spleen becomes firm from fibrous thickening of the trabeculæ.

Besides the spleen, the other lymphoid glands in the body may be swollen and hyperplastic, especially the mesenteric and retro-peritoneal glands. The marrow of bones, especially of the sternum, is in some cases also markedly hyperplastic.

But in spite of the occurrence of cases with but slight splenic affection and predominance of the medullary change, it is questionable whether there is a distinct myelogenic form, some authors attributing the change in this tissue to a secondary rather than a primary process. Indeed, in well-marked cases, most of the organs of the body exhibit a leukhæmic infiltration. The liver, for instance, may be enormously enlarged by a diffuse infiltration of leucocytes, and fibrin between the lobules, and the kidneys may be similarly affected and swollen. Foci resembling infarcts have been found in the lungs. There may be effusion in the serous sacs.

Symptoms.—In many respects they are like those of pernicious anæmia, but more insidious in their onset. The patient, for some months, may have been feeling languid, weak, and incapable of exertion, with perhaps some shortness of breath.

Then pain in the left side, or pain and tenderness over the sternum (in the myelogenic form); or a liability to epistaxis and other hemorrhages. There may be no pronounced anæmia, and the color of the skin may become sallow or pigmented. [It is possible that, in some recorded cases of marked cutaneous pigmentation, the coloration may be due to arsenic, which is largely given in leucocythæmia.]

On examination, in the ordinary form, the enlarged spleen is readily made out, for it may have attained considerable dimensions before the patient seeks relief. Its enlargement is found to be uniform—projecting below the ribs; and the well-defined notch on the anterior margin, the mobility with the diaphragm, and the continuity of its dullness, with that of the normal splenic area, enable its true character to be readily determined. Perhaps, also, the liver will be found slightly enlarged. An examination of the blood clinches the diagnosis.

As the case progresses, not only do the liver and spleen continue to enlarge and the relative proportion of leucocytes in the blood to increase, but other symptoms make their appearance. Thus, hemorrhages may occur beneath the skin, as well as from mucous membranes, and in the retina (leukhæmic retinitis). There is pyrexia, either with considerable remissions, or it may present almost an intermittent type. In a well-marked case observed by the writer, the patient suffered from rigors and an almost quotidian type of intermittent pyrexia. There is frequently diarrhea, and may be vomiting. Together with this there is increasing emaciation, and dropsy may supervene. Well-marked ascites is present in some cases. The urine is usually free from albumin, but is generally loaded with lithates, and often deposits crystals of uric acid. There may be hæmic murmurs at the heart. Pericarditis and pleurisy are common as complications. The intellect is unaffected, but in some cases cerebral hemorrhage occurs.

The duration is from one to two or three years. Death is usually due to slow and gradual exhaustion.

Pathology.—Most tenable theory is that the spleen and other hemopoietic organs fail to convert the leucocytes into red corpuscles. An alternative view is

to regard the condition as essentially a disease of the leucocytal elements of the blood, a malignant growth of this fluid tissue, and to refer *all* the visceral changes to the results of this. It has been suggested to be an infective disease, but as yet bacteriology has made no discoveries in support of such a view.

The *ætiology* is obscure. It is a disease mostly of the adult life, but has been met with in quite young children. It is far more common in males than females. Various causes have been assigned in individual cases, such as over-exertion, exposure to cold and damp, mental worry or emotional disturbance, but these and the like cannot be considered essential. In a certain proportion of cases the disease would seem to have some relation to previous malarial poisoning.

Treatment.—The drug on which most reliance is to be placed, and from which the best results have been obtained, is arsenic, administered by the mouth or subcutaneously. Quinine, reputed to have a special action on the leucocytes, may also be given, with or without iron. Iodide of iron has also been prescribed. At one time some rather striking results were recorded of the effect of phosphorus, but the anticipations raised of its efficacy have not been fulfilled. Transfusion has met with no success. Inhalations of oxygen deserve, perhaps, a more extended trial than has been given them. The use of oxygen in the treatment of this disease was introduced by Kirnberger in 1883, on the theoretical ground that the impaired oxygenation arising from deficiency in red corpuscles led to defective metabolism. He records the successful treatment of a case—with great splenic enlargement and a proportion of w. b. c. to r. b. c. as 1 : 90. Although arsenic was also given in this case, health was not restored until the oxygen inhalations had been fully tried. Splenectomy has been proposed and actually performed in a few cases, but with almost invariably fatal results (death being due to hemorrhage). It is difficult to see the rationale of so formidable an operation on any theory of the disease, and its performance should be strenuously discountenanced.

SIDNEY COUPLAND.

Symptomatic Indications.—See ANÆMIA, PERNICIOUS.

LEUCODERMA (*Vitiligo*; *Leucopathia*; *Leucasmus*).—An acquired disease characterized by the appearance of smooth white patches of skin with well-defined borders, more or less symmetrically distributed.

Rounded spots of small size, on a level with the surrounding skin, first appear, most commonly on the trunk, backs of the hands or genitals; these increase peripherally, and coalesce to form variously shaped and often very extensive areas of disease, the boundary line of which is always convex outward. Around the white patches pigmentation is generally excessive, the line of demarcation being usually abrupt; the healthy skin is thus apt to be mistaken for the seat of disease, and is the main cause of the disfigurement on account of which the patient frequently seeks for advice. If the scalp be affected the hair upon the patch usually becomes white (canities).

The disease is never unilateral, but its symmetry is not usually so perfect as to suggest a primary central nervous affection. Tactile and thermic sensibility, sweat and sebaceous secretion, and all other functions of the affected skin are invariably intact. Neuralgia and pruritus occasionally precede its appearance, and the writer has observed cases in which pruritus was a very distressing symptom throughout; one subsequently died of acute pemphigus.

Diagnosis.—May be mistaken for partial albinismus, chloasma, morphœa, lepra, for patches of pigment atrophy after the disappearance of macular or papular syphilides, or even for spots of psoriasis blanched by chrysarobin.

Pathology.—Consists in the absence or diminution of the normal pigment in the mucous layer of the skin; degenerative changes in the corresponding peripheral nerves have been described.

Ætiology.—The disease commonly begins in early adult life, affects chiefly "neurotic" persons and those with dark skins, and is generally progressive, but may become stationary; some authors consider gout a predisposing cause. It may develop after acute diseases, especially the exanthemata, in the course of syphilis and various chronic nervous disorders (tabes dorsalis, alcoholism, neuralgia), or may occasionally start from a cicatrix, while it may complicate morphœa, Addison's disease, and area.

Leucoderma is common in some districts of India where lepra is prevalent, and may even complicate it; there is no relation between the two diseases.

Treatment is never of permanent benefit. A temporary return of pigmentation may follow the application of a mustard plaster, but more benefit is usually obtained by the removal of the excessive pigment in the surrounding skin by weak corrosive sublimate lotions or by peroxide of hydrogen.

J. J. PRINGLE.

LEUCORRHŒA (*The Whites*).—The popular synonym for leucorrhœa is applied by women to most discharges which are not bloodstained. The secretions that normally flow from the female genitals are: (1) Mucus from the fallopian tubes and the body of the uterus. This is colorless, transparent like white of egg, and does not differ, so far as is known, from mucus in other parts of the body. (2) The secretion of the glands in the cervix uteri. This is clear like the white of egg, but rather more tenacious. (3) The secretion from the vagina. In the healthy virgin white flakes are seen lying between the vaginal rugæ. The flakes are formed by the mingled secretions from the uterus and tubes, cervix, and vagina. (4) The secretion from mucous follicles situated in the vestibule between the clitoris and meatus urinarius, and also from the glands of Bartholin. These pour out a glutinous mucus having a peculiar odor.

There is also some mucus secreted by the urethra, and there is the secretion from the sudoriparous and sebaceous glands of the skin of the labia. The secretion from the glands about the vulva is often seen inspissated in yellow flakes lying in the furrow between the labia majora and minora, and under the preputium clitoridis.

The mucous secretions, as a whole, are scanty in the virgin, more copious in those accustomed to sexual intercourse, still more abundant in those who have had many children, and greatest in quantity during pregnancy. In conditions of debility the discharges are increased. After the climacteric they diminish.

Catarrh of the genitals is not uncommon, and often disappears without any treatment, but in weakly women it is apt

to become chronic. Whether this slight leucorrhœa comes from the cervix or vagina we do not know, for, as a rule, medical men do not make local examinations for so slight an ailment.

Leucorrhœa may be divided into three kinds: vulvar, vaginal, and uterine. Of these, the first is most common in children, the second in young women, the third in elderly women.

A white or yellow discharge *in children* is usually the result of vulvitis. It is important (1) because it may cause, and often has caused, suspicion to be thrown on someone of having communicated gonorrhea to the child; (2) because the irritation it sets up may lead the child to the practice of masturbation. It is easily cured by syringing the parts with a saturated solution of borax, at first three or four times a day, then, as it gets better, less frequently. The injection may be given with an ordinary glass male syringe.

The most common cause of leucorrhœa in women *during the child-bearing age* is vaginitis following child-bearing. Next comes cervical endometritis, also a result of child-bearing. These two are often combined. Among other causes which may lead to leucorrhœa are gonorrheal vaginitis, and the other rarer forms of vaginitis; venous congestion, the result of heart, lung, or liver disease; cancer, fibroids, other new growths from the uterus, and endometritis. Most of these discharges are purulent.

In acute gonorrheal vaginitis the pus is copious, thick, and yellow; in the other more chronic conditions it is thin, watery, and less abundant. In mere vaginal catarrh the stains which the discharge leaves are colorless. In cervical endometritis the discharge is thick, and may produce a colorless stain, but as met with clinically it generally either contains pus or is mixed with purulent discharge from the vagina. The leucorrhœal discharge produced by fibroids or endometritis is watery and often tinged with blood. That caused by cancer has in the early stages no peculiar character, but when the cancer begins to break down, the discharge contains fragments of decomposing tissue, and is offensive. But any kind of discharge may cause an offensive smell if the patient neglect cleanliness.

In *old women* who have ceased to men-

struate, leucorrhœa may be the result of vaginitis, the discharge being purulent, or of endometritis, the discharge being either watery or purulent.

In *pregnancy* vaginitis and cervical endometritis are frequent, and are especially troublesome to treat.

G. E. HERMAN.

Symptomatic Indications.—*Pulsatilla* is specific when from morbid activity of the cervical glands, simple mucous leucorrhœa, with indigestion, depression of spirits; also for vaginal leucorrhœa in chlorotic persons. *Cocculus indicus* does good service when discharge is sero-purulent, with pain in the lumbar region; *borax* for white, albuminous discharge, just between menstrual periods. *Sepia* is the main remedy for debility with passive uterine congestion; also in vaginal leucorrhœa, discharge green and thick, or offensive, watery, and profuse. *Helonias* has especial value as a uterine tonic, uterus and appendages relaxed and weakened. *Calcarea carbonica* is valuable in vaginal leucorrhœa in scrofulous persons, discharge white and profuse, specific in infantile. *Kali bichromicum* is useful when discharge is yellowish, thick, and ropy. *Hydrastis*, when there is ulceration, abrasion of mucous membrane, with debility and indigestion; *arsenicum*, when there is uterine hyperæmia, malignant ulceration, thin, burning discharge. Locally, *hydrastis* and *calendula*, largely diluted with water or glycerine, are serviceable as injections.

LICHEN.—A generic term for a well-defined group of inflammatory affections of the skin in which the lesions consist of solid papules throughout the entire course of the disease.

The name was formerly used to designate conditions which are now known to constitute mere phases of other diseases, and much confusion in nomenclature still exists in consequence. Thus, lichen simplex and lichen agrius are now recognized as being the papular stage of eczema; lichen lividus as severe purpura, in which hemorrhage occurs into the lesions round the follicles; lichen tropicus (prickly heat) as constituted by the apparently solid lesions round inflamed sweat glands, and lichen urticatus by the persistent wheals of chronic urticaria. Lichen syphiliticus is a peculiarly unhappy and misleading designation of the minute papular syphilide.

Some doubt still attaches to the true position of lichen circinatus, but the bulk of modern opinion is in favor of regarding this disease as of sebaceous origin. See SEBORRHEA CORPORIS.

Lichen ruber is a chronic inflammatory eruption consisting of flat (lichen planus) or *acuminate*, persistent papules, arranged in groups or lines, or coalescing to form extensive patches.

Lichen planus.—Occasionally, but rarely, the onset of the disease is accompanied by a severe erythematoid outbreak, on the subsidence of which the characteristic lesions may be distinguished. These consist of flat-topped, angular, polyhedral papules, varying in size from a millet-seed to a pea, shiny—especially when viewed by oblique light—and with a central umbilication, when surrounding a sweat duct. Their color is at first sight that of the normal skin or a pale pink, but soon they become reddish or purple, and a deep brownish-purple pigmentation is very characteristic and persistent in lesions of old standing, especially when they are situated below the knee and arsenic has been administered freely. The papules are often arranged in lines, bands, or groups, suggesting nerve distribution. They do not spread centrifugally like the papulo-squames of psoriasis; but extensive plateaus or sheets of disease may be built up by the coalescence of numerous papules arising side by side, and over these some thin scale is usually present.

The distribution is almost always bilateral and usually remarkable symmetry is displayed; the sites of election are the flexor surface of the wrists and forearms, the inner sides of the knees, the legs, ankles, and loins; but no region of the body is exempt, except the face. On the soles and palms the lesions appear as whitish spots scarcely, if at all, elevated. Solid papules are often found on the upper surface of the tongue, generally arranged in two parallel lines along either side of the raphé and on other portions of the buccal mucous membrane, where they resemble the milky-looking patches of syphilis, and are very apt to be macerated and result in troublesome erosions. Much more rarely the glans penis or mucous lining of the vulva is attacked, and in a few cases the lesions of mucous membrane have been known to precede the skin affection by many weeks.

After the subsidence of the papules deep brown pigmentation and some atrophic pitting are generally left, and the staining is apt to persist for a long time.

In a small proportion of cases the papules and patches become very prominent (lichen hypertrophicus) and may project from $\frac{1}{4}$ to $\frac{1}{2}$ inch from the surrounding skin, when their surface becomes rough and shaggy—like shagreen—and in such cases the course of recovery is always very tedious.

Lichen planus is the form usually met, and is much commoner in women than in men, but there is no line of demarcation to be drawn between it and the next variety.

Lichen acuminatus assumes a more severe type than lichen planus, and generally affects men. In many cases acuminate and plane lesions coexist, the former being on the trunk, the latter on the extremities.

Generally speaking, when the papules are acuminate the disease is very acute, and accompanied by grave constitutional symptoms (rigors, pyrexia, sweats, prostration); and itching—usually a troublesome feature of lichen planus—is intolerably severe.

The constituent papules are minute, firm, conical, capped with scale, very closely aggregated, but can generally be recognized as being around hair follicles. The extent of skin attacked is generally also much greater than in lichen planus, the whole body surface being frequently involved; deep infiltration and thickening occur, interfering with movements at the joints; the palms and soles become deeply fissured and the nails discolored, brittle, and thinned. Occasionally pityriasis rubra may start from a lichen ruber patch whether plane or acuminate.

In children the disease assumes a somewhat special form; the papules are at first acuminate, but soon become flat and scaly; they develop in groups or circles on either limbs or trunk, and recovery usually occurs spontaneously in a few weeks. In adults, on the other hand, the duration of the disease is indefinite; it is always chronic, and there is a strong tendency to relapse even after perfect recovery, although not with the same seasonal regularity as in the case of psoriasis.

The *diagnosis* is straightforward in the majority of cases, the characters of the papules being easy of recognition; only

when confluent patches are present is diagnosis difficult, and in them outlying papules are always present which exhibit the characteristic appearances. The acute erythematous phase is rare, and time is necessary to clear up the nature of the case. The distribution, pigmentation, violence of the itching, depth of infiltration with comparatively little scaling, uniformity of type, and absence of discharge serve to distinguish it from psoriasis, pityriasis rubra, papular dermatosyphilides, and eczema, with which it is most likely to be confounded.

Morbid anatomy.—Copious small-celled infiltration occurs into the superficial layers of the corium; when the process is acute, the rete Malpighii is pushed before the infiltration; when more chronic, the rete cells proliferate, so that the papules are mainly formed by them. There is a special predilection for the lesions to form round the openings of sweat ducts and hair follicles, surrounding which there is a rich capillary network.

Ætiology.—Little is known of the ætiology of lichen ruber; it certainly is of common occurrence in persons of neurotic disposition, or in a generally depressed state of health; its subjects are often dyspeptic, and there is reason to believe that in predisposed subjects a chill may determine an attack. Lichen ruber planus is commoner in women, lichen ruber acuminatus in men. Below the age of five years the disease is extremely rare.

Treatment.—Both constitutional and local. In acute cases, absolute rest must be enjoined, the food must be nutritious, but easily digestible. Quinine in large doses is useful, arsenic probably harmful. The affected parts may be swathed in rags soaked in lead lotion or calamine liniment, or repeatedly dabbed with lactate of lead lotion (liquor plumbi subac., 3j ad 3j of fresh milk). When the acute phase is over, the following lotion may be substituted: liq. carbonis deterg., 3ss; glycerini, 3ss; liq. plumbi subac. ad Oj.

In chronic cases stimulants, full diet, and tonics are indicated, and a change of air and surroundings is often beneficial. Arsenic is now invaluable, but, to insure its full effect, must be given in full doses (m. v-xv of the liquor thrice daily) with due precautions. Possibly its influence is sooner exerted when given subcutane-

ously as in Germany, but few patients will submit to the treatment. In a certain number of cases, in which arsenic is ineffectual, the perchloride of mercury appears to be of value.

Locally, the preparations of tar are the most generally valuable; a lotion composed of 1 dram of liq. carbonis detergens to an ounce or more of water is often useful; or the oil of cade, mixed with oxide of zinc, calamine, or subacetate of lead ointments in the strength of 1 dram to the ounce may be used. Carbolic acid (grs. xx-xxx ad 3j), naphthol or thymol (grs. xx-3j ad 3j), either in lotions or ointments, are also much employed. Prolonged alkaline baths relieve itching perhaps better than anything else, and form a suitable prelude to the use of ointments or lotions.

Lichen scrofulosus (vel scrofulosorum) is not so rare as usually asserted, but its existence is often ignored, as the eruption is in itself inconspicuous and gives rise to no subjective symptoms; when noticed, its true character is seldom recognized, as Hebra's original description of an exceptionally severe form is still almost universally accepted as that typical of the disease.

Children are, in most cases, its subjects, and in almost all there is a phthisical family history, a strumous physiognomy or physical evidence of tubercular disease of lungs, lymphatic glands, or bones.

The eruption is situated on the trunk, especially upon the back, either diffusely or in patches; when diffuse and abundant, the arrangement of the component papules is indiscriminate; when patchy, there is a great tendency to the formation of rings. In either case the papules are very small, pale, conical, and surmounted by fine scale; they cause no itching, and, after their subsidence, leave rather persistent yellowish pigmentation. After disappearing from one situation they are apt to crop up in another, and so successively to invade the whole trunk.

In adults the disease is rarer, but Hebra's description is based upon a study of such cases; the same association with tubercular taint obtains as in children, but the lesions are much less abundant, the papules larger, brighter in color, more discrete, and with more marked tendency to ringed arrangement.

In children the *differential diagnosis* must be established from papular eczema,

and in adults from circinate papular dermatosyphilis, which sometimes closely resembles it.

Pathologically the disease consists of moderate small-celled infiltration into the upper layers of the corium, especially around sebaceous glands and hair follicles; tubercle bacilli have not been demonstrated.

The *treatment* is mainly that of tubercular affections, prominent among remedies being cod-liver oil; arsenic and the iodides are useful adjuncts. Externally, the inunction of vaseline or lanolin probably hastens the disappearance of the rash.

Lichen pilaris (lichen spinosus), a rather rare and ill-defined disease, in which inflammatory papules are formed around the hair follicles, the center of which is occupied by a spiny plug of epidermis. It has affinities on the one hand with so called keratosis pilaris (vel ichthyosis follicularis), which is, however, a congenital and non-inflammatory affection, and on the other with simple folliculitis—follicular eczema—and with psoriasis pilaris.

It occurs both in children and adults, but especially in early adult life. Darier has demonstrated the presence of psorospermiae in the disease, and they are most probably its immediate cause. Positive evidence in the form of successful inoculation experiments is still, however, wanting (*see* PSOROSPERMIÆ).

The papules are very prominent, taper to a fine point, and contain a central spine, which, when extracted, leaves a deep pit; at first they are bright red, but afterward become much paler. They appear suddenly in circular patches, especially about the back of the neck and shoulders, but also on the buttocks, over the trochanters and on the abdomen; they cause a rough nutmeg-grater-like feeling to the touch, as well as some inconvenience to the patient from catching on the underclothing. The amount of itching varies considerably in different cases. After subsidence some pigmentation is left, and the eruption has a tendency to recur,

Treatment consists in the mechanical removal of the plugs by vigorous friction with soft soap, after hot alkaline baths, and the subsequent inunction of some weak tarry ointment—*e. g.*, ol. cadini 3j ad 3j. Internally, cod-liver oil may be used.

J. J. PRINGLE.

Symptomatic Indications. — *Arsenicum* is the principal remedy, particularly in chronic cases. *Apis* is useful for simple lichen; *sulphur* for simple form in summer; *antimonium* when digestion is disturbed.

LITHOTOMY.—I. Lateral.—The deep incision carried through the membranous and prostatic parts of the urethra into the left lateral lobe of the prostate.

An aperient must be given the night before, and an enema the morning of the operation. The instruments required are a sound; a catheter and syringe for injecting the bladder or washing it out; a grooved staff, either straight or curved; lithotomy tapes, anklets, for fastening up the patient; a lithotomy knife, or broad-bladed straight-backed scalpel; various pairs of forceps, and a scoop. Besides the usual instruments required for operations, a straight-back blunt-pointed bistoury may be needed to complete the deep incision; a blunt gorget for opening up the prostate, and a tube with an india-rubber bag adjusted round it so that if introduced into the wound the urine may escape through the tube while any hemorrhage is prevented by inflating the bag.

The patient should be placed on a narrow, but well-raised table, so that with the operator sitting opposite, the nates may be of a convenient height, and the anæsthetic administered.

The stone must be felt with the staff by the operator, and, as a wise precaution, by one of the assistants also. If this cannot be done the operation should be abandoned. If the patient has not passed water recently there is no need to pass a catheter; but if he has, or if there is any doubt, it is as well to draw off the urine, and replace it with six to eight ounces of water of a proper temperature. Care must be taken, if bandages or lithotomy tapes are used, that the patient's hands grasp the soles of the feet, and that the bandage is fixed first by a clove hitch to the wrist, and then carried round the two together in a figure of eight.

The patient must be brought down to the end of the table, so that the nates project slightly, and the hips and knees being flexed, fastened in this position with one of the appliances already mentioned, the perineum shaved, and the staff given to the assistant to hold. If it is curved

in the ordinary catheter shape it should be held well up under the pubes, so as to separate the membranous portion of the urethra from the rectum, and grasped by the fingers, while the ball of the thumb is pressed against the flat of the handle. If the staff is straight, it is to be held well up, with the handle slightly inclined toward the operator.

The finger should be introduced into the rectum, to feel the apex of the prostate, to make sure the rectum is empty, and to stimulate the gut to contract, so that it may be out of the way. Then, the finger and thumb of the left hand steadying the skin, an incision is made from a point midway between the scrotum and the anus, just to the left of the middle line, downward and outward to below the anus, a little nearer to the ischial tuberosity than the orifice. This divides skin, superficial fascia, subcutaneous fat, external hemorrhoidal vessels and, perhaps the superficial perineal vessels and nerves. The incision is then deepened by dividing the transversus perinæi muscle with the artery on it and the lower border of the triangular ligament, the forefinger guarding the rectum in the wound. Some fibers of the accelerator urinæ may be divided, but not the bulb.

The finger is then pressed into the upper part of the incision, so as to feel the groove in the staff, and if this is a curved one, the point of the knife is placed in the groove, dividing the compressor urethræ and the membranous part of the urethra. The handle must now be slightly depressed, the blade turned a little toward the operator's right, so that it may be opposite the longest diameter of the prostate, and pushed firmly onward through some of the fibers of the levator prostatae and the prostate itself. The incision may divide the whole length of the lower and outer side of the prostate up to the neck of the bladder, though this is attended in old people by severe venous hemorrhage, but it must on no account divide the recto-vesical fascia. The fibrous ring at the neck of the bladder must be just notched; then the other tissues yield without injury to the fascia. If it is torn by the forceps the lateral ligament of the bladder gives way too. Moreover, if the incision is too small, the structures are so bruised during extraction that inflammation, which is almost always diffuse, owing to the

condition of the kidneys, inevitably results.

The knife is then withdrawn, the back being all the time pressed into the groove, and the finger gradually forced into the bladder by a twisting movement.

If the staff is a straight one, as soon as the point of the knife is placed well in the groove, the operator takes with his left hand the handle of the staff, lowers it till it is nearly horizontal, holding meantime the point of the knife quite still, and then, turning staff and knife together on their long axis, so that the latter may be in the proper plane, and pushes it on until the resistance of the prostate is no longer felt. The extent to which the prostate is divided depends on the angle formed by the knife with the staff. With the straight staff used in this way as a director, it is much more easy to keep the knife in the groove and to make an incision sufficiently free without being too wide. The staff must not be withdrawn until the finger has entered the bladder, and, if possible, touched the stone.

If the perineum is very deep, or the prostate much enlarged, a blunt gorget must be pushed along the groove, so as to divide the prostate, and the staff must be kept *in situ* until the forceps have been passed along it. As soon as the finger has touched the stone, and, if possible, fixed it and ascertained its shape, a suitable pair of forceps, well warmed, must be guided by it through the wound into the bladder, and the blades opened. Withdrawing the finger is generally followed by a gush of urine, which may carry the calculus at once into the grasp of the forceps, or a slight movement of the blades may enable it to be seized; but sometimes, especially when the calculus is of a peculiar shape, this is the most difficult part.

If it breaks up, or is encysted, it must be removed with the finger and a scoop. In all cases care must be taken to withdraw it in the axis of the pelvis, quietly and gently, easing it from the various structures that oppose it, and pressing the tissues off it with the finger. If, unhappily, it should break, it becomes necessary to wash out the bladder, perhaps many times, with warm water, in order to remove all the *débris*.

By this means, in the adult, a stone an inch and a half in diameter may be removed without dividing the recto-vesical

fascia ; one two inches across may possibly be extracted by drawing the stone well down and carefully dividing the tissues that resist, especially the right side of the prostate ; but it may well be doubted whether it would not be better, for such cases, either to perform the suprapubic operation or to crush it first and then extract the fragments. Under no conditions is it advisable to make the incision first and crush through the wound, as the walls of the bladder must be bruised. Even the fracture of a calculus, when grasped by the forceps, adds materially to the danger, owing to the necessity of washing out the bladder, etc., to get rid of the fragments.

The last step in the operation is to explore the bladder with the finger, in case there should be a second calculus present. Unless hemorrhage is feared, there is no need to insert a tube in the wound ; the urine drains away of itself through the opening for the first two days, and then sometimes comes by the urethra, owing to the swelling about the prostate. As suppuration becomes more free, it pours out of the wound again, gradually diminishing in amount as healing progresses. The patient should be placed in bed, on his back, with the knees and hips bent, and the mattress so arranged that the urine will not flow up toward his shoulders.

Accidents that may occur :

1. Hemorrhage, from making the incisions too high up and wounding the bulb, or its artery, or an abnormal branch. If, owing to the depth, it cannot be tied, forced-pressure, acu-pressure, or even digital compression, by relays of dressers, must be kept up for twenty-four hours. The pudic itself, unless abnormal, is rarely wounded. Venous hemorrhage, especially from the prostatic plexus, may take place at the time or later, some hours after, and the blood may collect in the bladder and distend it before the occurrence is known. The coagula must then be washed out, and the bleeding checked by the pressure of an "air tampon," with a tube running through it to allow the escape of urine.

2. Wound of the rectum, especially when much distended. Generally this closes, but it may leave a recto-vesical fistula.

3. Wound of the posterior wall of the bladder.

4. Missing the urethra altogether and

opening the base of the bladder on the staff.

5. Tearing the urethra across : this, especially in children, from not making a free and clean incision into the membranous part. The tissues are so delicate that the urethra may be torn across, and the bladder pushed in front of the finger, which enters into a space that feels like the interior, lying between the rectum and the wall of the bladder. If the urethra has been pushed off the staff, the operation must be abandoned.

6. Allowing the back of the knife to diverge from the groove as it is withdrawn. With the straight staff this can hardly happen.

Difficulties of various kinds may be met with ; false passages, enlargement of the prostate, especially when it is irregular ; unusual depth of the perineum ; contraction of the pelvis, from rickets or tumors ; encysted or adherent calculus. The stone, too, may be of unusual shape or size, or phosphatic, so that it crumbles into a mass of slimy tenacious mortar at the slightest touch. In boys, the mobility of the bladder and its position high up in the pelvis increase the difficulty ; in adults there may be sacculation, so that after the operation it is necessary to pass a double tube, one inside the other, so as to wash out the pouch as well as the bladder.

Causes of death.—1. Infiltration of urine into the cellular tissue at the base of the bladder, owing to the neck having been completely divided, and the recto-vesical fascia laid open. Peritonitis follows rapidly. The symptoms are those of acute sthenic peritonitis ; they come in within twenty-four hours, and usually prove fatal on the fourth or fifth day. Brodie saved one patient by laying the whole perineum open into the rectum. 2. Diffuse inflammation of the areolar tissue at the neck of the bladder, from bruising during the extraction of large calculi. Owing to the condition of the kidneys when large calculi are present, the inflammation is always diffuse, and spreads rapidly to the peritoneum and adjacent textures. 3. Hemorrhage ; not so much from the actual loss of blood at the time as from the weakened and enfeebled state in which the patient is left. 4. Pyæmia, probably spreading from the veins. 5. Peritonitis, from wound of the bladder, where it is covered with peri-

toneum or extension through the walls of a cyst. 6. Shock and exhaustion. 7. Cystitis. 8. Suppression of urine.

Prognosis.—Age.—Extraordinarily successful in children, and, as years advance, becomes steadily more and more dangerous.

The size of the calculus.—Either the lateral ligament of the bladder must be divided, or the prostate bruised in the lateral operation if a calculus is very large. In either case diffuse inflammation results.

The state of the kidneys and bladder, and the length of time the symptoms have lasted.—This is the most important of the three. Most of the fatal cases may be traced to diffuse inflammation or exhaustion, of which renal disease is the great predisposing cause.

II. The median operation.—The deep incision only through the membranous part of the urethra and the apex of the prostate. The patient is prepared for operation in the same way, and placed in the same position, but a rectangular staff is used, as it brings the apex of the prostate nearer the surface, and lessens the danger of wounding the rectum. The incision is made in the median raphe, commencing immediately below the bulb; the urethra is opened at the junction of the membranous with the prostatic part, and a small incision made upward so as to expose the staff fully, the back of the knife being toward the rectum. The finger is then gradually insinuated along the staff, following the upper surface rather than the lower, because the roof of the urethra is fixed more firmly than the floor, and there is less danger of tearing it across. When it reaches the bladder, the staff is withdrawn and the forceps taken up. This operation is essentially the same as that for exploration of the bladder with the finger.

Median v. lateral lithotomy.—The advantages over the lateral operation are: 1. Less hemorrhage. Abnormal arteries cannot be cut, and the prostatic plexus is not opened. 2. The reflected part of the recto-vesical fascia, forming the true ligaments of the bladder, cannot be divided. In the lateral operation the fibrous ring at the neck of the bladder should be just incised, and the tissues will yield without this portion of the fascia tearing; but, particularly with the curved staff, the incision may be carried too far. The prostate is torn by the finger, it is true, in the

median, but so it is in the lateral when the incision is only of moderate dimensions. 3. After the operation the urine does not come by the wound so much or so long. Healing takes place more quickly.

The disadvantages are: 1. Want of space, not only for the superficial, but also for the deep incision; so that it is very hard to extract a stone more than one inch in diameter without badly bruising the neck of the bladder. The fascia is not torn, so that infiltration does not follow, but diffuse inflammation may. 2. In children, particularly, there is more danger of tearing the urethra across. 3. The bulb and the rectum are more likely to be wounded.

III. The suprapubic operation.—The bladder is opened above the pubes below the fold of the peritoneum. The preparation of the patient is the same, but the position is the ordinary recumbent one. The bladder is to be carefully filled with warm water, or, better, an antiseptic solution, so as to raise the fold as high as possible; the urethra should be secured by a ring round the penis; and an india-rubber bag, provided with a stop-cock, so that it can be filled with fluid, should be introduced into the rectum, and distended in order to lift the bladder up from the pelvis.

The incision is in the middle line, three inches in length, with the lower end over the pubes; the linea alba is carefully divided, and the peritoneum pushed up. The soft cellular tissue and fat behind the symphysis are carefully separated with the finger or a blunt director in order to avoid wounding the large veins sometimes present; and the bladder is fixed with a tenaculum. The wall is then divided sufficiently to allow the finger to enter and feel the stone; if a large opening is required, it may be made either with a blunt-pointed bistoury toward the pubes, using the finger as a director, or by the fingers alone.

The forceps are then introduced, and the stone withdrawn; or the stone may be grasped with a small lithotrite through the urethra, and pushed upward when the bladder is reached. The wound should be left open, both the deep and the superficial one. A tube is not required; it delays the healing without draining the bladder effectually or protecting the patient from the danger of infiltration; and

it is almost impossible to close the wound in the bladder accurately by means of sutures. The patient should lie on his side to facilitate drainage, and should change from one to the other occasionally, so as to avoid excoriations.

Choice of method.—In children nothing can succeed better than the lateral operation for all calculi of ordinary dimensions. In the median there is always the danger of pushing the bladder in front of the finger. If the stone is exceptionally large the suprapubic method is advisable.

In adults much depends on the size and shape of the calculus.

1. Stones under an inch in diameter, or long and thin foreign bodies, such as a piece of bougie. Unless lithotrity is preferred, these are the most suitable for the median.

2. Stones under an inch and a half. Up to this size calculi may be removed by the lateral method, unless lithotrity is preferred.

3. Stones over this size. If soft and phosphatic, and the urethra capacious, a very large calculus may be removed by crushing; but in these cases the kidneys and the bladder are generally involved, and long operations are unadvisable. If the stone is hard, the choice lies between breaking it into a few fragments with a lithotrite, and extracting these through a median incision, or performing the suprapubic operation.

4. The number of calculi is of some importance; many small ones (too big to be washed out with an evacuating tube) are best removed, like the fragments of a large one, by the median operation.

5. The situation of the calculus sometimes determines the incision. If behind the prostate, and particularly if embedded in the substance of the gland, it may most easily be reached by the median incision; but it may be encysted in other parts.

Other points to be considered are: (a) The size of the pelvis; this may be seriously diminished by tumors, rickets, etc. (b) Atony of the bladder, perhaps after crushing. Here the median operation should be performed and the bladder thoroughly evacuated without delay. (c) Loss of blood; this may be serious in the lateral operation.

LITHOTRITY.—The calculus is crushed, and the fragments evacuated

through the urethra by means of a metal tube the size of No. 16 English catheter. Unless there is something quite exceptional, the operation is finished at one sitting. The prolonged, but gentle, use of instruments is less dangerous than leaving the bladder full of angular fragments (any one of which may become impacted at any moment) and subjecting the patient to the risk of many operations.

Lithotrites differ according to the work they have to do. They should be cut from a solid bar of metal, not forged. In introducing a lithotrite, the shape of the end must be taken into consideration; as a rule, when it is approaching the bulb, if it is supported in the vertical position, its own weight carries it in.

The evacuating tubes are merely large thin-walled catheters, with openings in various places to suit different conditions. The aspirator which is attached to them consists of an india-rubber bulb, to be grasped by the hand, and an intervening portion made of glass, so that the fragments may be seen and trapped, and not be sent back again with the stream. A current of fluid is driven into the bladder with each squeeze, and sucked out again (with the fragments) when the pressure is withdrawn.

Operation.—Either the patient should be placed under an anæsthetic, or the bladder and urethra should be rendered insensitive by injecting into them about two drachms of a four per cent. solution of cocaine. This succeeds admirably for about ten minutes or a quarter of an hour, if the walls are not coated over with an absorbing layer of ropy mucus; at the end of that time a second injection is necessary. The pelvis should be well raised, and the operator should stand on the right.

If the patient's bladder is not irritable, and is known to contain a certain amount of urine, it may be left: but generally speaking, it is better to draw this off, and inject six or eight ounces of a warm antiseptic solution. Care must be taken, when the aspirator is used, not to inject too much, or with too vigorous a hand; it often happens that parts of the bladder are thin-walled and soft from degeneration, so that it is quite easy to rupture it.

When the lithotrite is introduced, there are two methods of grasping the calculus: in the first the female blade is pushed

down on to the floor of the bladder, so that the stone drops into it and is caught by the male blade; in the other, the instrument is inverted and the calculus sought for on the floor, with the blades pointing downward. The latter is decidedly best when the prostate is enlarged, and it involves less moving of the lithotrite in the after-work. Care must be taken in both, but especially the former, that the male blade, as it is withdrawn, does not pull the calculus away from the female blade.

As soon as it is firmly grasped the stone should be crushed, if soft, by the pressure of the hand, but in general by steadily screwing the male blade into it. As a rule, the fragments drop vertically, so that if the lithotrite is used gently, and no currents are raised, the larger ones are picked up at once and crushed again until small enough to come through the tube. The lithotrite is then withdrawn, taking care that the blades are well home without any fragments caught between, the catheter passed, and the aspirator attached. Each compression sends a stream of fluid into the bladder, and each relaxation withdraws as much, the broken pieces coming out at the same time, but dropping down out of the way into the glass receiver. In this fashion a calculus of moderate size may be broken up at one sitting, and the bladder washed quite clear, the catheter acting as a sound to ascertain if a fragment is still present. One too large to come out either blocks the eye, and must be detached by squeezing the bulb again, or knocks against it, so that it can be felt or heard as the fluid pours out. Every fragment must be removed.

Small calculi of uric acid, and moderate-sized ones of phosphate of lime, may be sufficiently crushed with a small lithotrite without removing it from the bladder; but in the case of oxalate of lime, or large calculi of uric acid, it is best to make use of two instruments, a strong one to break them up, and a slender one to complete the operation.

If the urine is acid and if the kidneys are sound, the *after-treatment* of the case is very simple. There is always some cystitis from the use of lithotrites with, perhaps, hematuria, but if the cause is thoroughly removed this soon subsides of itself. The patient is better in bed, without stimulants or rich food; he may be

given a hot bath every day, and any irritation about the neck of the bladder may be subdued by morphia suppositories and hyoscyamus and buchu internally. When the calculus is phosphatic and the urine alkaline, not only are accidental complications more likely to follow, although the calculus is softer, but after it has been removed the cystitis is still kept up by the state of the urine. If this is ammoniacal, and particularly if the walls of the bladder are irregular, sacculated, or atonic, so that it cannot rid itself of the mixture of decomposing urine and mucus, the condition is most unfavorable. The kidneys are certainly involved, and every kind of trouble is more likely to happen.

Complete atony may come on. In old people this sometimes follows the simple introduction of a catheter. It is due in part to the muscular coat, in part to the feebleness of the nervous system, which is unable to withstand the shock. If the stone is crushed and removed at a single sitting, the bladder has simply to be relieved by catheter. When the evacuation of the fragments was left entirely to nature it was more serious and necessitated median lithotomy.

Cystitis is common, and when the urine is ammoniacal, serious. The mucus mixed with the alkaline products of decomposition becomes tenacious and ropy, forming, with the phosphates, a slimy and offensive coating on the lining membrane. The patient is poisoned by absorption from the putrid mass; the tongue becomes dry and red, and typhoid symptoms set in. The mucous membrane may slough in places; or abscesses may form in and round the prostate; or peritonitis may ensue from gradual extension through the thinned wall of a cyst; or, more common than all, the septic decomposition travels up the ureters and sets up acute suppurative nephritis in kidneys already diseased.

Suppression of urine comes on occasionally, especially when there is old renal mischief. It seems to be due to some reflex disturbances of the vasomotor or secretory nerves.

Constitutional symptoms in all degrees of severity may follow; either simple malaise with headache and slight fever, or rigors with high temperature and delirium, prelude pyæmia (probably spreading from the prostatic plexus), septicæmia, acute nephritis, or suppuration in or round the prostate and the walls of the bladder.

Prognosis.—Depends on the condition of the bladder and the kidneys. Age and size of calculus are, it is true, very important, but rather from the troubles they cause than for themselves. If a patient's urinary organs are sound, a calculus of any reasonable size may be crushed with as great security as a small one.

Lithotrity Compared with Lithotomy.—There are certain conditions in which one of these only is applicable. In children, lateral lithotomy is so successful that lithotrity is rarely tried; in encysted or adherent calculus it is impossible. On the other hand, if the patient is over puberty, if the urinary organs are fairly sound, and if the calculus is under certain dimensions (two inches for uric acid and one and a half for oxalate of lime) there is no doubt lithotrity is best. Larger calculi should be dealt with, as already mentioned, by the suprapubic method or by crushing and median lithotomy.

Cases of stricture, or of enlarged prostate of moderate size, do not preclude crushing; the difficulty is confined to those instances in which the calculus is phosphatic, the bladder inflamed or sacculated, the urine ammoniacal, and the kidneys diseased, especially when this occurs in conjunction with old age. Both the lateral method and crushing under such circumstances are very serious operations, but it will be noticed that there are two conditions in the selection. So far as the state of the kidneys and the age are concerned, the cutting operation is more serious than the crushing. Patients may not recover from the latter, but they probably will not from the former. The special danger in lithotrity is the condition of the bladder, which in lithotomy is not so material. But this can be obviated to a very considerable extent by the use of antiseptics, by care in the manipulation of instruments, and, if it is absolutely necessary to drain the bladder and give it free exit for its decomposing contents, by opening the urethra in the perineum. Where small phosphatic concretions form repeatedly, as they sometimes do in cases of enlarged prostate and cystitis, there is no doubt that lithotrity is best.

Calculus in the Female.—This is more rare than in the male, owing to the ease with which a calculus can pass through the urethra, and to freedom from the cystitis that is caused by enlarged prostate. It is

probable, too, that owing to the difference in the mode of life, fewer renal calculi are formed in females than in males.

Symptoms.—Much the same, but incontinence of urine and bearing-down pains are more common. As in the opposite sex, it sometimes happens that very large calculi exist without giving rise to nearly such acute symptoms as the smaller ones.

The urethra in the adult female may be dilated so as to admit the forefinger with but little fear of subsequent incontinence, so that small calculi, or those of elongated shape, and foreign bodies, may readily be extracted. Larger ones should be crushed first and washed out; the attempt to extract through the urethra too large a calculus may be followed by sloughing of the anterior wall of the vagina.

Very large calculi may be extracted by the suprapubic operation; by an incision through the wall of the vagina, which is then to be treated as a vesico-vaginal fistula; or by introducing a staff into the urethra and making a modified lateral incision.

Calculus impacted in the urethra.—Very rare, except in children, though it may occur after lithotrity if the fragments are left in the bladder. The calculus must be a small one; and it may be impacted at the neck of the bladder, in the membranous part, or in the penile portion. The *symptoms* come on suddenly during micturition; the stream stops abruptly from the spasm and congestion excited, even if the calculus is not sufficiently large to block the urethra of itself; there is intense pain, the child screaming and pulling at the end of its penis; a drop or two of blood may come from the meatus; and there is complete retention. If left to itself, ulceration and extravasation of urine follow; indeed, in male children, impacted calculus is the most common cause of retention and extravasation.

If the calculus is in the penile part, it may generally be worked forward by the fingers until it reaches the orifice, when a small incision may be necessary; or it may be extracted with urethral forceps; but the mucous membrane is less injured by the former proceeding. If it is fixed, or too far back, the skin over it may be stretched with the finger and thumb of the left hand, and a small, longitudinal incision may be made on to it. The

wound should be left to granulate. If deeper still at the neck of the bladder, it may be extracted by the median method, or pushed back with a blunt bougie, and the lateral operation may be performed.

LIVER, ABSCESS OF (Hepatic Abscess).—Abscess of the liver is rarely caused by *mechanical injury*, rarely also from irritation set up through *obstruction* of bile passages or *ulceration* of their walls due to calculi or round-worms. A *hydatid cyst* may suppurate, and then form an abscess. *Pyæmic* or *metastatic* abscesses occur in connection with surgical suppurations, ulcerative endocarditis, and gangrene of the lung, but the chief cause of abscess of the liver is *ulceration* or *suppuration*, occurring in the area of the *portal circulation*.

Among the rarer conditions that have been known to give rise to it are phlegmonous gastritis, ulcer and cancer of the stomach, enteric fever, catarrhal ulceration of the intestine, ulcers of the cæcum and vermiform appendix, pelvic abscesses connected with the uterus or its appendages, and purulent peritonitis.

The most common cause is *dysenteric ulceration* of the large intestine. It is doubtful whether *tropical* abscess ever occurs apart from dysenteric ulceration.

Symptoms.—In the majority of the secondary forms there are no special symptoms; what symptoms there are, are constitutional, and are masked by those of the grave disease in the course of which it has occurred.

In tropical abscess there may be no symptoms, several sudden deaths having occurred from rupture of an abscess into one of the neighboring serous cavities in persons supposed to be in good health. But the most usual symptoms are local pain, feverish attacks resembling ague and often mistaken for that disease, with the appearance of a fluctuating tumor or evidence of enlargement of the liver, and jaundice. If the abscess reaches the peritoneal surface of the liver, it causes local peritonitis. There may be pain at the tip of the right shoulder, furred tongue, gastric catarrh, loss of appetite, wasting, and profuse sweating. The *termination* of such an abscess is by pointing and opening externally or into some neighboring cavity. The most favorable mode of evacuation next to external pointing is into the colon, but it

may open into the pleura, the lung, the stomach, the duodenum, the pericardium, the pelvis of the right kidney, or the peritoneal cavity.

Diagnosis.—When there is a fluctuating tumor the presence of suppuration may be suspected, but is only rendered certain when the swelling is proved to contain pus by puncture with a fine needle. When residence in a tropical climate is followed by local pain, rigors, and enlargement of the liver, it is probable that there is an abscess, but in this case its seat may be difficult to recognize, and the diagnosis is hardly established until, by perhaps repeated punctures with a long fine aspirator needle, the abscess is hit and pus is drawn off.

Morbid anatomy.—The anatomical appearances vary in the different ætiological forms. In connection with disease of the bile ducts, the abscesses are multiple, and are formed by the suppuration of cavities consisting of dilated and sacculated ducts. In pyæmia and other metastases, abscesses are also multiple, usually of small size, and rounded in shape; the walls of such abscesses are formed of infiltrated and softened liver tissue. In the tropical variety the abscess is generally large, single, and the wall is more organized.

The modern *treatment* of hepatic abscess is exclusively surgical. Wherever it is possible the cavity should be opened, its edges stitched to the abdominal wound, and drained. ROBERT SAUNDBY.

LIVER, ALBUMINOID DISEASE OF.—*Symptoms.*—*Enlargement* of the liver, the organ often attaining a great size, with a well-defined edge, easily palpated. There is, as a rule, no ascites, but in the later stages there may be œdema of the lower extremities. The spleen is also enlarged. In many cases the degeneration is not advanced far enough to give rise to distinct enlargement of the liver, and the diagnosis is only made on the post-mortem table. Its existence may often be inferred from the presence of favorable ætiological conditions; but it is a noteworthy fact that, in some places, waxy degeneration occurs with much less frequency in connection with chronic suppurations than it does in others.

Morbid anatomy.—The liver is enlarged, smooth, and hardened. Its edge

is sharp, the normal shape is retained. Its color is rather pale. On section, it is firm to the knife, like bacon, and on pouring over it a weak solution of liq. iodi (1 part of liq. iodi to 10 of water) a mahogany-brown stain appears; sometimes this reaction can only be obtained by soaking thin sections in the fluid, and examining with the microscope, and this even in organs whose naked-eye appearances leave little doubt as to the nature of the change. Under the microscope, the affected parts are stained rose-violet with methyl-violet while the healthy tissue is colored blue-violet. The degeneration commences in the middle zone of the lobules, and attacks the capillaries of the hepatic artery, causing these to swell and compress the cells which undergo atrophy.

Ætiology.—See ALBUMINOID DISEASE.

Treatment.—The removal of the cause is the only measure which is known to have any influence upon this condition. The malarial taint may be treated by quinine and arsenic; syphilis, by mercury and iodide of potassium; phthisis, by quinine and cod-liver oil. Surgical conditions should receive proper local attention, and the presence of evidences of waxy degeneration should not be allowed to bar an operation, if it be possible by this means to get rid of the cause. Cases are recorded in which, after removal of a source of suppuration, the liver, although previously much enlarged and extending downward below the umbilicus, resumed its normal size.

ROBERT SAUNDBY.

LIVER, ACUTE YELLOW ATROPHY OF (Icterus Gravis).—A rare disease, characterized clinically by the presence of jaundice, and pathologically by a rapid wasting of the liver. It occurs as a primary affection or as secondary to chronic hepatic disease.

Symptoms.—In the beginning resemble those of simple catarrhal jaundice, and in many there is some gastro-duodenal catarrh. But cerebral symptoms soon manifest themselves; headache sets in, followed by delirium, which often amounts to maniacal excitement; later the patient becomes comatose, and convulsions are common, especially in young subjects. Hemorrhages may take place from all the mucous surfaces, hematemesis being

the most common. The temperature is at first subnormal, normal, or slightly raised, and this may persist until the end, but, in a considerable proportion of cases, during the last hours of life the temperature rises considerably.

The urine is small in amount, of high sp. gr., loaded with bile pigment, and contains very little urea, with much leucin and tyrosin, and is often albuminous. The jaundice is intense.

Pain in the region of the liver is sometimes complained of, but the area of liver dullness is always reduced or entirely absent. This sign is favored by the tympanitic distention of the intestines,

The *diagnosis* of the condition may be impossible before the occurrence of cerebral symptoms, but the supervention of acute jaundice in pregnant or puerperal women, or the subjects of cirrhotic liver, should be regarded with watchful misgiving. Later the disappearance of the liver dullness, and the presence of leucin and tyrosin in the urine, will confirm a diagnosis which the severe cerebral symptoms has suggested.

The *duration* of the disease varies very greatly, from a few days to two months, but most cases terminate between the fifth and the fourteenth days.

The *prognosis* is not absolutely hopeless; though it is not easy to understand how recovery can take place from the anatomical condition found post mortem, nevertheless a certain number of alleged recoveries have been recorded. Yet the prognosis must be most grave.

Morbid anatomy.—The liver is much reduced in weight, weighing from 20 to 30 ozs. in adults; it is flattened, of very soft consistence, while its capsule is shrunk and wrinkled. The external bile apparatus is generally empty. In the *primary* form, on section, the liver is uniformly yellow, and no definite structure can be recognized. Under the microscope all that can be seen is a mass of granules of fat, bile pigment, blood pigment, and leucin and tyrosin crystals. The liver cells have disappeared. In the *secondary* form the process is commonly partial only; some areas of the liver are bright yellow, while others are bright red, and others again are unaffected by any acute degeneration. Under the microscope the yellow areas are much the same as in the first form, but the red areas show acute infiltration of round

cells in the interlobular fissures and spaces. The liver cells show various stages of acute fatty degeneration; bile and blood pigment granules and leucin and tyrosin crystals are present. The nature of the pathological process in the yellow form is a most intense acute parenchymatous inflammation; in the red form this is less intense, and is accompanied by interstitial inflammation. A similar parenchymatous inflammation affects the muscular wall of the heart and the parenchyma of the kidneys. The disease is undoubtedly due to a toxæmia, the nature of which is not known. The best explanation of the jaundice in this disease is that it is due to the absorption of bile secreted in the early stages of the disease, but which is hindered from escaping by the ordinary channels on account of the plugging of the smallest bile ducts by plugs of desquamated and degenerated epithelium.

Ætiology.—The influence of previous attacks of jaundice, of syphilis, and of alcohol is questionable, except in so far as either may have led to cirrhosis of the liver, for it is especially as a mode of termination of cirrhotic liver that the secondary form occurs.

The primary affection is especially associated with pregnancy and the puerperal state, but the nature of this relation is not understood.

Cases have been observed to occur in enteric fever and in pneumonia.

The influence of age is observed in both sexes, it being rare before fifteen and after forty years in both men and women, but females are twice as liable to the disease as males.

In acute *phosphorus* poisoning the liver may present quite identical appearances to those seen in this disease.

No treatment would seem to be of much use, but, in some of the cases which have recovered, mild purgatives of calomel, jalap, etc., were used, in another aconite, and in still another benzoic acid with musk in large doses.

ROBERT SAUNDBY.

Symptomatic Indications.—The principal remedy for this condition is *phosphorus*; after phosphorus, *arsenicum* or *cinchona* may be useful.

LIVER, CANCER OF.—Cancer of the liver is generally secondary to cancer elsewhere, the primary disease being

most commonly situated in the stomach, but primary cancer of the liver is not rare.

Of primary cancers a considerable proportion begin in the bile ducts, and the disease is so often associated with gallstones that the irritation of them has been justly regarded as a cause. In other cases the cancer appears to commence in the liver tissue itself. Like cancer generally, it is rare before middle life, but affects both sexes, though it is more common in women.

Symptoms.—Secondary cancer of the liver often runs a latent course, and is only recognized on the post-mortem table. But in a typical case of cancer of the liver the patient suffers from gradual impairment of health and strength, loss of appetite, gradual appearance of cachexia, wasting and indications of chronic gastro-intestinal catarrh. Ascites and œdema of the legs supervene; jaundice is commonly present, and there may be pain over the liver.

On examination the organ is found to be enlarged, and is often tender; in the nodular form irregularities of the surface may be perceived on palpation. There is considerable variation in the symptoms, and the *diagnosis* is often beset with difficulty, especially when a primary cancer of the stomach has become adherent to the left lobe of the liver. Perhaps the most important symptom of cancer is an excessive loss of body weight.

The *duration* of the disease is usually from four to five months, but some cases far exceed this limit.

The *prognosis* is necessarily bad.

Morbid anatomy.—The cancerous liver is almost invariably greatly enlarged, while the new growth appears under four different forms.

1. The commonest form is as large, white, hard nodes, which, where they are visible on the surface of the organ, are distinctly umbilicated, and on section their cut surface becomes concave: less commonly the masses are softer. They are sharply marked off from the liver tissue, and their centers are usually undergoing fatty necrosis. Under the microscope they present the usual characters of cancer—epithelial cells lying in an alveolar stroma.

2. There is diffuse cancerous infiltration of the liver, with much thickening of its capsule and connective tissue.

3. The liver is beset with small nodules, varying in size from a pin's head to a walnut, which appear to grow in the interlobular connective tissue.

4. When the primary disease is in the region of the gall-bladder, an enormous mass of new growth may be present in the situation with secondary nodules elsewhere in the liver.

Treatment can be only palliative.

The pain can be relieved by morphine hypodermically; if the itching of the skin be very troublesome, sponging with vinegar and water, or pilocarpin (gr. $\frac{1}{8}$) hypodermically may be tried, but these remedies are uncertain. If the ascites be very great it may be quite worth while to draw some of it off by a trocar to relieve the pressure on the diaphragm.

ROBERT SAUNDBY.

Symptomatic Indications.—The principal remedy in this condition is *hydrastis*; *arsenicum* or *conium* may be sometimes useful.

LIVER, CIRRHOSIS OF (Interstitial Hepatitis).—This disease is essentially characterized by the formation of fibrous tissue in the liver, with consecutive atrophy or destruction of the glandular elements.

The following varieties may be distinguished:

1. Alcoholic cirrhosis.—The common form ("hobnail" or "gin-drinker's" liver). The organ is generally small, hard, and granular. The disease is frequently met with clinically in association with ascites. It is undoubtedly caused by the abuse of alcohol.

Symptoms.—The ordinary rule is for the cases to come under observation with more or less ascites, associated with various dyspeptic phenomena due to the gastric catarrh, such as morning sickness, loss of appetite, water brash, sour risings, and, later, hematemesis.

There is often great flatulence; the skin may have a subicteric tinge, and occasionally, though rarely, there is actually jaundice, probably by extension of catarrh from the duodenum to the bile ducts. The urine is generally scanty, high-colored, containing so-called febrile *urobilin*, and loaded with lithates; it often contains a little albumin. Enlargement of the spleen can generally be made out. On percussion, the liver dullness is notably diminished, especially in the

epigastrium, but even in the right vertical mammary line the area of dullness is reduced from $4\frac{1}{2}$ to 2 or $1\frac{1}{2}$ inches, or even less when there is much flatulent distention.

Ascites is absent in about one-third of the cases; when there is no ascites the case does not usually come under medical care until some serious and often fatal accident, such as hematemesis or the supervention of acute atrophy (*q. v.*), has taken place.

It is quite possible for this form of cirrhosis to go through its entire evolution without producing any marked disturbance of health. Some years ago the writer examined the body of a foreman engineer at a colliery, who had died suddenly of hematemesis. Although a hard drinker, he was a valued servant and a steady workman, not having lost a day's work for the previous two years. His liver was a most typical example of small "hobnail" cirrhosis, and he died, as these cases often do, from the rupture of a varicose esophageal vein.

The explanation of the absence of ascites is probably to be found in the venous enlargement taking place more readily and completely in certain cases. But it is common to find well-marked chronic peritonitis associated with cirrhosis of the liver, and it is possible that slight degrees of peritoneal inflammation may play a more important part in the production of the ascites of this disease than the prevalent mechanical theory would indicate.

Course and duration.—The disease is essentially chronic, and usually exists for one or two years before it comes under observation in its developed form. Even after that, such cases may go on for years, but, as a rule, the patients do not give up their drinking habits, and in that case recovery is hopeless.

Morbid anatomy.—The liver varies in size, but is ordinarily reduced in volume; when it is larger than normal there is usually marked fatty infiltration as well. The atrophy especially affects the right lobe, but there is a general reduction in every diameter. The color is usually a pale olive-brown. The surface is extremely granular, and the capsule thickened and opaque. The external biliary apparatus contains very little bile.

On section, the organ is tough, and the cut surface shows bands of fibrous tissue

traversing the organ in all directions and encircling groups of acini, which are often stained yellow; hence the name cirrhosis.

Under the microscope the new formation is seen to grow from the pre-existing connective tissue in the portal canals and interlobular fissures and spaces. The branches of the portal vein in the portal canals are dilated and thickened. The branches of the hepatic artery are also thickened, while there is frequently an abundant new formation of capillary bile ducts around the margins of the affected acini. The acini are slowly invaded from their periphery by the encircling growth, their rows of cells undergoing retrogressive changes, losing their protoplasm, and apparently becoming in some places converted into cubical epithelium which lines the newly formed ducts; in other places they disappear by direct transformation into connective tissue. The hepatic cells can be seen to be enlarged, and their nuclei have divided and proliferated to form groups of round cells, out of which connective tissue is formed.

Ascites is frequently present. There is often great dilatation of the subdiaphragmatic, gastric, and esophageal veins, which may be as large as the femoral or iliac veins. The spleen is generally much swollen. The kidneys usually present some degree of chronic inflammatory induration. The mucous membrane of the stomach shows an advanced stage of chronic catarrh, being grayish colored, covered with thin mucus and mammillated.

Treatment.—The patient should become a total abstainer, and his diet should consist of light meats, fish, fowl, eggs, milk, cream, bread, butter, small quantities of well-cooked vegetables, and some alkaline mineral water or aerated distilled water. The ascites should be tapped and drawn off as often as it reaccumulates. If this be persevered in, the fluid will eventually, in many cases, cease to be poured out.

If tapping be absolutely objected to, the fluid may be got rid of by purging with bitartrate of potash—*R*. Potassii bitartratis 3 ss, mellis 3 j; sig. This may be given as often as required to keep up free purgation—but its use is not unattended with danger, and is not to be recommended in place of tapping. The effect of the cessation of the effusion is to bring the patient into a condition like

that of his fellow-sufferers who do not acquire ascites. He is still liable to death from hematemesis, due possibly to rupture of a distended esophageal vein.

2. Cardiac or cyanotic cirrhosis has been described as a consequence of prolonged venous hyperæmia (*see* LIVER, HYPER-ÆMIA OF), depending upon pulmonary or cardiac disease.

The liver is at first enlarged, but may atrophy; it is usually hard, with a thickened capsule, and is of a dark color. The liver cells around the radicles of the hepatic vein in the centers of the acini become destroyed, and are partly replaced by fibrous tissue, mingled with granules of blood and bile pigment. There is often slight jaundice, the liver is tender; the peritoneum contains fluid.

The *diagnosis* rests upon the recognition of the disease in the thoracic organs.

Treatment must be directed to the cause of the obstruction.

3. Biliary cirrhosis is best seen in cases where there is some permanent or protracted occlusion of the common duct, as by a calculus.

Early jaundice is a leading feature in the clinical history,

The liver is generally enlarged, but may undergo atrophy; its surface is tolerably smooth, its tissue deeply bile-stained and traversed by fibrous trabeculæ. Charcot has pointed out that the bands of fibrous tissue embrace single acini (monolobular) instead of groups of acini, as in alcoholic cirrhosis (polylobular). The increase of capillary bile ducts is often very well marked, but not so as to constitute a distinctive feature, as has been asserted. Ascites is generally absent.

The *course* of these cases is chronic, but they are very unfavorable. They terminate sometimes with partial acute atrophy, and often with so-called uræmic (? cholæmic) symptoms—*e. g.*, muttering delirium, dry tongue, and stupor.

Treatment.—Can be only palliative. The diet should consist of light animal and farinaceous food, with no uncooked fruit or vegetables, no pickles, condiments, or strong wines or spirits. Some alkaline water (Vichy) should be taken twice a day with lemon-juice or claret. The bowels should be kept open by saline purgatives—Carlsbad salts or Hunyadi water—and if there be any gastric irritability, bismuth (grs. x) should be given before food.

4. Syphilitic cirrhosis.—The disease which most truly deserves this name is only seen in congenital syphilis in children.

Symptoms.—The child usually presents other signs of congenital syphilis—*e. g.*, depressed nasal bones, atrophied incisor teeth, a yellow cachectic skin. The enlargement of the liver is the only local sign of the affection.

Morbid anatomy.—The liver is enlarged, the capsule opaque, and the surface smooth. On section, it is tough, and in parts the liver tissue has undergone complete fibroid transformation. Under the microscope the growth is seen to invade the lobules, destroying them cell by cell; hence Charcot's designation, "monocellular cirrhosis." In adults, cirrhosis may be combined with gummatous deposit. In the latter case waxy degeneration may also be present. The spleen is always enlarged.

Treatment.—Small doses of mercury, gr. $\frac{1}{12}$ thrice daily, with syrup of the iodide of iron and cod-liver oil, good food and fresh air afford the best chance of arresting the disease and eradicating the constitutional malady.

In **gummatous cirrhosis** the *symptoms* are usually obscure unless the cirrhosis be well marked. The cases are commonly regarded as examples of alcoholic cirrhosis, as the external manifestations of syphilis are often but slight when the effects of the poison on internal organs are very marked. It may give rise to jaundice or ascites or to hematemesis. The liver may be enlarged, or atrophied, or irregular in shape owing to the cicatricial contraction of old gummata.

In many cases the *diagnosis* is only made on the post-mortem table.

Treatment.—When the nature of the disease is recognized, it should be that of constitutional syphilis. Iodide of potassium in full doses, 3 ss three times a day, with 3 j doses of liq. hydrargyri perchloridi, or, better, small doses of calomel gr. $\frac{1}{2}$ thrice daily.

5. Tubercular cirrhosis occurs in phthisical patients without producing any symptoms.

The liver is enlarged, smooth, and of normal consistence; on section, its surface shows a meshwork of fibrous bands running between the lobules, and there is a very great development of capillary bile ducts in the newly formed connective tissue around the lobules.

It is doubtful if it could be diagnosed during life, as enlargement of the liver in phthisis commonly occurs from venous congestion or fatty infiltration or waxy degeneration.

It is probable that the cirrhotic livers described in connection with certain cases of tubercular peritonitis belong to this class.

6. Malarial cirrhosis.—The indurated and pigmented liver met with in the subjects of malarial poisoning.

The *symptoms* are indefinite; jaundice is often present, and there is frequently a sense of weight in the hypochondrium while, on examination, the liver is found to be enlarged. It is usually associated with chronic gastric catarrh. The spleen is also enlarged.

The organ is usually large and dark, tough on section, and under the microscope the new growth is seen in the portal canals, fissures, and spaces of the liver, from whence it penetrates the lobules. The connective tissue is loaded with pigment.

Treatment.—Consists in the administration of a course of arsenic in small doses combined with nitro-hydrochloric acid and a bitter infusion, and the use of mercurial purgatives and saline or alkaline mineral waters—*e. g.*, Carlsbad or Vichy.

7. Scarlatinal cirrhosis is a possible explanation of certain examples of cirrhotic liver met with in young children. An interstitial hepatitis seems very commonly to form part of the morbid anatomy of scarlatina, but it is a microscopical fact without any clinical features that are known.

8. Rachitic cirrhosis has been recently described as occurring in young children. A very important point in its ætiology is *chronic gastro-intestinal* catarrh, from which these children have generally suffered.

The *symptoms* are chiefly those of chronic or intermittent gastro-intestinal catarrh, constipation alternating with attacks of diarrhea. The child's appearance is cachectic and it has a strong superficial resemblance to a case of congenital syphilis, but there is an absence of specific signs and history. There is no doubt that the two conditions are not identical.

Morbid anatomy.—The liver is enlarged, smooth, and of normal color or

pale from fatty infiltration. On section it is tough, and on microscopical examination there is an increase of connective tissue in the interlobular fissures and spaces, assuming a "monolobular" distribution, and accompanied by a considerable new formation of biliary canaliculi. The spleen is also enlarged.

Treatment.—Calomel in small doses is best from gr. $\frac{1}{12}$ to $\frac{1}{8}$ three times a day with syrup of the iodide of iron and cod-liver oil, fresh air and good food. Care should be taken to exclude from the diet uncooked fruit and vegetables, and even cooked vegetables which contain much vegetable fiber—*e. g.*, carrots, parsnips, stewed celery, onions. In obstinate cases all vegetable, starchy, and saccharine articles of diet must be forbidden.

ROBERT SAUNDBY.

Symptomatic Indications.—The principal remedy in the treatment of this condition is *phosphorus*; *nux vomica* is valuable when the disease is the result of alcoholic excess, or of malarial poisoning; *cinchona* and *arsenicum* are useful when the disease arises from malaria: *arsenicum*, when there is much debility, chronic cases; *mercurius* and *kali hydriodicum* when from syphilis. *Bryonia* and *chilodonium* are useful for hepatic pains; *apis* and *apocynum* for serous effusions into the peritoneal cavity; *digitalis* for cardiac complications and debility.

LIVER, HYPERÆMIA OF.—

Symptoms.—In *mechanical congestion* the main symptom is increased size of the percussion area of the liver, with perhaps a palpable displacement downward of its anterior border.

In *active congestion* there is often pain in the right hypochondrium, or a sense of weight and fullness there. Jaundice, gastric disturbance, mental depression, and ascites may be present.

The urine is generally diminished in amount and loaded with lithates; it often contains albumin, and sometimes bile pigment or febrile urobilin.

Course and duration.—This will depend upon the causation. When of a temporary nature the liver recovers with the cessation of the cause, but when it is permanent no improvement can be looked for. In congestion from chill recovery is usually rapid and complete, though there is a liability to recurrence.

Diagnosis.—It is necessary to exclude

the various organic diseases, which can only be done by a knowledge of their symptoms and relationships.

Morbid anatomy.—In *mechanical congestion* due to obstruction of the circulation the liver is at first enlarged and soft; later it becomes reduced in size, of firm consistence, and darkened from the deposit of pigment. The central veins of the acini are dilated, and the surrounding cells are more or less destroyed. This is the condition called *cyanotic induration* of the liver. In many cases there is an accumulation of fat in the portal zones of the acini, giving rise to a peculiar mottled appearance called the *nutmeg liver*. There is some increase of connective tissue, the capsule of the liver is thickened, and the surface is more or less finely granular.

In *active hyperæmia* the liver is dark red, soft, and vascular.

Ætiology.—Mechanical congestion may result from heart or lung disease, pleural effusion, intra-thoracic tumors, or tumors compressing the vena cava just after its junction with the hepatic vein.

Congestion may also result from high living, sedentary habits, and abuse of certain articles of diet, especially alcohol.

Chills seems to be a not uncommon cause of active congestion of the liver in predisposed subjects.

Treatment.—In all *mechanical congestions* remove, as far as possible, the cause. The hyperæmia may be relieved by saline purgatives, by euonymin, calomel, and other cholagogues.

Acute hyperæmia from chill should be treated by hot fomentations and large doses of calomel (5 to 10 grains). The diet should be simple and all substances tending to cause hyperæmia should be avoided—*e. g.*, alcohol, meat, sugar. The following pill is useful: \mathcal{R} , Euonymini gr. j. extr. aloes, grs. ij; extr. belladonnæ, gr. $\frac{1}{4}$; ft. pil.; sig. One to be taken half an hour before the principal meal of the day. It is especially useful in obesity with hepatic congestion.

ROBERT SAUNDBY.

Symptomatic Indications.—*Nux vomica* is the principal remedy when the congestion is the result of an excess of stimulating food or alcohol; *cinchona* is valuable when the congestion occurs during or after an attack of intermittent fever; *bryonia*, when subinflammatory, pain in right shoulder, enlargement and hardness

of liver, constipation; *iris versicolor* is serviceable when the liver is irritable with diarrhea, sick headache, vomiting, prostration; *nitric acid* is useful in chronic congestion, with dropsy, *sulphur*, in passive congestion from portal engorgement; *sepia* is useful for congestion from uterine derangement; *chelidonium* in chronic congestion, yellow tongue, nausea, dull headache, constipation; *arsenicum* in severe chronic cases, enlarged spleen, vomiting, debility, ascites; *mercurius* in torpidity of liver, dull pain, pale offensive stool; *podophyllum*, active congestion, diarrhea, prolapsus ani, bitter taste, sallow complexion.

LIVER, HYDATID OF.—See HYDATID DISEASE.

Symptoms.—A hydatid tumor produces effects varying with its size and situation in the liver. It may cause displacement of other organs, compression and obstruction of the bile passages and portal vein, leading to jaundice or ascites. It may rupture into the pleura or lung, discharging its contents through the bronchi; or into the bile passages through the common duct, causing jaundice and pain and simulating the passage of gall-stones. It may rupture into the inferior vena cava or hepatic vein, causing death by embolism of the hepatic artery, or into the abdominal cavity, causing peritonitis.

The *diagnosis* is difficult, and may be impossible. A slowly growing tumor of the liver unattended by grave constitutional symptoms, especially if it give evidence of fluctuation, is probably an "hydatid." An exploratory puncture with a fine needle will afford positive information if the cyst be not inflamed. Hydatid fluid is clear, free from albumin, of low sp. gr. (1007 to 1015) and contains a large amount of chloride of sodium. It may contain sugar.

Under the microscope, hooklets or even tapeworm heads may be found in the sediment, or pieces of hydatid membrane may be obtained. The latter are recognizable by their characteristic serrated lamination. When the cyst is inflamed, puncture is not so valuable, but hooklets may be found in the pus under the microscope; in this case differential diagnosis is not so important, as operative interference should be undertaken in any case. Multilocular cysts are said to be always accompanied by swelling of the spleen.

The *prognosis* in cases of simple cyst is good; and even in suppurating or multilocular cysts a cure may be hoped for.

Treatment.—Simple cysts can be usually cured by merely *withdrawing the fluid by a fine needle or aspirator*. Injection with iodine has been performed, but is not recommended. Electrolysis is not free from danger. Suppurating and multilocular cysts should be treated by free incision, the edges of the cyst being stitched to the abdominal wall and the cavity drained.

ROBERT SAUNDBY.

LIVER, PARASITES OF.—The following parasites occasionally localize themselves in the liver: *Tænia echinococcus*, *distoma hepaticum*, *distoma lanceolatum*, *distoma hæmatopium*, *pentastoma denticulatum*, *psorospermæ*, and *cysticercus cellulosæ*. Of these the *echinococcus* is the only one which ordinarily gives rise to symptoms (see LIVER, HYDATID OF).

Psorosperms are very rare in man, but are common in the livers of rabbits. They are said to be gregarinæ at rest. They form small white cysts containing a milky fluid, in which, besides epithelial cells and pus corpuscles, psorosperms can be seen under the microscope (see PSOROSPERMIÆ).

The *pentastoma denticulatum* is the embryo of the *pentastoma tænioides*, which haunts the nasal cavity of the dog. It has been found chiefly in Egypt, but also in Germany. It occurs in the liver in the form of rounded nodules, the size of a pin's head, which are composed of a connective-tissue capsule, inclosing the parasite, which is generally infiltrated with salts of lime. If these are dissolved by acids the feet and skin of the parasite can be recognized. The latter is studded with fine thorns alternating with rows of double-contoured stigmata. When a large number of these parasites invade the liver at one time, they give rise to grave constitutional disturbances.

ROBERT SAUNDBY.

LOCOMOTOR ATAXIA (Tabes Dorsalis).—The variety of the symptoms is so wide, and their grouping so irregular, that it is difficult to give a general definition of the disease. Broadly, it may be said that the affection is characterized clinically by the absence

of the knee-jerk, by inco-ordination of movement, by the absence of nutritive changes in the muscles of the affected limbs, by the frequent occurrence of pains and sensory disorders, and by various nervous symptoms. The chief anatomical change is sclerosis of the posterior columns of the spinal cord, and more especially of the posterior-root zones.

Symptoms.—The occurrence of severe pains, especially if they be of short or momentary duration, together with absence of the knee-jerk, suggests the probability of locomotor ataxy. These may be the only indications for months or years, but sooner or later the disease justifies its name and symptoms of ataxy or inco-ordination make their appearance. Among other symptoms likely to occur at an early period are diminution of sensibility of the soles of the feet, temporary paralysis of the external ocular muscles, incontinence of the urine or difficulty in passing it, loss of sexual power, sometimes preceded by marked increase, and lastly loss of the reflex action of the iris to light.

Pains.—Most commonly are sudden, so-called "lightning pains," affecting mainly the lower limbs, but sometimes also the arms, head, and trunk. Occasionally the pains are described as burning, stabbing, constrictive, or rheumatic. The attacks tend to come on in paroxysms, lasting a few hours or a few days. The pains may or may not follow the distribution of a nerve. In rare cases an erythematous, vesicular, herpetic, or bullous eruption appears in the track of the pain, especially when this can be referred to the distribution of an individual nerve.

Visceral pains are present in many cases; they are usually paroxysmal and very severe. When referable to the stomach they are accompanied by obstinate vomiting, faintness, and occasionally by slowness or irregularity of the action of the heart. Such attacks are termed "gastric crises." Rectal, nephralgic, vesical, urethral, bronchial, and laryngeal crises are also described. Of these the last only demands notice. Most commonly there is severe paroxysmal dyspnoea, due to laryngeal spasm, and resembling an attack of laryngismus stridulus. In some of these cases paralysis of the abductors of the larynx has been found.

Sensory disorders.—Loss or diminution of sensibility is usually present in an ordinary case. It affects the lower limbs, and more especially the soles, which feel to the patient, when standing, as though padded. Anæsthesia may involve the arms, trunk, and rarely the head. All the various forms of sensibility may be affected, but some may be involved more than others. Retardation of perception and impaired localization are common. Anæsthesia may be present in other parts, such as the muscles, joints, or even the viscera. The muscular sense is usually diminished in the advanced stages, so that the patient does not know the position of his limbs when the eyes are closed.

Motor symptoms.—Inco-ordination is the special motor symptom in locomotor ataxia, and usually supervenes slowly. At first the condition is one simply of clumsiness, as shown by some difficulty in walking in the dark, or in attempting to turn round quickly when walking. If the patient be made to stand with his feet together, his eyes being closed, he sways, and may fall unless supported. Later the gait becomes affected in a characteristic way. Standing with the trunk bent forward and the legs apart, his eyes fixed on the ground, the patient proceeds by throwing the limb forward and outward, at the same time raising it too high. The foot is brought to the ground violently, the heel touching first. As each limb is brought forward in progression the trunk is moved from side to side and the arms thrown here and there in order to maintain the equilibrium. After a few steps the gait becomes less irregular, and the patient may walk a considerable distance with comparative ease. At an advanced period walking, or even the upright posture, may be impossible. But as the patient lies in bed the ataxy of his lower limbs is very evident, when he tries to touch an object with his foot. Throughout the disease the muscles of the lower limbs, however great the inco-ordination, usually preserve their normal bulk and strength, and the electrical reactions are intact. The upper limbs frequently become affected with inco-ordination. Often writing is first noticed to be imperfect, or some difficulty is experienced in picking up fine objects or in buttoning or unbuttoning. Inco-ordination of the hands can

be brought out by the observer asking the patient to touch his nose with the index finger when the eyes are closed, or to bring the tips of the forefingers together. In other cases the uncertainty of the movement is very obvious, the patient being unable to feed himself or to perform other necessary duties. In exceptional instances the muscles of the trunk are affected by ataxy. Articulation also occasionally becomes slow and jerky from inco-ordination of the muscles concerned.

Reflexes.—The knee-jerk is almost invariably absent at the earliest period, often long before other symptoms make their appearance. The plantar reflex is usually normal, sometimes diminished or delayed, and occasionally in the early stage increased.

Eye symptoms.—The pupils are often small (*myosis*) and in the majority of cases the reflex action of the iris to light is abolished, while the contraction on accommodation is preserved. The pupils may be unequal or irregular; occasionally they are of average size, or even large. Erb has pointed out that in many cases the pupils do not dilate on painful stimulation of the skin of the neck. Loss of accommodation sometimes occurs from paralysis of the ciliary muscle.

Temporary paralysis of the external ocular muscles, leading to squint and double vision, occurs usually in the early stages. In the advanced periods persistent paralysis may be present, such as ptosis alone or ptosis together with palsy of the other parts supplied by the third nerve, or convergent squint from paralysis of the sixth nerve. Paralysis of the third and sixth nerves is often present in cases having a syphilitic origin. Ataxic nystagmus occurs rarely, and usually when the disease is advanced. The two following forms of paralysis are comparatively rare: (1) Impaired power of the internal recti when acting together in convergence, the same muscles acting well when associated with the external recti in lateral movements (paralysis of convergence). (2) Ophthalmoplegia externa, or paralysis of most or all of the external ocular muscles.

Atrophy of the optic nerve, often quite an early symptom, is present in a certain proportion of cases. This condition gives rise to color-blindness, to con-

traction of the visual field, and, lastly (sometimes soon, sometimes after the lapse of years), to total blindness.

Affections of other cranial nerves.—Deafness from atrophy of the auditory nerve occurs as a rare condition, and still more uncommon are disturbances of taste and smell. Hemiatrophy of the tongue from disease of the hypoglossal nerve, paralysis of the facial, and paralysis of the abductor muscles of the vocal cords have been described.

Affections of joints and bones.—Tabetic arthropathy usually occurs early in the disease, and affects mainly the large joints, such as the hips, knees, ankles, and shoulders. In many cases the affection commences suddenly, with painless effusion into and around the joint. Later, disorganizing changes may take place, the cartilages becoming eroded, the heads of the bones atrophied, and the ligaments calcified. Bony outgrowths are often developed in and around the affected joint after the lapse of time. Dislocations are frequent. The shafts of the bones sometimes become brittle, spontaneous fractures occurring; the union of such fractures is accompanied by an over-abundant callus.

Various trophic changes.—Cutaneous eruptions have been described as occurring after the paroxysmal pains. Perforating ulcer of the foot is not unfrequent. Nutritive changes in the nails, falling out of the teeth, changes in the pigmentation of the skin and hair are of occasional occurrence. Sometimes rapid wasting of muscles supervenes in ataxy, and in such cases there is every reason to believe that the anterior gray matter of the cord has been affected secondarily.

Course of the disease.—Sometimes the affection does not pass beyond the first stage, which is characterized by absence of the knee-jerk, lancinating pains, and slight unsteadiness, with perhaps absence of the light reflex of the iris. In a typical case, anæsthesia with marked inco-ordination sooner or later makes its appearance. Commonly, when these symptoms become evident, the lightning pains disappear or become less frequent and severe. Later the various symptoms are irregular in their appearance and development. Sometimes the disease, in whatever stage it may be, remains without material change for months or years; sometimes

abrupt exacerbations occur, often dependent on secondary extension in the nervous centers or on affection of the peripheral nerves. Occasionally marked amelioration takes place, and the improvement may be maintained for considerable periods. Death usually proceeds from intercurrent maladies, but occasionally results from complications occurring in the course of the disease, such as cystitis and pyelitis, or to the formation of bed-sores.

Complications.—Extension of the morbid process to other parts of the cords may take place. When the lateral columns are invaded, marked muscular weakness without wasting is superadded to the inco-ordination. Muscular atrophy from involvement of the anterior gray matter is common, and as a rare condition true progressive muscular atrophy may be noted. Symptoms of the locomotor ataxy are frequent in general paralysis of the insane, sometimes preceding, sometimes following, the characteristic features of the latter disease. It may be mentioned here that in ataxy, as in general paralysis, acute cerebral symptoms, such as convulsions, may take place, but their occurrence in the former is much rarer than in the latter. Myelitis may come on in the course of ataxy, and its existence will be made clear by the rapid supervention of various spinal symptoms, such as diffuse muscular wasting, with loss of sensation and urinary complications. Ordinary hemiplegia occasionally coexists with locomotor ataxy, and sometimes symptoms due to independent syphilitic lesions in the brain. Cardiac disease, especially aortic valvular incompetency, is present in a proportion of cases.

Diagnosis.—There will usually be no trouble in differentiating between diphtheritic paralysis and locomotor ataxy. Occasionally, however, the absence of the knee-jerk is the sole indication in the former of any change in the nervous system. In such the suspicion of early tabes may arise and necessitate a careful inquiry into the history of the patient. In alcoholic neuritis symptoms resembling locomotor ataxy are sometimes present. The history of alcoholism, the presence of motor weakness as well as of inco-ordination, the existence of muscular wasting, with change in the electrical reactions, and the hyperæsthesia on deep pressure, are char-

acteristic of alcoholic pseudo-tabes. Disease of the cerebellum is often accompanied by a staggering gait, suggesting locomotor ataxy. In cerebellar disease, however, there are no lightning pains and no impairment of sensation, whereas severe headache, vomiting, and optic neuritis are common. The knee-jerk, with few exceptions, is present in cerebellar disease. In general paralysis of the insane, tabetic symptoms are frequent, and not uncommonly play a prominent part in the symptomatology. In some cases the only indication of the more serious affection may be slight tremor of the face, with some defect of speech and possibly some degree of emotional disturbance. In every case of ataxy having an onset and course more than usually acute, the suspicion of general paralysis should be entertained. It occasionally happens that ataxy forms a marked symptom in disseminated sclerosis. Some of the characteristic symptoms, such as nystagmus, vertigo, tremors of the hands and tongue, and the slow, scanning speech, will usually be found at an early period.

Prognosis.—Its course is essentially chronic, but fortunately by no means always progressive. Inco-ordination may never be present, or, if present, may be insignificant. Remarkable improvement frequently occurs independent of treatment, occasionally even in advanced stages of the disease. The lightning pains usually tend to become less severe and frequent in the course of time. Visual defects from disease of the optic nerve as a rule undergo no improvement.

Morbid anatomy and pathology.—The spinal pia mater is thickened and adherent, especially on the posterior surface, and the cord itself is reduced in size and flattened from before backward. The posterior nerve roots are gray and atrophied in the lower part of the cord. On section, the posterior columns in the sacral and lumbar regions show extensive gray, translucent change; higher up the degeneration is less obvious, and is usually limited to the postero-median columns in the cervical region. Sometimes degeneration in the lateral columns can be made out by the naked eye. The precise degree of change in the posterior columns is subject to certain variations.

Not unfrequently the entire extent of

the posterior columns is degenerated in the sacral and lumbar regions, the postero-external columns or posterior root-zones becoming less and less affected on passing from the lumbar enlargement upward. The anterior part of the postero-external column is often only slightly affected. The postero-median columns invariably undergo degeneration throughout their entire length, the change being traceable to the fasciculi graciles—the continuation of these columns in the medulla. In some cases the posterior root-zones are involved in the dorsal and cervical regions, and in exceptional cases the entire posterior columns may be densely sclerosed throughout all the regions of the cord. A comma-shaped tract of fibers, degenerating from above downward, and probably commissural, is often found degenerated in the dorsal region, where it occupies the middle of the anterior part of the posterior columns. The fibers of the posterior cornu frequently undergo degeneration. The so-called antero-lateral tract and the direct cerebellar tract are commonly degenerated, and occasionally the pyramidal tracts are invaded. Rarely the cells in the anterior gray matter undergo atrophy from extension of the disease in the posterior columns along the internal radicular fasciculi.

The walls of the small vessels are usually much thickened, and the sclerosis is often most obvious in their neighborhood. The primary change, however, consists in a degeneration of the nerve fibers in the posterior roots, the sclerosis being secondary. In some cases the peripheral nerves have been found degenerated. Many of the symptoms of tabes dorsalis are easily intelligible from the consideration of the morbid anatomy of the disease. The pains are due to irritation of the posterior nerve roots, but it is not so easy to explain the intermittent character of these pains; possibly it may be ascribed to changes in vascular supply or pressure. Anæsthesia is caused by destruction of the posterior roots and the loss of the knee-jerk by disease of the afferent part of the reflex loop. Acute muscular wasting and marked paralysis without atrophy are due respectively to secondary implication of the anterior gray matter and of the lateral columns. Certain symptoms are clearly dependent on affection of the peripheral and cranial nerves. No satisfactory explanation of the inco-ordination has been

adduced. Ataxy may be extreme when cutaneous and muscular anæsthesia are slight or even absent. There is, indeed, no necessary relation between the two conditions. The fact that some of the posterior root fibers pass by the lateral columns of the cord directly to the cerebellum, strongly suggests that the inco-ordination is due to disease of the cerebello-afferent fibers.

Ætiology.—The disease is much more common in males than in females, and the majority of cases occur between the ages of thirty and fifty. Prolonged exposure to cold and wet, great mental and bodily exertion, and injury to the spine have probably some share as predisposing agents. Heredity has some influence, the disease occasionally occurring in subjects in which there is a family history of insanity, epilepsy, or other nervous affections. The influence of sexual excess and of alcoholism is doubtful. In a considerable proportion of cases a history of syphilis is obtainable. The precise ætiological share which it holds in the production of tabes is uncertain. It is believed by Gowers that, by lowering the resisting power of the nerve-elements, it acts indirectly as a permissive agent. The lesion in tabes, however, is of a "system" nature, and it is improbable that it is directly syphilitic.

Treatment.—Avoidance of depressing influences, either bodily or mental; careful attention to diet, and avoidance of excess in alcohol and tobacco should be enforced. Rest in bed is often followed by marked improvement. Iodide of potassium may be given in doses up to 30 grains three times daily, and with it bromide of potassium may be combined. Nitrate of silver (in dose of $\frac{1}{8}$ to $\frac{1}{3}$ grain) and arsenic are highly recommended. Iron, quinine, nux vomica, ergot, belladonna, and cod-liver oil have been frequently employed, but their action for good is doubtful. Morphine is often the only efficient agent in relieving the lancinating pains. It should be used with caution. Cannabis indica is sometimes a useful substitute.

Hypodermic injections of cocaine, applied locally, occasionally relieve pain. Antipyrin has also been used with benefit, but its action is not constant. For the relief of pain, blisters, chloroform applications, and the warm bath may also be used. Blisters or the actual cautery to the spine are occasionally of use in the early

periods. Sulphur and saline thermal baths and the cold pack have been recommended. The constant current in an ascending direction applied to the back has been occasionally of some benefit, especially when muscular wasting existed. Faradization over the hypogastrium is useful in vesical weakness. The bladder should be regularly emptied and washed out if there be residual urine and evidence of cystitis. Within the last few years nerve-stretching has been performed, chiefly with the view of relieving pain. Occasionally the operation has been followed by improvement in the inco-ordination. The results of nerve-stretching are not always beneficial, and when improvement has followed it has usually been temporary. The great sciatic nerves have usually been selected for operation.

Quite recently Charcot has warmly advocated the suspension of the patient by Sayre's apparatus in the ordinary manner. The duration of suspension is, at the outset, half a minute. At each application the period is increased by half a minute, but the longest time should not exceed, at the outside, four minutes. The suspensions should not be carried out oftener than every other day. While the patient is suspended he should be made to raise his arms away from the body, and nearly at right angles to it, at intervals of every fifteen or twenty seconds. Under this treatment inco-ordination becomes less marked, or may even disappear, the lightning pains diminish, the functions of the bladder are partially or entirely restored, sexual power returns, and anæsthesia may give place to sensibility; the absence of the knee-jerk and the condition of the pupils are persistent. This treatment is not invariably of service. In some cases, at least, the beneficial result has been but temporary.

W. B. HADDEN.

Symptomatic Indications.—The most generally useful remedy is *belladonna*, the inco-ordination is marked in both upper and lower extremities; raises the feet slowly, when walking, puts them down with force, weak and tottering gait, trembling of the muscles, great restlessness, sudden startings. *Argentum nitricum* is useful when weakness and paralytic feeling are most apparent in lower limbs, cannot walk in the dark without staggering, numbness and want of feeling in the limbs. *Physostigma*, when there is feel-

ing of unsteadiness and insecurity in walking, has to tread carefully, especially in dark, has to walk with a cane or other support. *Phosphorus*, heavy paralytic feeling in the limbs, great restlessness of limbs, pains darting from hip-joint, sexual irritation, great irritability, and nervousness. *Gelsemium* is useful when there is paralysis of all the limbs, sharp, darting pains, like electric shocks, through the limbs, muscles feel sore and bruised, numb feeling through the limbs. *Nuxvomica* is valuable for numbness and paralysis in lower limbs, unsteadiness of gait, tottering and giving way of the knees, with extreme weakness, paralysis of the bladder, constipation. *Helleborus*, when the muscles do not act in harmony unless the attention is fixed upon the movement; walk slow and tottering, weakness and numbness of feet, with prickling sensation.

LOOSE CARTILAGE.—See JOINTS.

LONG SIGHT (Hypermetropia).—See REFRACTION.

LORDOSIS.—See SPINE, DISEASE OF.

LUMBAGO.—See MUSCULAR RHEUMATISM.

LUNGS, CIRRHOSIS OF.—Chronic pneumonia, chronic interstitial pneumonia, indurative pneumonia, ulcerative pneumonia, fibroid induration of the lung, fibroid phthisis, are other names used to designate the same affection, but the term cirrhosis is preferred, as it implies no theory.

Pathology.—Cirrhosis of the lung is a condition characterized by consolidation of the pulmonary texture consequent upon an overgrowth of connective tissue. Contraction and excavation of the lung, bronchial dilatation, thickening and adhesion of the pleura are generally, but not necessarily, associated with cirrhosis. The pulmonary induration may remain stationary for a long period of time, but more often a tendency to extension is manifested. Fibrous changes in the lung may be the result of several different causes, of which tuberculosis is the most common and important. Few cases of tubercular phthisis run their course without inducing some degree of fibrous induration.

Cirrhosis may be *massive*, *insular*, or *reticular*. In the *massive* form, one or more lobes of the lung are converted into

a tough, grayish, airless substance, which commonly shows pigmentation or marbling on section. In the early stages the consolidation closely resembles red hepatization, from which it is only distinguished by its greater toughness. The consolidation may be uniform, or small islets of partially spongy tissue may be scattered through the solid lung.

The disease is generally confined to one lung, and the lower lobe, as a rule, is mainly or exclusively affected, though the whole lung may be more or less involved. In rare cases cirrhosis may attack the upper lobe in the first instance.

Except in the early stages, some degree of shrinking of the affected lung is an invariable occurrence. The bronchi commonly show a diffuse cylindrical dilatation, saccular expansions being less frequently observed. Sacculated bronchiectasis is very apt to be complicated by ulceration of the bronchial wall, giving rise to irregular cavities; but ulcerative excavation of the lung may develop without the intervention of bronchial dilatation. It is important, however, to recognize that bronchiectasis and the formation of vomicæ are not essential accompaniments of the cirrhotic process.

The *insular* type of cirrhosis is sometimes met with in the less diseased portions of lungs affected with massive induration, but in other cases it constitutes the prevailing character of the lesion. Saccular dilatation of the bronchi is more generally combined with this variety of cirrhosis than with any other, but at the same time cylindrical bronchiectasis is also very common. The lung tissue separating the indurated patches may be unaltered, or it may be marked by fibrous strands extending from the larger cirrhotic foci. Varying degrees of emphysema are also very common.

In the *reticular* form of cirrhosis the lung is traversed by pigmented, tough, fibrous bands, which cross one another at various points, forming a sort of trellis-work. This change may be confined to the base, or to special parts of the organ, and in exceptional cases may be uniformly distributed throughout both lungs. The intervening tissue is often more or less emphysematous, and sometimes presents a condition of brown induration.

Caseous nodules are absent in all forms of this affection, but tuberculosis occasionally develops as a secondary disease

in cases of advanced non-tubercular cirrhosis.

Small aneurisms sometimes develop in the cavities, as in cases of chronic tubercular phthisis, and give rise to fatal hemorrhage. Slight hemoptysis may be produced by erosion of small vessels in the cavity walls, and possibly also by rupture of the dilated capillaries in the diseased bronchioles. In all forms of cirrhosis some degree of thickening and adhesion of the pleura is almost invariably present, and this condition is most pronounced where the induration of the lung is greatest. The pleura may be comparatively little affected in reticular cirrhosis.

As regards the relation between bronchiectasis and cirrhosis, it may be stated that bronchial dilatation, in the great majority of cases, is secondary to pulmonary induration. Shrinking of the lung tissue by its traction on the tubes, coupled with the greater influence of inspiratory pressure on the elastic bronchial walls than on the unyielding thoracic parietes, the expiratory pressure of cough, diminished power of resistance on the part of the altered bronchial tissues, and accumulation of secretions in the tubes surrounded by rigid lung, are probably all concerned in different degrees in the production of bronchiectasis. Bronchial dilatation occasionally leads to gangrene of the lung.

The *microscopical appearances* consist in a growth of connective tissue replacing the vesicular structure of the lung. In some cases a small-celled infiltration is found irregularly distributed about the margins of the cirrhotic masses. At other times sharply defined, rounded collections of small cells, possibly distended lymphatic vessels, are seen in various parts. Collapsed alveoli with thickened walls, and irregular spaces lined with short, cubical epithelium suggesting an adenomatous structure, and due to compression of groups of air sacs and alveolar passages, are also common appearances. Bunches of dilated capillaries may often be seen in large numbers, especially in the walls of the smaller bronchi.

The changes described refer more especially to cirrhosis of long standing. In the earlier stages the disease may often be seen to consist of a fibro-cellular thickening of the alveolar walls, causing compression and collapse of the pulmonary vesicles. A similar growth is almost in-

variably witnessed in the interlobular and peribronchial spaces. The alveoli in many places contain collections of large epithelial cells and leucocytes, but in some instances they are filled with an opaque fibrinous material, and no distinct epithelial lining is visible. In such cases it is not unusual to find evidence of a process of intra-alveolar cirrhosis, depending on the ingrowth of granulation tissue from the alveolar walls into the substance of the fibrinous plug. This process has with much reason been likened to the organization of a thrombus.

The development of connective tissue cannot always be traced to the alveolar walls, even in the early stages, and the fibrous growth seems to start from the peribronchial and perivascular sheaths.

The framework of the lung consists of the subpleural, interlobular, peribronchial and inter-alveolar connective tissue, which is continuous throughout, and is brought into the closest relationship through the lymphatic and bronchial blood vessels which ramify along these lines. Hence it is easy to understand how any irritant acting upon one part of the pulmonary connective tissue may affect other sections of the same system.

In comparatively rare cases the cirrhotic process commences at the pleural surface, and spreads inward along the interlobular septa.

The smaller bronchi always show some alteration, being usually more or less dilated and distended with secretion. The epithelium, as a rule, has undergone irregular desquamation, groups of columnar, ciliated or short cubical cells being separated by gaps where no epithelial lining remains. The basement membrane is sometimes thickened and glassy-looking; at other times no trace of this structure is visible, the bronchial wall being lined by an irregular granulating surface. A cellular infiltration and a varying amount of fibrous growth commonly exist in the coats of the bronchi, the fibrous change reaching its highest development in the external layer. The cartilages may disappear or may undergo a fibrous or calcareous transformation. The mucous glands are commonly atrophied, owing to implication in the indurative process, and the orifices of the ducts are dilated. The larger bronchiectases and the pulmonary cavities are lined by granulation tissue, small scattered islets

of mucous membrane being traceable at times in the bronchiectatic spaces. These morbid conditions are more pronounced in the medium and smaller bronchi, the larger tubes presenting generally the appearance of chronic bronchitis.

The bronchial lesions seem to be the starting-point of some examples of the insular and reticular forms of cirrhosis, and the term "peribronchitis fibrosa" fitly describes this condition, which, however, is not to be confounded with the small pigmented nodules met with in cases of chronic tubercular phthisis, which are sometimes spoken of as peribronchitis, but which in most cases are merely old fibrous tubercles.

Ætiology.—If we exclude the circumscribed fibrous lesions due to infarction and perhaps to syphilis, it may be said that pulmonary cirrhosis is the result of the following causes:

I. Inflammatory Affections of the Lung.—Acute croupous pneumonia may, in exceptional instances, terminate in cirrhosis, though this is denied by good authorities. Cases have been observed in which an apparently typical pneumonia has lapsed into a condition of chronic pneumonia or cirrhosis. On the other hand, it is urged that these forms of indurative pneumonia differ from the classical type in certain points, and sometimes present a resemblance to typhoid fever. Our knowledge of pneumonia is still incomplete, and it is not improbable that acute fibrinous exudation into the air sacs may be a consequence of different diseases. A subacute type of pneumonia has been lately described which may end fatally in a few months or may pass into cirrhosis. The inflammatory changes in this variety are mainly interstitial. The onset of the disease is less acute, and constitutional symptoms are less pronounced than in the true croupous pneumonia.

Broncho-pneumonia, especially when it ensues on measles, whooping-cough, and possibly typhoid fever and diphtheria, is a frequent source of cirrhosis, particularly in children.

Certain affections of the mediastinal structures may also lead to pulmonary induration, probably through transmission of inflammatory processes along the peribronchial sheaths which are continuous with the mediastinal connective tissue. Disease of the subtracheal glands,

especially suppuration, spinal abscesses, suppuration around the esophagus, and aneurism of the aorta may in this manner give rise to pulmonary cirrhosis. It is possible that cirrhosis is sometimes the outcome of a primary chronic interstitial pneumonia.

2. Certain Diseases of the Bronchial Tubes.—Bronchial dilatation or stenosis, chronic bronchitis resulting from inhalation of finely divided particles, and foreign bodies in the bronchi may occasion fibrous induration of the lung as the result of extension of the inflammatory process.

It is true that bronchiectasis in most cases is a consequence of cirrhosis, but there is no reason to doubt the truth of Laennec's view that bronchial dilatation may be the primary change in some instances.

The rare cases in which stenosis of the main bronchus leads to bronchiectasis, cirrhosis, and ulcerative excavation of the lung are also examples of the bronchial origin of pulmonary induration. In all these cases, and in those instances where cirrhosis seems to have developed out of a simple chronic bronchitis, the occurrence of broncho-pneumonia, whether subacute or chronic, is probably intimately connected with the indurative process.

The inhalation of irritant particles causes chronic bronchitis and peribronchitis, and secondary cirrhosis of the lung (pneumono-coniosis). In many cases this affection is so indissolubly associated with chronic phthisis—*e. g.*, miners', steel grinders', potters' phthisis—that the part played by the inhaled dust is difficult to estimate. But there appears to be no doubt that in some instances fibrous changes in the lungs may be produced by dust.

3. Pulmonary Collapse is another cause, especially when due to bronchitis. Induration is probably the result of extension of the bronchial inflammation to the alveolar walls. This process is therefore closely related to broncho-pneumonia and affection of the bronchial tubes.

4. Pleurisy is an occasional cause, more particularly when the lung has been long collapsed. The induration mainly consists in a patchy or reticular fibrous growth in the peripheral part of the lung, which seldom attains to important dimensions.

Symptoms and course.—The onset of

symptoms may date from an acute pulmonary attack, or, more commonly, the history is that of chronic bronchitis.

In the first case the constitutional and local symptoms of pneumonia may continue for weeks or months without intermission, the patient ultimately making a gradual and imperfect recovery. Or, again, the acute illness may be succeeded by a subacute or chronic stage, which ends fatally in the course of a few months. An interval of apparent good health may separate the initial attack from the onset of symptoms of chronic disease of the lung. In the second case the illness commences insidiously, and appears to be chronic throughout, but attacks of subacute bronchitis are liable to arise from time to time, and probably lead to the development of broncho-pneumonic processes.

Patients suffering from this condition complain of cough, expectoration, dyspnoea, and pains in the chest—in fact, the symptoms of bronchitis. The severity of the symptoms depends on the extent of lung involved, on the stationary or progressive character of the lesion, and on the presence or absence of bronchitis, bronchiectasis, and excavation of the lung. The supervention of constitutional symptoms, like wasting, fever, night sweats, debility, and loss of appetite, is determined partly by a tendency to extension on the part of the pulmonary induration, but still more by the development of bronchial dilatation and excavation of the lung, which are apt to give rise to a low septic condition, depending upon absorption of the products of suppuration.

The clinical course of the disease under these circumstances can hardly be distinguished from that of chronic phthisis, the same irregular type of pyrexia being observed in both affections. It is commonly said that the progress of non-tubercular cirrhosis is more gradual, nutrition is longer preserved, and constitutional symptoms are less pronounced, but these differences are not to be relied on generally. Laryngeal ulceration, so common in phthisis, is almost unknown in cirrhosis.

Diarrhea is not uncommon in the present affection, and sometimes depends on accidental swelling of the putrid sputa or on amyloid disease of the intestine. Ulceration of the intestine does not occur.

In cases uncomplicated by bronchiectasis or by ulcerative changes in the lung, the fatal termination is commonly due to bronchitis with dilatation of the right heart, visceral stasis, and dropsy, or to intercurrent pneumonia or œdema of the sound lung.

Where bronchial dilatation or excavation is a prominent feature, the sputum becomes profuse and puriform, and generally acquires a terribly putrid character. The paroxysmal expectoration of large quantities of foul-smelling purulent fluid is very characteristic of bronchiectasis or excavation affecting the lower part of the lung. When these changes are limited to the upper lobe, the secretions gradually drain away by force of gravity, and in such cases cough and expectoration are more continuous. In basic cavities or bronchiectases the secretion slowly accumulates, and, until it overflows the margins of the inert cavity walls or bronchial expansion, no cough is induced. But when the acrid fluid trickles over the less diseased bronchial mucous membrane in the neighborhood of the morbid area, it excites reflex cough and evacuation of the contents of the cavity or dilated tubes.

A tendency to general bronchitis is always marked in these cases, owing to contamination of the bronchi by the foul fluid passing over them, and to inhalation of noxious materials into the air tubes of the healthy lung.

It is apt to assume a putrid character, and death commonly results from the development of septic broncho-pneumonia or pleurisy. The fatal determination may also be due to abscess of the brain, multiple pyæmia abscesses, phlegmonous erysipelas, exhaustion, amyloid disease of the kidney produced by the long-continued suppuration, nephritis, pulmonary gangrene, and hemoptysis.

The subjects of this disease at times complain of rheumatoid articular pains, which some regard as a pyæmic manifestation. The subjects of pulmonary cirrhosis are generally more or less anæmic and cachectic, though nutrition may be fairly preserved for some time. Clubbing of the fingers is marked in most instances.

Physical examination discovers signs of consolidation of the lung associated with contraction of the chest walls and displacement of neighboring organs. In

the ordinary form of cirrhosis the lower part of one side of the thorax is flattened, the respiratory movements are restricted, and the heart is displaced to the affected side. Percussion elicits a varying degree of dullness, combined, as a rule, with a marked sense of resistance. At times a somewhat tubular or tympanitic quality of resonance may be associated with the dullness. When the stomach or intestine is drawn up from contraction of the lung, a tympanitic note is produced on percussion over the lower part of the chest. The vocal fremitus and resonance are increased, and the breath sounds acquire a bronchial or tubular character. At times the most cavernous breathing and pectoriloquy may be heard, especially where large bronchi or cavities approach the surface of the lung. Bubbling or metallic râles, of medium or large size, are commonly audible, and, when bronchial dilatation or excavation exists, a peculiar croaking or sucking rhonchus can often be detected. A succession or splash sound on cough may sometimes be recognized in such cases. Various rhonchi and râles are frequently heard over the upper part of the same side, or over the healthy lung, pointing to diffuse bronchitis. The resonance of the sound lung commonly extends across the middle line of the sternum. The amount of dullness on the affected side may undergo some diminution in the course of the disease when much emphysema is developed.

The breath sounds and vocal phenomena are liable to great variations, typical cavernous breathing and pectoriloquy alternating with weak indistinct breath sounds and vocal resonance. These differences depend on the amount of fluid contained in the cavities and dilated bronchi.

In some cases the respiratory murmur and vocal phenomena are persistently obscured over the dull area. The presence of dense pleuritic adhesions may contribute to mask the signs of consolidation and excavation.

The expectoration in uncomplicated cirrhosis does not differ from that of bronchitis. The sputum of bronchiectasis has a curious tendency to separate into three layers on standing. See BRONCHIECTASIS. When ulcerative changes are proceeding in the lung, elastic fibers may be detected in the expectoration, but tubercle bacilli are absent.

Diagnosis.—Contractile disease limited to the lower part of one lung, combined with signs of excavation or bronchial dilatation, and with marked fetor of the breath and sputum, is rarely tuberculous. But the same group of physical signs, excluding putridity of the sputum, which is no essential part of simple cirrhosis, may be presented by certain rare cases of chronic basic phthisis.

A failure to detect tubercle bacilli in the sputum, after repeated examination, would almost negative the idea of pulmonary tuberculosis. It must be remembered, however, that secondary tuberculosis may become grafted upon a simple cirrhosis. The following affections have to be excluded :

Chronic Pleurisy.—The breath sounds and vocal fremitus are always weakened, there is no evidence of bronchial dilatation or excavation, and the symptoms, both local and constitutional, are less pronounced.

Empyema perforating the lung may closely simulate cirrhosis and bronchial dilatation, but the fetor has not the special characters of bronchiectasis, and the purulent fluid expectorated does not separate into the characteristic layers. In some cases, an exploratory puncture will alone decide the point.

Chronic abscess of the lung may give rise to contraction and to physical signs hardly distinguishable from those of cirrhosis, but the history of the case and the character of the sputum will usually prevent mistakes.

Hydatid cysts of the lung and liver do not cause contraction, and pulmonary symptoms are slight or absent.

Abscess of the liver perforating the lung is often associated with persistent blood-stained expectoration, and enlargement of the liver can usually be recognized. The history may also throw light on the case.

New growths are mainly distinguished by the absence of contraction and by the existence of symptoms of mediastinal pressure. When external tumors exist the diagnosis presents little difficulty.

Prognosis.—The area of lung involved, the presence or absence of bronchitis, bronchial dilatation and excavation of the lung, and the condition of general nutrition and digestion are the main elements on which prognosis must rest.

Except in those cases where cirrhosis is very limited, the prognosis is always more or less unfavorable, owing to the progressive nature of the disease. At the same time the duration of life is likely to be protracted.

Treatment.—The treatment of cirrhosis of the lung is practically included in that of chronic phthisis, bronchitis, and bronchiectasis. The patient should wear flannel next the skin, he should live in a light airy room, and avoid smoky or dusty atmospheres. A temperate and moderately bracing climate is generally to be preferred. Nutritious food, including cream, milk, and cod-liver oil is of much importance. Iron, quinine and other tonic remedies may be prescribed from time to time. The patient must especially avoid all possible causes of bronchitis, and catarrhal attacks must be promptly met by suitable treatment. Where bronchiectasis or excavation of the lung exists, the patient should endeavor to promote periodical evacuation of the cavities by resorting to certain postures which experience will often suggest—*e. g.*, stooping down, partial inversion, etc.

Drugs like turpentine, terebene, pix liquida, and creosote may be administered internally for the purpose of diminishing the fetor of the breath and expectoration. The same result is sometimes more successfully obtained by the inhalation of creosote, carbolic acid, eucalyptus, iodine, and other remedies diluted with chloric ether or rectified spirits in some form of oro-nasal respirator. Cough, as a rule, should not be treated directly, but this symptom may sometimes be relieved by counter-irritation and expectorants which promote the removal of bronchial secretions. When the cough is so severe and incessant as to prevent sleep, the inhalation of a few drops of oil of peppermint or eucalyptus in the oro-nasal respirator may be attended with marked relief. Opium should only be exhibited in exceptional cases. The question of surgical interference is considered in the article on BRONCHIECTASIS. Diarrhea, dyspepsia, albuminuria, and other complications must be dealt with on general principles. Patients should be specially cautioned against the practice of swallowing their sputa, as diarrhea and digestive disorders are often produced in this way.

PERCY KIDD.

LUNGS, CONGESTION OF.—*Etiology.*—Hyperæmia of the lung may be active, mechanical, or passive. Active congestion results from : 1. Increased cardiac action from any cause. 2. Hypertrophy of the right ventricle. 3. Irritation set up by certain conditions of the air inspired, or by morbid formations in the lungs. 4. Various pulmonary affections which interfere with the capillary circulation in some parts of the lungs, in consequence of which the vessels of other parts become overloaded. 5. Inflammatory pulmonary diseases, of which congestion is the first stage, and which it often accompanies. 6. Obstruction to the entrance of air into the lungs during inspiration, and hence rarefaction of the residual air, with diminished pressure on the vessels.

The causes of mechanical hyperæmia are : 1. Some cardiac disease in the great majority of cases, interfering with the passage of blood through the left cavities of the heart, especially mitral disease, but probably also a feeble and dilated condition of the left ventricle. 2. Very rarely a tumor pressing on the pulmonary veins.

Passive congestion is most frequently observed in connection with low fevers and other conditions which greatly depress the action of the heart, and disturb the capillary circulation, especially in aged and feeble individuals ; it is seen chiefly in dependent parts, usually the bases and posterior portions of the lungs, on account of the influence of gravitation, and the congestion is then termed hypostatic. Probably it may also arise in connection with a very weak dilated right ventricle.

Pulmonary œdema is as a rule the result of long-continued or intense congestion from any cause, but especially when this is associated with cardiac disease. It may be but a part of general dropsy.

Hemorrhage into the lungs may occur under the following circumstances : 1. As a result of congestion. 2. From the lodgment of an embolus in one of the branches of the pulmonary artery. This embolus is usually associated with cardiac disease, and is detached from a clot in the right ventricle, but it may be conveyed from more distant parts. 3. From a diseased condition of the branches of the pulmonary artery. This often materially aids in the causation of pulmonary hemorrhage. 4. As a consequence of injury to the lungs or chest. 5. In connection

with pulmonary diseases, such as morbid growths, cavities, or ulceration in the lungs, particularly in cases of phthisis or cancer. 6. Owing to some morbid condition of the blood, such as that associated with scurvy, purpura, or malignant fevers.

Anatomical characters.—Hyperæmia of the lung gives rise to a more or less deep-red color, which may become bluish, purple, livid, or blackish-red. The part affected is enlarged, relaxed, and moist, crepitates imperfectly, and a quantity of aerated bloody fluid escapes from its tissue on section. Pieces of congested lung float in water. In extreme cases the vesicular structure is scarcely apparent, and the tissue breaks down very readily, this condition being termed splenification. Hypostatic congestion may end in hypostatic pneumonia.

œdema is necessarily chiefly observed in dependent parts, and is always present more or less when the lungs are congested. The lungs are enlarged, tense, and do not collapse when the chest is opened, while they have a peculiar feel, and after pressure retain the impression of the finger for a time. The tissues are moist, and on section a large quantity of serous fluid escapes, either red or colorless according as the œdema is associated with congestion or not, and it may or may not be frothy. The lungs are either congested or pale and anæmic.

Hemorrhage is described as occurring under four forms, viz. : 1. Circumscribed or nodular—hemorrhagic infarction or pulmonary apoplexy. 2. Diffuse or true pulmonary hemorrhage. 3. Interlobular. 4. Petechial, in connection with blood diseases. The last two are rare.

Hemorrhagic infarction is due to embolism, and the blood comes from the capillaries of the pulmonary artery, collecting within, as well as outside the alveoli and minute bronchi, but there is no laceration of tissue. The size of an accumulation varies considerably, depending upon that of the branch of artery obstructed, and it may measure from half an inch to four inches or more in diameter. When situated in the interior of the lung, the infarction is large ; when near the surface it is small and wedge-shaped or pyramidal, with the base projecting outward a little beyond the surface. The most frequent seats of infarction are the interior of the lower lobe and the vicinity

of the roof of the lung, but at the same time there may be others more superficial, and they are often numerous. Each hemorrhage is circumscribed and defined, and it may only correspond to a single lobule, but the surrounding tissue is congested and œdematous. The infarctions feel very firm and hard; a section presents a solid, airless, slightly granulated, dark-red or blackish appearance, while coagulated blood can often be scraped away, and then the lung structure may become perceptible.

Apopleptic clots in the lungs are liable to the usual changes, and the blood may ultimately be completely removed, the tissues being restored to their normal condition. In many cases, a permanent blackish, pigmented knot is left. Pneumonia is sometimes excited, or an abscess may form, the clot softening in the center; or it may undergo caseous or calcareous degeneration, and become subsequently encapsuled.

In the diffuse form of hemorrhage, a vessel of some size gives way, the lung tissue being lacerated, and an irregular potential cavity being formed, varying in size, and containing a mixture of fluid and clotted blood. The pleura may rupture, the blood consequently escaping into its cavity.

In cases of hemorrhage into the lung in connection with hemoptysis from phthisis Dr. R. Thompson has described two classes of anatomical appearances, which deserve notice. The first consists of well-defined circumscribed nodules of an oval or round form, in color varying according to their age from blood-red to yellowish-red and white, in size ranging from an eighth of an inch to an inch, but being generally about half an inch in diameter, marked in their center with the openings of two or more bronchioles, which are usually surrounded or spotted with pigment; they have a slightly granulated face when red, but when white are firm, tough, unyielding, and hard. They show a marked tendency to separate around their circumference from the lung tissue, which surrounds them. These nodules are usually regarded as pneumonic, but Dr. Thompson believes they are altered blood. Moreover he considers that they are not the results of a hemorrhage *in situ*, for they may be found in the lung opposite to that which is the source of the bleeding. Nor are they due to the simple

gravitation of blood dribbling downward, as they are found in the apex of the lung. The localities which they occupy are sometimes the upper lobe, where they run into each other and occasionally form rather large masses; the base being often found close to the periphery of the diaphragmatic surface, and sometimes only in a narrow region corresponding to the arched part of the diaphragm; and the anterior axillary border close to the periphery, in the region of the nipple, or between the third and fifth ribs. He regards these nodules as due to the forcible impaction of clotted blood, driven from a distance into the bronchi and alveoli by forced inspiratory efforts. The second group of appearances arise from hemorrhage *in situ*, of some violence, and producing laceration and contusion of the lung tissue. They consist of irregular blackened patches, sometimes of considerable size, as much as two inches and a half across, which may be found in the upper part of the lower lobes, or irregularly placed in the upper lobe. They are formed of calcareous matter loosely coherent, mingled with the black pigment of old blood, and surrounded with a defined but irregular envelope of some thickness, which is deeply pigmented with the same black granules. Occasionally, the yellow coloring matter, which is often found in old blood clots, is observed scattered about.

A condition known as brown induration of the lung, follows long-continued pulmonary congestion, especially that due to mitral disease, and it is characterized by the accumulation of granular, yellowish pigment, probably of the nature of hematin, in enlarged epithelial and granular cells, which collect in the alveoli, accompanied with varicose dilatation of the capillaries, and probably thickening of the alveolar walls. The pigment may become black, and may finally be found free. The lungs are increased in bulk, and do not collapse; they feel heavy, compact, and inelastic, and present a yellowish tint, passing into brown or reddish-brown. On section, in addition to the general change of color, red spots are seen, shading into black, and a brownish fluid may be expressed. Various degrees of the change are observed, and the extent of tissue affected differs much in different cases, while infarctions are often present at the same time.

Symptoms.—The symptoms resulting from pulmonary congestion and its consequences are not easy to define, as they are usually only exacerbations of previously existing phenomena. One of the most obvious is dyspnœa, either coming on for the first time, or being more intense than before, and sometimes amounting to orthopnœa. A feeling of tightness or oppression is often experienced across the chest, but pain is generally absent. There is more or less cough, which in pulmonary œdema is attended with very profuse watery expectoration; and when hemorrhage takes place, a variable quantity of blood is usually discharged, which may have a dull brownish or bister color, or be almost black. If a clot excites inflammation, pyrexia and other symptoms indicating this complication will supervene.

Physical signs.—1. Respiratory movements are often diminished. 2. Percussion sound may be at first abnormally clear in pulmonary congestion; but afterward becomes more or less deficient at the bases. There may be localized dullness in connection with hemorrhage. 3. Respiratory sounds are usually weak and harsh; over the seat of hemorrhage they may be bronchial. 4. Œdema is characterized by abundant, small, liquid, bubbling râles; localized moist râles may also be perceptible over the part of the chest corresponding to pulmonary hemorrhage and here signs of pneumonia or abscess may ultimately be detected. 5. Vocal fremitus and resonance may be increased or diminished, but are quite unreliable.

Prognosis.—As a rule the affections now under discussion are serious, and they often increase the gravity of the prognosis considerably, because they complicate other conditions.

Treatment.—Much will depend on the exact nature and extent of the morbid changes; and on the conditions which cause them, or with which they are associated. Free dry cupping of the chest is often very useful in pulmonary congestion, and sometimes local removal of blood is indicated. It is important to attend to position, and to keep the patient at rest. Good diet, tonics, and stimulants are frequently necessary. Care must be taken in cases of œdema that the fluid is not allowed to accumulate in the lungs. In diffuse hemorrhage astringents are re-

quired. Remedies which act upon the heart and vessels may be of much service, especially digitalis.

FREDERICK T. ROBERTS.

Symptomatic Indications.—*Aconite* is the principal remedy in acute congestions, and is usually all that is needed. *Veratrum viride* is useful in acute parenchymatous congestions, especially with full, hard pulse, also congestion from chill. *Belladonna* is serviceable in chronic congestions, heat in head, throbbing carotids. *Phosphorus* is valuable in œdema pulmonum, dry, tickling cough, hoarse voice. *Antimonium crudum*, loose cough, rattling phlegm, dyspnœa.

LUNG, GANGRENE OF.—Necrosis of a more or less extensive area of the lung following arrest of the circulation, with putrefaction of the sphacelated mass, and the subsequent formation of a cavity or cavities. Gangrene of the lung is produced by a variety of conditions, the majority of which are related to the inhalation of septic material; it is also occasionally a sequel of acute pneumonia.

Symptoms and physical signs.—Unless the gangrenous mass be in open communication with a bronchus, its presence may not be detectable. It thus sometimes happens that a gangrenous focus, unsuspected during life, is revealed at the post-mortem examination. The supervention of gangrene is, however, generally denoted by the accession of dyspnœa, the continued irregular hectic fever, and a marked degree of prostration. The patient often presents a pinched and livid appearance. If there be bronchial communication, the extremely foul and penetrating odor of the breath and sputum is characteristic, but not absolutely pathognomonic, as it may be present in putrid bronchitis and bronchiectasis without gangrene. The appearance of the sputum, apart from its odor, is also fairly characteristic. It consists of greenish or grayish-black matter, and a thin dirty gray or slate-colored fluid, in which muco-purulent masses and the other more solid elements are suspended. Traube considered it to form characteristically three layers, the upper frothy, turbid, and brownish green in color, the middle layer liquid and serous, the lower, thin, brownish, and in masses.

Microscopically, the sediment and solid masses are found to consist of a quantity

of granular *débris*, oil globules, and fat crystals, many bacteria, especially leptothrix, and monads. The rarity, or even entire absence, of elastic fibers has been explained by the presence of a ferment which dissolves them.

When the gangrenous cavity is in communication with a bronchus, then the physical signs of excavation are present, including cavernous breathing and metallic râles. It must, however, be borne in mind that all the signs of a cavity may be yielded by a congeries of closely aggregated small cavities or even by consolidated lung, and also that there is hardly any safe criterion for determining the size of such a cavity.

Pleurisy may also be present, and in some cases the supervention of pneumothorax is indicated by its special signs. When gangrene supervenes upon chronic lung disease or any of the concomitant conditions mentioned below, there will perhaps be no other indication of its presence beyond the fetor of the breath. Occasionally the occurrence of hemoptysis denotes that the gangrenous process has eroded a pulmonary vessel. As the disease progresses it is not uncommon for diarrhea to occur; this is obviously due, in the main, to the entrance into the alimentary tract of the foul ichorous material discharged from the lung.

The ordinary termination of pulmonary gangrene is by death from exhaustion and septic poisoning. The existence of a gangrenous cavity is likely to lead to the formation of foci of septic bronchopneumonia in other parts of the lung by the inhalation into them of the ichorous matter proceeding from the original focus. In this way it is possible for the opposite lung to become affected, and the chances of recovery are greatly diminished. It would be wrong, however, to say that recovery does not sometimes take place, the condition for such a favorable issue being a limitation of the affected area and the maintenance of the patient's strength.

The *diagnosis* has to be made between gangrene and abscess of the lung, and also from putrid bronchitis and bronchiectasis. From abscess the diagnosis is not always possible; for this, like gangrene, may ensue upon pneumonia, and the pus expectorated may have undergone putrefaction. The presence of

putrid bronchitis is denoted by an abundant bronchorrheal secretion of a fetid character, and the diffusion of bronchitic signs throughout the lungs. In the cases of bronchiectatic cavities the expectoration is often fetid, and the distinction from gangrene is the more difficult, since the latter condition may supervene on the former.

Prognosis.—Is very grave.

Morbid anatomy.—The area of lung involved in gangrene varies considerably in extent. There may be a small limited focus, or the greater part of a lobe may be sphacelated. Or, again, the lobe may be pervaded by numerous areas of "lobular gangrene." As a rule, there is a single cavity of irregular outline, with blackish discolored shreds of tissue, depending into it on all sides, containing a foul grumous material of penetrating odor. When its contents have been washed away, the ragged cavity remains, in which it is possible to detect the relics of disintegrated bronchi and blood vessels. In the latter, thrombi may be seen, sometimes extending into branches of large size. The gangrenous focus is mostly surrounded by a more or less wide zone of hepatized or carnified lung.

Besides pneumonia, there are several pulmonary lesions which may be associated with gangrene; phthisis, bronchiectasis, and cancer being perhaps the most frequent of these. If, as often happens, the focus be situated near the periphery, there is a concomitant pleuritis of intense severity. Pyo-pneumothorax may be set up by the rupture of a gangrenous cavity.

As regards the exact site of the disease, it may be stated that of 20 cases in which pneumonic hepatization or chronic consolidation coexisted with gangrenous cavities, the latter occurred in the right upper lobe in 11, in the right lower lobe in 3, in the left lower lobe in 4. In 2 cases gangrenous foci were found in both lungs—viz., in the right lower lobe and left upper lobe in one, and in the converse lobes in the other.

Pathogeny.—The number of cases in which the lesion is clearly traceable to thrombosis or embolism of the pulmonary or bronchial arteries is very small. Simple obstruction from such causes is certainly not productive of gangrene, but of the form of necrosis known as "hemorrhagic infarction." For gan-

grene to occur it would seem that there must be an additional factor, viz., sepsis, and it will be seen that this may be the essential element in determining the lesion. At the same time there may, in certain cases, be no proof of the intervention of septic agencies, but only evidence of depraved nutrition, which *per se* may favor the passage of a condition of inflammation into one of gangrene. This may explain the greater liability of post-pneumonic gangrene in typhus, tuberculosis, in the habitual drunkard and the insane, as well as in diabetes and chronic Bright's disease; constitutional states which are prone to favor similar low forms of inflammation elsewhere than in the lung. It is a moot point whether the nervous system may so control the nutrition of the lung as to determine pneumonia and gangrene. This view, once held, seems no longer tenable. So far, then, as present knowledge permits a classification of the antecedents of gangrene of the lung, they may be divided into the following:

A. Thrombosis and embolism (mostly septic).

B. Inflammation.

1. Acute lobar pneumonia.
2. Chronic lobar pneumonia.
3. Lobular (septic) pneumonia.

A. Out of a series of 38 cases of gangrene of lung analyzed, there were only 3 in which pulmonary embolism could be traced, and but one with pulmonary thrombosis as an antecedent. In all there was evidence of the septic nature of the process, while in one another explanation than that of mere thrombosis was possible. It is certainly remarkable that, as regards the lung, the supervention of gangrene upon vascular obstruction alone should be practically unknown.

B. *Acute pneumonia*.—In the series mentioned (38 cases) hepatization was found associated with the gangrene in 14 cases. But in only 8 of these could it be said that the gangrene was dependent on the pneumonia. Laennec thought that pneumonia was always secondary, but he attributed gangrene to a special constitutional tendency, and seems to have regarded it as a disease *sui generis*. It is important to note that in the majority of cases of gangrene following pneumonia there is to be found one or other of the predisposing conditions above alluded to. The same remark applies to *chronic pneumonia*,

which is singularly common in association with gangrene (in 6 out of 38 cases). But by far the most frequent antecedent of gangrene is *septic pneumonia*, which is *lobular* in form. This condition may be excited in various ways, all of which are referable to the inhalation into the lung of decomposing or putrescent material. The sources of such products may be thus classified:

(1) Retained bronchial secretion, as in bronchiectasis, or compression of bronchus by aneurism, cancer, etc.

(2) Putrid material from extra-pulmonary sources, as the products of ulceration in the mouth, fauces, and larynx (noma, diphtheria, cancer), cancerous ulceration of esophagus ulcerating into air passages or lung (a common cause of gangrene), discharge of a suppurating bronchial gland into a bronchus, especially if it also perforate the gullet.

(3) Foreign bodies in the lung, causing ulceration of a bronchus, and the consequent inhalation of the discharges into the lung, the inhalation of food particles (*Schluck-pneumonie*), or of vomited matters, or of foul water. The latter circumstances may explain the frequency of gangrene in the insane and the paralyzed.

Doubtless there are other ways in which putrid or septic material may gain access into the lung and excite a form of lobular pneumonia, which, owing to the presence of putrefactive organisms, passes into gangrene. At the same time it is highly probable that the process thus initiated is accompanied by blood stasis.

Treatment.—In general to support the vital powers, in the hope that the pulmonary sphacelus may become encapsulated and detached, the cavity then cicatrizing. In all cases it is necessary to administer restoratives, a free amount of stimulant, and as nourishing a diet as possible. Cinchona, with ammonia and ether, or with the mineral acids, is clearly indicated. Locally, the inhalation of anti-septic vapors, such as of turpentine, benzoin, eucalyptus, etc., is essential, and it is generally necessary to use disinfectants freely around the bedside and in the sputum.

The propriety of surgical interference for the drainage of gangrenous cavities may be regarded as established, as several cases have been successfully treated. The

chances of success depend on the limitation and circumscribed character of the cavity, and also on the existence of pleural adhesions over the affected area. But there are some cases where the cause of the gangrene is of a nature precluding any hope of treatment being other than palliative; but even then an operation may be justifiable, as affording a vent to the fetid products, and thus diminishing the harassing cough, the fetor of the breath, and the risk of secondary bronchopneumonia. The most fortunate results have been obtained where the gangrene occurred in consequence of impaction of a foreign body in a small bronchus, the operation causing the detachment of this body as well as the drainage of the cavity. The precise localization of the gangrenous area is, however, often a matter of great difficulty. The very nature of the morbid process precludes an invariably successful issue to surgical intervention; but, on the other hand, the rarity of spontaneous cure on expectant treatment would seem to demand such intervention.

SIDNEY COUPLAND.

Symptomatic Indications.—The most generally useful remedy is *arsenicum*, particularly when there is much debility and prostration, anxiety and restlessness. *Lachesis* is useful when patient awakens from dyspnœa, very offensive odor of breath; *silicea* when there are suffocating spells at night, with copious, fetid-smelling mucus.

LUPUS (Lupus Vulgaris).—A chronic disease of the skin and some mucous membranes, characterized by the formation in the connective tissue of nodules of granulation tissue.

Lupus vulgaris, so termed in distinction to lupus erythematosus, assumes very many clinical phases, to denote which a multitude of distinguishing appellations have been from time to time used.

Lupus maculosus is an affection characterized by the eruption of very soft, smooth, brownish-red, semi-translucent (apple-jelly-like) miliary nodules, which develop without subjective sensations in the connective tissue of otherwise healthy skin. This eruption constitutes the earliest sign of lupus, and may also be seen at the periphery of a spreading area, or recurring in scars where the disease has pre-existed. The nodules increase in size, others arise between and around them,

and join together to form a more or less circular patch of a special reddish-brown color. The center undergoes retrogressive changes beneath the unbroken epidermis, and cicatrizes, while new miliary nodules may be seen beyond the extending raised border. The inter-papillary processes are flattened out, and hence the patch is smooth and glistening. When the surface desquamates, the name *lupus exfoliativus* is by some used to designate the condition.

The term *lupus exulcerans* is used when the destruction of lupus tissue is rapid or intense, or when the epidermis is lost and a secreting ulcerating surface is disclosed. The ulceration may be deep and rapid or phagedænic, and cause great destruction and mutilation. On the removal of the crust, a readily bleeding, irregular, granulating surface is seen, composed of a soft, friable neoplasm. Sometimes the connective tissue proliferates very freely, and large granulations form and give the growth a framboesoid aspect.

The term *lupus hypertrophicus* is applied to a condition in which new connective tissue formation predominates over the destructive process, and markedly raised, thick patches result. Sometimes again sclerosed patches are formed by the organization of the new inflammatory tissues.

If, without any breach of surface, the papillæ are irritated and undergo much hypertrophy, a watery-looking patch results, often completely masking the original lupus formation, a phase which is called *lupus verrucosus*. Further, as a lupus patch spreads or creeps on periphery it cicatrizes centrally, or at one part of its border, and hence the term *lupus serpiginosus* has arisen.

Lupus is generally stopped by the deep fascia and bones, but necrosis of the latter may result if the periosteum be destroyed. Cartilage is, however, frequently invaded by lupus, as may constantly be seen in the nose and ears, where great destruction and deformity result.

The disease may exist as a single patch or less often as several patches, but it only becomes symmetrical by accident. Sometimes a limb, or the face, neck, and much of the trunk, may be extensively invaded. The exposed parts of the body, such as the face and hands and feet, are by far most frequently attacked.

Primary lupus of the mucous membranes of the nose, mouth, pharynx, larynx, eye, and external genitals of the female is far less common than a secondary affection, by extension or infection from the skin. On mucous membranes the little nodules are generally covered by papillary overgrowths and whitish collections of epithelium, and the patches thus formed soon break down into shallow intractable ulcers, with an irregular granulated base.

Course.—Lupus is usually chronic, persisting over many years, or a lifetime, but the rate of evolution of the nodules and their destruction varies widely, according to the resistance offered by the tissues and to the intensity of the process. A patch may be almost stationary for years, and very limited in extent, or it may spread actively, and break down with surprising rapidity, and be accompanied by the formation of other patches.

Diagnosis.—Mistakes rarely occur if attention be given to the presence of the characteristic brownish-red, jelly-like nodules, and the more diffused friable neoplasm, the usually scanty number of patches and the symmetry, the peculiar method of spread, the chronicity, the production of spontaneous scarring, the frequent concomitance of tuberculosis, and the age at onset. It is only when some of these characters are masked that difficulties arise in the diagnosis of lupus vulgaris from lupus erythematosus, or from a chronic localized patch of eczema or psoriasis.

Fungating forms may stimulate epithelioma, and the latter occasionally arises from a lupus patch.

Rodent ulcer is usually situated on the upper two-thirds of the face, and generally affects old people. There is also a history of a continuous spread from a simple nodule, and the rolled cartilaginous-looking border can be always distinguished. Tuberculated and serpiginous syphilides, whether ulcerating or not, may be almost indistinguishable in aspect, and the age at onset, the far more rapid spread of syphilis, etc., have to be taken into account.

Pathological histology.—Lupus belongs to the class of infective granulomata. The newly formed tissue consists of a small-celled granulation growth situated about the vessels in the connective tissue, and forming little rounded nodules. In

the periphery of the latter, collections of lymphoid cells, larger epithelial and giant cells form, while the central parts gradually undergo caseation, a process which overtakes the peripheral portions also. The lupus patch results from the repeated formation of these nodules, which coalesce, and thus the growth extends along the vessels. The connective tissue lying between and about the nodules becomes infiltrated with inflammatory cells, which may become part of the lupus growth, or undergo organization into fibrous tissue. Tubercle bacilli are present in the new growth, but only sparsely.

Ætiology.—Lupus histologically resembles tuberculosis, but the process in this affection is less acute and less intense. Caseation is a less-marked feature, the epithelial cells are fewer and the giant cells more numerous, the miliary nodules less distinctly isolated and circumscribed than in pulmonary tuberculosis.

Clinically, also, the evidence is very strong. It is undoubtedly an infective process. The disease is frequently associated with tuberculosis or so-called scrofulosis of glands, joints, and bones, and it may result from the extension to the skin of a tuberculous gland or cold abscess. Evidence is also forthcoming that, though purely a local process in the skin, the subject is not without danger of acquiring general tuberculosis, and inoculation experiments on animals point in the same direction.

Lupus is not hereditary; it but rarely attacks two of a family simultaneously, and is far more frequent in females. Mostly commences in childhood, between the third and tenth years, and after puberty its onset becomes rarer, but it may appear at any age.

Treatment.—Lupus very seldom dies out spontaneously, and then only after having committed ravages. No specific is known; indeed, lupus is refractory to internal treatment, though some, and often considerable advantage is obtained by improving the general health by the judicious administration of cod-liver oil, iodine preparations (iodine, the iodides of starch or potassium or iron, iodoform) arsenic and other tonics, proper hygienic and dietetic precautions, and a sojourn at suitable sea-side or other localities, or at some ferruginous, sulphur, arsenical, or salt spa.

Local treatment alone promises a radi-

cal cure, and this can usually be effected. The infective nature of the disease must be borne in mind, because, after the larger areas of infiltration have been removed or destroyed, there may still remain in the surrounding tissues centers where the virus is active, and hence relapses are the rule.

Caustics.—The majority of these agents are very difficult to regulate, and effect either too much destruction or too little. Caustic potash (*Potassa fusa*, Vienna paste), arsenical paste, lactic acid, carbolic acid, and acid nitrate of mercury may be tried, but the one most recently in request is a ten per cent. ointment of pyrogallic acid spread on linen and renewed twice daily for three days. This is said to have a selective action on the lupus tissue.

Nitrate of silver or chloride of zinc pencils can be used to bore out the lupus nodules, and their destructive action is mainly mechanical. This method of treatment is now but little employed.

Extirpation or excision is only applicable in certain sites where the lupus is limited in extent, and even then is not a certain means, and leaves bad scars. The same may be said for the *thermo-* or *electro-* or *actual cautery*, except that these agents are useful when the disease is situated upon a mucous membrane.

The injection of fluids, such as iodized glycerin, lactic acid, iodoform, etc., into the nodules has been practiced with some success.

Scraping and scarification.—The nodules may be scraped away or removed by the use of spoons of various sizes and shapes, or by double-threaded screws. By this method only the friable lupus tissue is removed and good scars are produced. Still better results are attainable by the destruction of the neoplasm by multiple stabbings or linear scarifications, operations which should be repeated in various directions at different sittings till a scar forms. In any case it is essential to destroy every vestige of the disease. Sometimes it is advisable to supplement this treatment by the application after each operation of a caustic, such as one composed of equal parts of chloride of zinc and alcohol. The wounds may be dressed on ordinary surgical principles, but iodoform is believed by some to have a special action upon lupus tissue.

Unna has introduced *plaster mulls* which contain various definite proportions of salicylic acid and creosote. These are applied night and morning till the neoplasm is destroyed.

Besnier strongly recommends a fragmentary punctiform or linear cauterization with a thermo—or galvano—apparatus, with which he claims to have obtained excellent results.

T. COLCOTT FOX.

LUPUS ERYTHEMATOSUS.—An affection of the skin, probably of an inflammatory nature, usually limited to the superficial portion of the cutis, and characterized by the evolution on certain definite elective sites of symmetrical erythematous-like macules, which tend to persist, spread peripherally, and leave, without antecedent ulceration, smooth superficial cicatrices.

It is generally held that lupus erythematosus has no relation to ordinary lupus beyond an occasional close resemblance in aspect.

Symptoms.—The eruption ordinarily commences by the appearance of smooth, slightly elevated macules, from a pin's head to a lentil in size, which disappear on pressure, and resemble a patch of erythema, seborrhea, or psoriasis. They spread peripherally, with a distinctly limited border, are usually very persistent, feel a little thickened, and undergo atrophic changes in the older central parts, which result in the formation of a delicate scar.

The surface is sometimes dotted with dilated sebaceous follicles, which may contain comedones. There is no tendency to suppuration or ulceration, though the patches may now and again show signs of secondary inflammation.

The *course* of the disease may be chronic or more or less acute, and is marked by the increase of the "primary eruptive spots" to the size of a shilling or half-a-crown, and the evolution of fresh macules, which tend to coalesce, especially over the nose and cheeks, where they form the so-called "butterfly" configuration.

The sites chiefly affected are the nose, cheeks, ears, scalp, fingers, eyelids, and lips. On the scalp and ears the atrophic feature is very prominent, and in hairy regions there is a total destruction of hairs. Sir Erasmus Wilson first pointed

out that chilblains are prone to form on the nose, fingers, and ears, and that, though for a time apparently simple in nature, they may acquire the characters of lupus erythematosus. The disease tends to symmetry, though it may remain asymmetrical for many months, or years. Such is the phase known as *lupus erythematosus discoides*.

Kaposi has also described another variety, which is very rare in this country, and is only known here in its milder forms, the lupus-psoriasis of Hutchinson.

This form, *lupus erythematosus disseminatus v. aggregatus*, is characterized by a wider diffusion of the eruptions, an extension by repeated outbreaks, and by the fact that the patches never coalesce. In some cases the whole surface may be dotted over. Its spread is usually chronic, but Kaposi describes an acute febrile and very grave form, accompanied by a typhoid condition. The eruptions may be vesicular or pustular, and the subcutaneous tissue may be involved, giving rise to doughy swellings.

Diagnosis.—At an early period of the evolution of the disease a patch may look very innocent, and simulate erythema, seborrhea, or tinea circinata. Its persistence, and any implication of the sebaceous glands, will, however excite suspicion, which subsequent observation, and the formation of scarring, will confirm. On the face, old-standing patches, where the deeper layers of the cutis are involved, will simulate exfoliating lupus vulgaris. The diagnosis will be sometimes difficult unless the mode of development or extension of a patch can be watched, but in lupus erythematosus there will be no small stellate, semi-translucent, brownish-red, soft granules and nodules. On the scalp the atrophic scarring is characteristic, but it is seen to be associated with an erythematous condition. On the fingers and the tip of the nose chilblains are simulated, but attentive examination will ultimately disclose the scarring and scaling. The disseminated form may closely simulate psoriasis, but is distinguished from it by the presence of scarring.

Pathology.—The diseased condition commences in the corium, generally in the papillary layer (rarely in the deeper or subcutaneous connective tissue), by dilatation of the blood vessels, and stasis of the blood, changes which are followed

by considerable cell infiltration and fluid exudation into the periphery, forming the circumscribed morbid product. Fatty and hyaloid degeneration ensue in the cells, and a cicatrix is formed. The process is prone to pick out the vascular plexuses about the follicles. It is to be observed that there is not the same tendency as in lupus vulgaris to the formation of cell nests and giant cells, and no micro-organisms have been found.

Ætiology.—Obscure. It is not contagious, and not hereditary. Lupus erythematosus is much less frequently met with than ordinary lupus. Females are much more often affected than males, and the age at which it occurs is somewhere between twenty and forty years. It has no effect on the general health except in the malignant cases. Many sufferers are anæmic or debilitated, or belong to tuberculous families. All congestive conditions of the skin appear to predispose to it.

Treatment.—Internal treatment cannot be relied on to cure the disease, but success has been reported from the use of arsenic, phosphorus, iodide of potassium, and iodide of starch. No effort, however, should be spared to place the general health on as satisfactory a footing as possible.

All local exposure to extremes of heat and cold should be avoided. In the selection of local treatment minute regard must be had to the condition of the patches, whether actively congested and inclined to spread, or chronic and quiescent, the depth to which the skin is affected, and the site of the lesion.

If active and angry-looking, soothing measures, such as calamine or weak lead lotion or zinc ointments, are called for; if chronic and quiescent, the following plans of treatment may be tried. Constriction by contractile collodion, and the application of strong astringents, such as nitrate-of-silver solution or liquor plumbi by means of a camel's-hair brush. Stimulants of various degrees of strength, up to those verging on caustics, are much in vogue. For superficial forms, Duhring recommends sulphide-of-zinc lotion (sulphate of zinc, sulphuret of potassium aa grs. xxx, alcohol ℥ iij, rosewater ℥ iijss), increasing the strength if well borne. Weak tarry ointments, if used, should be long continued. Liveing advises the use of a three to five per cent. oleate of mercury.

Daily frictions with flannel dipped in Hebra's spiritus saponatus kalinus (2 parts of soft soap in 1 of methylated spirit), to which tar may be added, is often very beneficial, especially if soothing applications, such as ung. plumbi vaselinum, be used in the daytime. There are also various kinds of absorbent and stimulating plasters in use, such as emplastrum hydrargyri, the French sparadrap rouge (diachylon plaster 26 parts, red oxide of lead $2\frac{1}{2}$ parts, cinnabar $1\frac{1}{2}$ part). To do good they must be persisted in, but the length of time over which they should be continuously used must be carefully determined by observation. The pyrogallic and iodoform plaster mulls (Unna's) are stronger, and require only an application of several days. As caustics, collodion of mercurial sublimate, ethylate of sodium, caustic potash (equal parts, or 1 to 2 of distilled water), the strong iodine preparations, and the still more powerful chloracetic acid and the acid nitrate of mercury, are all of service in suitable cases. Before scarification was introduced, Veiel obtained the best results from blistering, with subsequent removal of the thick coating, then painting with equal parts of chloride of zinc and alcohol, removal of the crusts on the third or fourth day, and the application of progressively weaker solutions of the chloride of zinc. This treatment may be repeated if necessary. Lassar lightly brushes over the surface with a Paquelin's cautery at a dull heat. In recent years the best results have been obtained from linear scarification of the skin. The part having been rendered anæsthetic, the skin is lined superficially with parallel cuts, and these are crossed. This is best done with Pick's instrument. When the crusts have fallen off, the process is repeated until a delicate scar forms. This operation is specially suitable for patches on the face where the least possible scar is desirable.

T. COLCOTT FOX.

Symptomatic Indications.—In the "exedens" form *arsenicum* is the chief remedy, and should be perseveringly used. *Hydrastis* is also useful in lupus exedens, particularly in cachectic cases. *Kali bichromicum* is valuable in tubercular non-exedens form. *Lycopodium* is often sufficient in recent lupus exedens, persons of deficient vitality. *Aurum muriaticum* is valuable when lupus starts from

mucous membrane and spreads to cartilages, bones, and skin.

LYMPHADENOMA (Hodgkin's Disease; Lymphadenosis; Malignant Lymphoma; Adenie; Pseudo-leukhæmia; Anæmia Lymphatica). — An affection characterized by a progressive enlargement of lymphatic glands and other lymphoid tissues, with new formation or hyperplasia of such tissue in various viscera, notably the spleen, and with anæmia and emaciation. The first examples of this disease were recorded by Dr. Hodgkin in 1832.

The diversity of opinion respecting its nature and affinities is shown in the numerous synonyms it has received. It seems to bear, on the one hand, relations to malignant growths, and, on the other, to such blood diseases as leucocythemia and pernicious anæmia, while its precise cause is unknown. In aspect and mode of extension it resembles new growths—hence the term "malignant lymphoma"; but there are many cases of lymphosarcoma, especially those originating in the mediastinal glands, which neither clinically nor pathologically run the course or exhibit the characters of this affection. To signify its more general condition and its analogy with scrofula and tubercle, the term "lymphadenosis" was suggested by Dr. Gowers. Trousseau on similar grounds applied to it the name of "adenie." To differentiate it from leucocythæmia, and especially from "lymphatic leukhæmia" the unfortunate term "pseudo-leukhæmia" has been employed in Germany. But in this country most, if not all, cases of so-called lymphatic leukhæmia are considered to be examples of the disease first described by Hodgkin. A less debatable term is "anæmia lymphatica," which, however, does not wholly express the condition, and it is highly probable that it may be differentiated into more than one variety or type.

Symptoms.—At the onset the subject may be in comparatively good health, until the appearance of glandular enlargement. Or the earliest symptoms may be those of anæmia—viz., lassitude, debility, and emaciation, together with pyrexia. In such cases the starting-point of the gland affection may be in the internal groups rather than the external. The commonest cases are those where the cervical glands are primarily involved.

In the pronounced disease the symptoms are referable to (1) the mechanical interference due to the enlarged glands, (2) the accompanying anæmia, and (3) the pyrexia.

Thus (1) the cervical tumor may compress the carotid and jugular, leading to cerebral symptoms or to congestion of that side of the head and face. Or the axillary may produce pain and œdema of the upper limb; the mediastinal, by pressure on the trachea or esophagus, may produce cyanosis, dyspnœa, bronchopneumonia or dysphagia; while involvement of the mesenteric and lumbar glands may seriously impair nutrition and produce great emaciation. Or, again, hydrothorax may be caused by pressure on the azygos and bronchial veins; ascites, by pressure on the portal vein in the hilus of the liver; jaundice may accompany the ascites.

(2) The anæmia in some cases is very pronounced, in others by no means marked. An examination of the blood shows manifest diminution in the number of red corpuscles, and often many small, red, spherical corpuscles or microcytes. The relative number of white corpuscles varies; the proportion may be normal, or there may be an excess. The usual symptoms of anæmia may be present, and a cardiac hæmic bruit is often to be heard. Œdema of the feet may sometimes be due to the anæmia present; at other times to pressure of enlarged glands on the iliac veins or vena cava.

(3) The pyrexia forms a marked feature of the affection, and is often of the remittent type, as in tuberculosis.

There are but few symptoms attributable to the presence of lymphomatous growths or infiltrations of organs. Vomiting may be due to this cause, or indirectly to pressure on the vagus nerve. Diarrhea is sometimes marked. Albuminuria is very rare; indeed, the urine is not notably altered. There is some liability to cutaneous eruptions, especially furuncles, and occasionally to lymphomatous growths in the skin. Pigmentation of the skin simulating the browning of Addison's disease, and attributed to pressure of a glandular mass upon the sympathetic plexuses in the abdomen, has been noted. The suprarenals were not involved, although they are sometimes the seat of lymphomatous infiltration, like other or-

gans; but in such cases none of the characteristic symptoms of Addison's disease are present.

Certain intercurrent affections, as pneumonia, pleurisy, and pericarditis, may occur in the course of the disease; and a few cases are on record where acute tuberculosis has supervened. The disease terminates by asthenia, or by the involvement of the respiratory passages, or by coma from cerebral congestion; but hemorrhages are less common than in leucocythæmia or pernicious anæmia.

The *diagnosis* of the disease has to be made from (1) chronic lymphadenitis, (2) tubercular lymphadenitis, (3) lymphosarcoma, and it rests upon the diversity of the seat of the affected glands, the absence of any tubercular history or evidence of tubercular disease elsewhere, the association with an enlarged spleen, anæmia, and pyrexia.

Morbid anatomy.—The essential anatomical change in this disease consists in a hyperplasia of lymphatic glands, which seems to assume infective or malignant qualities. The change at first, and for a long time, may remain localized to one group of glands—more often the cervical—but the axillary, inguinal, mediastinal, or abdominal glands may be the starting-point of the affection. In other cases several groups of glands enlarge almost simultaneously.

There are differences also in the type of the glandular lesion. Thus, and this obtains in the majority, the enlarged glands may be smooth, hard, discrete, and mobile, the enlargement gradually involving one gland after another. They may remain so throughout the course of the affection, or after a time may become fused into a lobulated mass from adhesion to one another and to surrounding tissues. The cases in which the glands remain firm and discrete run a more chronic course than those in which they are softer and more nearly confluent.

The histological characters of the two types of enlarged glands depend on the greater amount of trabecular and fibroid tissue in the firm variety, which, on section, are of potato-like consistence and aspect, and the more abundant cell formation in the other type, which may infiltrate through the capsules, and present a soft, pinkish, medullary appearance resembling the soft sarcomata.

Other lymphatic tissues are prone to a

similar hyperplasia—*e. g.*, the tonsils and adenoid tissue of the pharynx, and the abundant lymphoid tissue in the gastrointestinal submucosa—leading either to a diffuse infiltration and thickening of the wall of the stomach and intestines, or to marked enlargement of the solitary and agminate follicles, or even to vascular growths which readily ulcerate. The thymus, in some cases, has been observed to be enlarged.

The spleen is, in typical cases, somewhat enlarged, firm, of dark-red color, but studded throughout with pale-yellowish masses (variously compared to lumps of suet and to hardbake) which consist of the altered (fibrous) malpighian bodies or of masses of new-formed lymphoid tissue. The trabeculæ of the organ are greatly thickened. In some cases, however, the spleen is barely altered from the normal; and in at least one case—marked by leucocythæmia—the spleen had all the characters met with in that disease.

Lymphomatous nodules, firm and yellowish, may be also met with in the kidneys, liver, lungs, and other organs. They have been mistaken for tubercle. But it is unusual for either the lymphatic glands or these nodular formations to caseate.

Course.—The disease runs a variable course, often being local, limited, and almost stationary for months, and having a duration of three to five years, but there are cases of much more acute nature. The majority have a duration of from one to two years. Sometimes a distinct regression occurs apart from the effects of treatment, and in some there may be considerable subsidence of the gland before death.

Ætiology.—The disease, which in some cases appears to be initiated by irritation—*e. g.*, a lymphadenitis from otorrhœa, eczema, or chancre—is more common in early life, although a fair proportion of cases are recorded beyond the age of fifty. It is more frequent in males than in females. Beyond the alleged connection of some cases with local irritation, the causes of the affection are mostly unknown.

Treatment.—Attempts have been made to effect a radical cure of the disease by removal of the glands first implicated, in the hope that further extension may be checked. Apart from the fact that there are few cases where the affection is so

local and limited as to warrant a surgical operation for their removal, the failure of such a measure is often due to the existence of the glandular swelling in internal regions. Indeed, the disease, although often localized at the onset, is eminently a generalized affection, and theoretically as well as practically it is hardly to be arrested by such a measure.

Some good results have been recorded from the administration of arsenic, and also from the interjection of liq. arsenicalis into the substance of the enlarged glands, a procedure not entirely free from the risk of setting up severe inflammation. Under the use of arsenic the glandular swellings have been known to almost entirely disappear. The same has been said of phosphorus. But the disease is known to occasionally retrogress spontaneously and then again to develop, so that some caution is necessary in accepting these statements. Arsenic, which is the only drug known to have any pronounced effect in pernicious anæmia, and has also been used with advantage in leucocythæmia, does, however, seem to exert in some cases of Hodgkin's disease almost a specific influence. Iodide of potassium, iron, cod-liver oil, strychnine and other tonics may be given.

SIDNEY COUPLAND.

Symptomatic Indications.—See ANÆMIA, PERNICIOUS.

LYMPHATIC DISEASES OF THE SKIN.—Under this title certain rare forms of skin disease may be considered which are essentially of lymphatic origin, and are not known by familiar clinical names, as in the case of ELEPHANTIASIS (*q. v.*).

Lymphangioma Circumscriptum (Lymphangiectodes, Lupus lymphaticus).

The disease is always first observed in early life, although it is not proved ever to be congenital. The lesions consist of vesicles, connected with lymphatics from which albuminous fluid containing a few lymph-cells exudes on puncture, closely aggregated together to form patches. These vesicles are of straw-yellow color, deeply situated in the skin, their walls thick and tense; sometimes they are intimately intermingled with dilated capillaries and papillary hypertrophy, so that the composite patches assume a very vascular and warty appearance, which may mask the nature of the fundamental lesion.

There may be one or numerous clustered patches, and their commonest seats are the shoulder trunk, face, neck, back, thighs, and arms. The disease causes no subjective symptoms; it tends to spread gradually by the formation of fresh vesicles at the periphery, and to recur after destruction by caustics or removal with the knife. Nothing positive is known of its ætiology. Its lymphatic nature is proved by the microscopic researches of Sangster, who describes flask-shaped spaces in the papillary layer, and smaller, more regular spaces in the deeper layers of the corium, the former being due to rupture, the latter to dilatation of lymphatic channels.

Treatment.—Electrolysis applied in a manner similar to that for the destruction of superfluous hairs seems the method of treatment most likely to be useful.

Lymphangioma Tuberosum Multiplex is a still rarer condition, of which but three cases are on record. The disease is probably congenital. The lesions consist of large, brownish-red papules or tubercles, the size of a lentil, not in groups or clusters, but scattered indiscriminately over the trunk. They dip down into the subcutaneous tissue, and both feel and look solid, but on section they prove to be made up of much diluted lymphatics.

A diffuse general lymphatic dilation, causing *erythrodermia*, and accompanied by swellings of lymphatic glands, may be the precursor or represent the first stage of some cases of GRANULOMA FUNGIFORMES (*q. v.*), and a localized ectasia of lymphatics, generally unsuspected, enters into the constitution of many nævoid, telangiectatic, and warty growths.

J. J. PRINGLE.

LYMPHATIC SYSTEM, DISEASES OF.—The absorbent system is divided into three parts: (1) Absorbent surfaces, which include the serous surfaces of the different cavities of the body, the skin and mucous membranes, and intercellular interstices, particularly of the connective tissues; (2) the whole of the lacteal and lymphatic vessels; (3) the lymphatic glands and other masses of lymphoid tissue.

In consequence of the universal distribution of the system throughout the body, it is liable to be affected by a large number of morbid conditions, and, though

any one part may be alone involved, there is a tendency for two or all to be so.

Most of the diseases of the lymphatic system commence locally, but they are liable to spread, to a greater or less extent, throughout the whole.

Acute inflammation presents itself under three forms—(1) of the vessels alone; (2) of the glands alone; (3) where both are involved.

(1) **Lymphangitis.**—If only the smallest vessels near the point of irritation be affected, the part is red, and the small lymphatics appear as fine wavy red lines, and the condition is spoken of as Reticular Lymphangitis. If the larger trunk be inflamed, the condition is spoken of as Lymphangitis simply.

Symptoms.—There is tenderness of the affected part and along the course of the vessels, often accompanied by pain, usually of a throbbing character. The position of the vessels, if superficial, is often marked by red lines in the skin, and they can occasionally be felt as fine cords just beneath the skin. There is some swelling of the surrounding tissues, and, if the vessels be obstructed, œdema of the part supervenes, which becomes, in consequence, peculiarly tense and swollen, and the pitting usually produced by pressure on œdematous parts is difficult to obtain (lymphatic œdema).

Pathology and morbid anatomy.—The larger vessels, when exposed, are seen to be swollen, often irregularly so, and red, with, perhaps, some thickening of the connective tissues around. If a vessel in this condition be laid open, the contained lymph will be found coagulated and adherent to the lining endothelium, which is irregular, proliferated in some parts, destroyed in others. The rest of the wall is thickened with an increased number of round cells. Under the microscope, micro-organisms can frequently be demonstrated in the coagulated lymph and in the endothelial cells.

The inflammation may either subside or the vessel may become occluded by organization of the clot, or the clot may suppurate and the pus escape into the system, either along the lymphatic vessels and so into the general circulation, or inflammation may occur in the tissues surrounding the vessel, leading to local suppuration, and in either of these ways general septic infection may result.

(2) **Acute Inflammation of the Glands**

(**Adenitis**).—An irritant may traverse the vessels without injuring them and become lodged in a gland, which is generally the first one met with.

The first evidence of inflammation of a gland is its enlargement and induration; it is usually tender. The gland is at first freely movable beneath the skin, and may continue so. The enlargement is due to blocking of the sieve-channels by leucocytes, followed by multiplication of the parenchymatous and connective tissues of the gland. If the inflammation continue the surrounding tissues become adherent, so that the gland is no longer movable. From this point subsidence may occur and the gland return to its natural size; it will contain, however, an increased quantity of connective tissue; or suppuration may supervene. This commences in the center of the gland, where an abscess forms; the overlying skin becomes red and œdematous, and finally the abscess discharges, unless the pus has been liberated by operative interference.

As the distance of the gland from the original point of irritation is in many instances considerable, as, for instance, when a femoral gland becomes enlarged from suppuration under a toenail, it is customary to speak of the inflammation of the gland as sympathetic, and as the term "bubo" has been inaccurately applied to any acutely inflamed or suppurating gland, such a swelling is sometimes termed a "sympathetic bubo." Suppuration of the parotid gland is thus termed "parotid bubo." The word bubo, when unqualified, signifies a swelling of an inguinal gland secondary to venereal disease.

Although the gland nearest to the source of irritation is the most liable to be affected, yet not uncommonly several, even a whole chain of glands, may become inflamed.

When a gland has been enlarged by irritation, but has not suppurated, the enlargement, as soon as the irritant is removed, generally quickly subsides, but occasionally it continues for a long time. This is due to the inflammatory products having become organized from a formation of fibroid tissue. Contraction slowly ensues, and the size of the gland is reduced, occasionally to less than its normal dimensions.

Ætiology.—Acute inflammation of

lymphatic vessels and of glands originates from some source of irritation within or without the body. From within—from inflammation of internal absorbent surfaces, as mucous or serous membranes, joints, bones; from without—from wounds, burns, scalds, and friction. The immediate cause, however, is the entrance into the vessels of an irritant, such as micro-organisms or cells from malignant growths.

In the vessels, micro-organisms, and particularly micrococci, can often be demonstrated in the clotted lymph or in the endothelial cells. It is very rare to find bacilli in the vessels, though tubercular deposits, containing tubercle bacilli, have been found in the thoracic duct.

In the glands, micro-organisms, both micrococci and bacilli, are frequently found, as also are cells derived from a malignant growth. If micrococci be present they are nearly always of the staphylococcus forms, and, as a rule, suppuration follows. The bacilli found in glands are generally those of the specific diseases, *e.g.*, tubercle, syphilis, or glanders. Malignant cells also correspond to those of the original disease, whether carcinoma or sarcoma.

Treatment.—The first point is, if possible, to remove the exciting cause. The affected part must be kept at rest, and poultices or fomentations, with or without belladonna, opium, or other anodyne, should be assiduously applied.

If suppuration have occurred, the pus should be let out by free incision, and in the case of glands, the ragged glandular wall of the abscess should be scraped out. During the pyrexial stage, some febrifuge drug, as citrate of potash, should be given, and free action of the bowels maintained. After the occurrence of suppuration, cod-liver oil, quinine, and port wine are of great use. Residence in a dry, bracing air, is an essential adjunct to the treatment of glandular diseases.

Chronic inflammation.—The lymphatic glands are liable to various forms of chronic inflammatory change, and such lesions constitute a prominent feature in the morbid anatomy of the diseases.

F. G. PENROSE.

Symptomatic Indications.—*Belladonna* is the principal remedy for traumatic lymphangitis, particularly when lym-

phatics and glands are swollen, with throbbing pain. *Mercurius* is useful if tendency to suppuration appears; *apis mel.* in the intermittent form in women, with tearing pains, is valuable. *Calcium sulphide* may be required if suppuration appears inevitable.

LYMPHATICS, INJURIES OF.—

Wounds and rupture.—The lymphatics are so widely distributed through the tissues that they must often be severed in wounds, but it rarely happens that any serious result ensues except in the case of the largest trunks. The walls collapse at once from the pressure of the surrounding tissues, and the valves prevent any backward flow until the ends are firmly sealed by the lymph that coagulates on the surface.

A few instances have been recorded in which the *thoracic duct* has been injured, leading to the discharge through a fistulous opening of spontaneously coagulating liquid, milky during digestion; and one of rupture without wound proving fatal from general peritonitis, but this vessel is so thoroughly protected in its whole course that such cases are exceedingly rare. In another instance the duct was ruptured opposite an unrecognized fracture of a dorsal vertebra; chyle was poured into the pleural cavity, and led to death from compression of the lung. In the case of other large trunks the freedom of anastomosis, as a rule, prevents stasis, and it is quite exceptional without this to meet with a chronic discharge of lymph (lymphorrhea).

C. MANSELL MOULLIN.

MADURA FOOT (Fungus Foot of India; Mycetoma).—A rare affection of the foot, or more seldom of the hand, endemic in certain parts of India.

Symptoms.—The disease first shows itself in the form of small erythematous patches, or of pustules or tubercles, the exact nature of which cannot be accurately diagnosed. Soon more diffuse swelling and induration occur, and boil-like lesions, either superficial or deep, ensue. These suppurate, rupture, and discharge ordinary pus, which, in the majority of cases, soon becomes blackish in color from the presence in it of dark, granular matter, like poppy seed ("black fungus foot"). As the disease progresses in extent and depth, the affected

part becomes studded with wart-like mammillary projections, at the bottom of each of which there is a discharging orifice, enormously swollen and disfigured, riddled with sinuses in all directions and totally disorganized, bones and fibrous tissue being generally absorbed, and soft parts thickened and infiltrated. The sinuses are lined by distinct membrane, and contain characteristic "fish-roe-like" particles of a white, yellowish, reddish, or blackish color.

The disease is much commoner in men than in women, and almost always occurs in adults. It attacks only natives, and preferably those who work with bare feet. Very rarely, the shoulders and scrotum are affected similarly to the hands and feet. The rate of progress of the disease is very variable, cases lasting from three to thirty years. The result is always lethal, unless the patient die from intercurrent disease.

Treatment.—In the earlier stages the growth may be removed by scraping or excision. In the later stages, when the limb has become a burden to the patient, amputation, wide of the disease, is the only resource.

J. J. PRINGLE.

MALARIA.—The miasm which produces the malarial fevers.

Malaria is most frequently observed as an emanation from marshes, and has hence been called marsh-miasm, and the fevers which it produces paludal fevers. Low, moist, warm localities, and the late summer or autumn, produce the miasm in its most virulent form. This is explained by the observation that the miasm only develops when the mean air temperature has been 59° or 60° F. for about three weeks, and by the fact that the flooding of a marsh by heavy rains diminishes malaria. Marshes which are regularly covered by the sea, or which consist chiefly of peat, are seldom malarious. Malaria may be carried for considerable distances by winds, but an expanse of water tends to limit this extension, and even a river may afford considerable protection. A belt of trees also has a similar effect, while the planting of quick-growing trees, such as the eucalyptus globulus, exercises a beneficial influence, partly by drying the soil, and partly by regulating the rainfall and distributing it more evenly through the year. Except

under peculiarly favorable topographical conditions, malaria does not extend far into a hilly country; even a few feet sometimes make all the difference between a healthy and an unhealthy site. The early morning and late evening hours are especially dangerous, as is sleeping in tents or on the level ground in a malarious locality.

The conditions of soil under which malaria arises may be summarized: (1) alluvial soils in deltas, or old estuaries which are silting up, especially if occasionally overflowed by the sea; (2) old water-courses and partially drained lakes, and sandy plains with a clay or marl subsoil—a condition often found in old river beds; (3) at the foot of hills in the Tropics where the soil is full of vegetable matter, and is imperfectly cultivated; (4) in the lower chalk formations, especially if the subsoil be clay or marl; (5) weathered granitic or trap rocks containing much vegetable matter (fungi, etc.). Rocks in this condition absorb and retain much moisture. To these main conditions are to be added (6) soils recently cleared of forest or brush and not completely brought under cultivation, and also when soils have been deeply turned up, as in making canals or railways; (7) where tracts of rich land have been allowed to fall out of cultivation. Finally, it must be observed that on board ship outbreaks have occurred which could not be traced either to previous infection ashore or to the drinking of water obtained in malarious localities, and must be attributed to the development of the miasm from the foul bilgewater in an ill-ventilated ship.

On the other hand, malaria tends to disappear as a country is drained and brought under systematic cultivation; it has thus greatly decreased in the New England States.

The diseases produced by malaria are, as a rule, endemic; occasionally a great prevalence in an endemic area is followed or accompanied by an epidemic prevalence in neighboring tracts of country; more rarely pandemics occur, four such having been noted during the present century.

DAWSON WILLIAMS.

MALARIAL FEVER (Ague; Intermittent Fever; Remittent Fever).—An acute, non-contagious, specific dis-

order, produced by a miasm, generally air-borne, originating under certain conditions of soil and climate (*see* MALARIA).

The symptoms of malarial fever vary greatly, and many subdivisions have been made; in a well-marked case of intermittent fever, or ague, a febrile paroxysm occurs daily, or at longer intervals, the temperature in the intervals being normal and the patient free from any symptoms. In other types (remittent) the pyrexia is continuous, but presents more or less marked remissions.

Intermittent Fever (Ague).—*Prodromal symptoms.*—Lassitude, pains in the limbs, and anorexia, or nausea, are sometimes present.

Phenomena of the ague fit.—The actual ague fit, whether preceded by these symptoms or not, sets in abruptly; weariness, epigastric discomfort, headache and giddiness are quickly succeeded by severe shivering.

Cold stage.—The surface is cold, the features pinched, the tongue pale and dry, nausea may be distressing and accompanied by vomiting; the pulse and respiration are quick and often irregular.

Hot stage.—This, after a varying period, succeeds; the surface becomes gradually red and warm, the face flushed, the eyes injected, the pulse full and bounding, the respiration deep and frequent. The headache, which was complained of at the commencement of the cold stage, acquires a throbbing character, and is more distressing.

Sweating stage.—This gradually replaces the hot stage. The flushed skin is now moist, and perspiration quickly becomes very profuse; coincidentally all the general symptoms subside, and the patient is left free from pain or fever, but probably somewhat exhausted.

The body temperature (as ascertained by a thermometer placed in the mouth or rectum) begins to rise before the cold stage, and as the rigor becomes well developed, the temperature rises as much as 4° F. or 5° F. in the course of an hour. It continues to rise all through the hot stage, eventually reaching 105° F. to 107° F. or even higher, but when the sweating stage has set in, or a little later, it begins to fall as rapidly as it rose, finally dropping 1° F. or 2° F. below the normal.

The duration of each paroxysm varies.

from two to twelve hours ; as a rule the more severe the disease, the longer the paroxysm ; the cold stage may last for several hours, for a few minutes, or may be so short and slight as to pass unnoticed by the patient ; the hot stage lasts from three to eight hours, but may be much shorter, and is occasionally not to be observed, the sweating immediately, or almost immediately, succeeding the cold stage.

The urine undergoes a parallel series of changes ; the amount of urea and water is increased from the time the temperature begins to rise, that is, a little before the cold stage develops, and remains in excess until the temperature falls at the commencement of the sweating stage. During the sweating stage the quantity of urates and of chloride of sodium is increased, and albumen or blood may be occasionally found.

The period which elapses between the end of one paroxysm and the beginning of another is termed the *intermission* ; that between the beginning of one paroxysm and the beginning of another, the *interval*. In any given case the intervals are generally about equal, often exactly so. The commonest interval is one day, the paroxysm commencing at the same hour daily ; this is the **Quotidian** type, which generally has a short cold stage and a relatively long hot stage, the whole paroxysm lasting eight to ten hours. The next most usual type, and that which is perhaps oftenest seen in temperate climates, is the **Tertian**, in which the paroxysms occur every other day ; it has a long cold stage and a relatively short hot stage, the whole lasting six to eight hours. Occasionally cases are met with—generally in patients who have contracted the disease in the autumn in a temperate climate—in which there are two entire days between the paroxysms, which begin on the fourth day ; this is the **Quartan** type, which generally has a short paroxysm with a relatively long cold stage, and is reputed to be very obstinate.

A somewhat complicated terminology has survived from the writings of the Roman physicians, to describe cases in which the paroxysms occur at other intervals ; thus, in a “double tertian,” there is a paroxysm daily, but the hour of onset and other characters of the paroxysms on alternate days correspond.

There may be a double quartan, the two series being thus combined : Days 1 . 2 . 4 . 5 . 7 . 8. Celsus described a “semi-tertian” which would really appear to be a combination of the quotidian and tertian, the patient having two paroxysms on one day and one on the next. In practice, however, it is neither easy nor necessary to employ these terms in a large proportion of cases, and it appears certain that many slight cases occur in which the intervals seem to be much longer, either because the intermission is really prolonged, or because some of the paroxysms are very slight. In fact, as a case grows milder the interval lengthens, the disease being said to “postpone” ; thus a postponing quotidian becomes a tertian. Conversely, if the case becomes more severe the paroxysms occur at shorter intervals, and the fever is said to “anticipate” ; thus an anticipating tertian becomes a quotidian. After apparent recovery *relapses* are very frequent, and in time a condition of malarial cachexia may become established.

The most frequent and important *complication* of intermittent fever is pneumonia ; consolidation occurs very rapidly, frequently affects both lungs, and seems to be determined by a sudden transference to a cold climate. In persons who have previously suffered from bronchitis, dysentery, diarrhea, asthma, or epilepsy, these diseases may reappear. It has, however, sometimes been observed that epilepsy has disappeared on the onset of ague.

Diagnosis of well-marked intermittent fever is generally easy, the regular sequence of the three stages, the sudden rise and fall of the temperature, the urinary changes, the enlargement of the spleen, the history of exposure, and the effect of quinine, combining to form a very characteristic group of phenomena. In relapses, the history of previous attacks will serve as a guide. Hectic fever, due to phthisis or other chronic suppuration, has been confounded with ague, as have also pyæmia and ulcerative endocarditis ; careful physical examination ought to prevent such errors.

Prognosis is generally good, the direct mortality being very low. During the late war over seven hundred thousand cases of intermittent fever were treated, the mortality being in quotidian, 1.047

per mille ; in tertian, 1.007 per mille, and in quartan, 2.245 per mille. In making a prognosis, the influence of complications has chiefly to be considered, and the special liability to pneumonia must be borne in mind.

Pathology.—The chief morbid changes are those observed in the blood and spleen. The spleen is enlarged, soft, and easily ruptured ; the liver is congested, pigmented, and in cases of some standing enlarged from overgrowth of connective tissue. The myocardium is soft, and pale or yellowish. The blood is profoundly affected ; the red corpuscles are diminished in number, and do not run so readily into rouleaux, the white corpuscles are increased, the serum is stained a brown color, and the coagulum is loose, friable, and dirty red ; the blood, as a whole, has a dark color. The *bacillus malarie* found in the air and mud of the Pontine Marshes is said to produce remittent fever in dogs and rabbits with enlargement of the spleen, the organism being discoverable in the spleen and medulla of bones. The bacillus is said to be present in the blood of human patients, but only during the period of invasion. The important clinical fact is that the malarial poison is capable of producing with extraordinary rapidity the most profound anæmia, insomuch that severe dropsy may quickly supervene, and the patient may even succumb to an attack of œdema of the larynx.

Treatment during the paroxysm must, in the main, be limited to relieving the more distressing symptoms. During the cold stage the patient's desire for warm covering should be gratified, and if this stage be prolonged the onset of the hot stage may be favored by warm drinks (*e.g.*, tea). The emptying of the stomach by emesis, which is generally considered advantageous, is thereby facilitated. Severe neuralgia is an indication for a small dose of morphine administered hypodermically. The routine use of purgatives during the prodromal or early paroxysmal stages is generally condemned, but the great traveler, Dr. Livingstone, whose experience was very large, strongly recommended their use in the prodromal stage. (His "rousters" were thus compounded : —Jalapæ resinæ, pulv. rhei, aa gr. vj, hydrargyri subchloridi, quininæ sulph., aa gr. iv).

If the tongue be furred, the skin sallow,

and the bowels constipated, mild purgatives should be administered during the hot stage, as otherwise the quinine to be subsequently given may be rejected. Special caution must be used when the patient is much debilitated, or there is a previous history of diarrhea or dysentery.

Advantage must be taken of the intermission to administer quinine. Not less than 20 grains should be given during the interval. This quantity may be given in two equal doses, one at the end of the sweating stage, and the other about five hours later ; others prefer to give 3 or 4 grains every hour until the desired quantity is exhibited, believing that thus absorption is better assured. If there be purgation or much irritability, laudanum in doses of 7 or 8 minims may be combined with the quinine. If there be obstinate vomiting, the quinine must be administered by enema, or, in very urgent cases, by hypodermic injection ; but if an irritating solution be used, ulceration may be produced, and in a few cases tetanus has been observed to follow. The best salt for the purpose is that known as the acid hydrobromate ; gr. j dissolves in m. vj water. The acid hydrochlorate is soluble in the same proportion ; the dose of each is gr. $\frac{1}{2}$ –ij.

The temperature ought to be watched systematically for several weeks, and as long as any periodic elevations are to be detected quinine should be taken daily to the amount of about 10 grains. On the appearance of prodromal symptoms, 10 or 15 grains should be taken in a single dose. The remaining anæmia should be combated by arsenic and iron. In cases where quinine in doses sufficiently large to produce toxic symptoms fails to prevent the recurrence of modified paroxysms, arsenic, either alone or in combination with the quinine, is sometimes found to succeed. The following prescription is recommended by Dr. Bemiss : Ferri redacti gr. xl, acidi arseniosi gr. j, quininæ sulph. gr. xl, ol. pip. nigr. m. x ; M., ft. pil. No. xx. Sig. One pill three times a day. Warburg's tincture, which contains quinine in combination with numerous aromatic drugs, is a powerful remedy. The bowels having been opened, half an ounce is given, all other fluids being withheld ; the dose is repeated in three hours. It is a powerful sudorific, and this action, beneficial as a rule, renders it a somewhat dangerous remedy in patients

exhausted by disease. Chloroform in large doses, as much as 1 dram, given at the commencement of the paroxysm, either alone and immediately followed by water or suspended in mucilage, sometimes arrests it and produces refreshing sleep. Small doses (m. viij to m. x) of nitric acid, four or six times a day, are also said to be of great use in some cases, and may be easily combined with quinine.

The administration of pilocarpine at or shortly before the beginning of the paroxysm has been observed to prevent or arrest the attack, and in some cases no recurrence has taken place. The salt used has been the hydrochlorate; the dose by the mouth is gr. $\frac{1}{4}$, but the drug is better given hypodermically, the dose being gr. $\frac{1}{8}$ dissolved in water m. x. The alkaline sulphites, carbolic acid, biberine, various preparations of eucalyptus and numerous other drugs have been praised by some, but when tested by others have not yielded satisfactory results.

Symptomatic Indications.—*Cinchona* is useful in typical cases when each stage is well marked, nausea, headache, and anguish before the chill, great debility during and after the paroxysm, pain in the liver and spleen, bilious symptoms. *Nuxvomica* when gastric and bilious symptoms predominate. Long lasting, hard chill, with bluish cold face, much heat during fever but the patients want to be covered. *Arsenicum* in chronic ague and when paroxysm is imperfectly developed, much heat or the chill is mingled with heat and fever, or there is internal chilliness and external heat. During the fever, great anguish, restlessness, and fear of death. After the paroxysm great prostration. *Ipecacuanha* when there is much chilliness and little heat or much heat and little chilliness. Nausea and vomiting, with thickly, yellow coated tongue. *Eupatorium* for violent shaking with comparatively little coldness, violent pain in the bones during chill and heat. *Natrum muriaticum* in chronic cases, chill commencing at 10 A. M. during heat, violent headache, ulcerated corners of the mouth. Liver and spleen enlarged. *Ignatia*, frequent paroxysms, much chilliness, which is relieved by external heat.

Remittent Fever.—A severe type of malarial fever exhibiting periodic oscillations of temperature of the same character as those observed in intermittent

fever, but without complete defervescence.

The factors determining the occurrence of malarial fever of this severe type are—(1) a virulent form of malaria; (2) new arrival in a malarious district, especially if combined with exposure to a hot sun, or with alcoholic excesses; (3) personal idiosyncrasy or dyscrasia; (4) want of early treatment of intermittent attacks, and continued exposure to malaria. For the reasons mentioned under (1) and (2), remittent fever is most often observed in the tropics: in India it is commonly known as “jungle fever”; it is peculiarly virulent on the West Coast and tropical interior of Africa; it is frequently seen in Algeria, Italy, and the southern part of the United States.

The *symptoms* bear a general resemblance to those of intermittent fever, but the onset is generally more abrupt, prodromal symptoms may be absent, and the cold stage short and often but slightly marked. As the temperature begins to rise the patient feels chilly and ill. The hot stage is quickly developed; the face becomes flushed and anxious, and the skin pungently hot to the touch. The tongue is large, with white or yellowish fur and indented edges. There is great epigastric oppression and usually free vomiting, the vomited matters being at first clear, then bile-stained (hence the term “bilious fever” is applied). Hic-cough is often distressing. The bowels are, as a rule, constipated, and the motions passed are bile-stained. Jaundice is rare, but a sallow tint, often due to blood degeneration, is generally observed. The urine is acid, scanty, high-colored, and often bile-stained, and, occasionally during the height of the febrile paroxysms, contains albumen; during the hot stage the urea is increased. The pulse is rapid (120 or more), full and tense. Epistaxis is not infrequent. The nervous system is less profoundly affected than in enteric fever, but there is severe headache with pain in the back and limbs at the onset of the illness, and delirium is frequent at a later stage.

The temperature begins to rise with extreme rapidity during the cold stage, and in the hot stage may reach 105°–107° F., or even to 110° F. The high temperature and the other acute symptoms above described continue unabated for six or twelve hours; then the *remission*

occurs. The temperature falls from two to four degrees, the skin becomes moist, the epigastric discomfort and vomiting cease or greatly diminish, and the headache is less severe. After a remission of from two to twelve hours, varying according to the severity of the case, the patient again becomes chilly, and quickly passes into the hot stage; the remission almost invariably occurs in the early morning, the exacerbation at noon or in the afternoon. If the paroxysm be short, there may be a second less well-marked remission in the evening, a second exacerbation before night, and the chief remission in the morning. In severe cases the exacerbations, roughly speaking, last from noon to midnight, the remissions occurring during the early morning hours. The duration of remittent fever is very uncertain; in mild cases it may end in from five to seven days, and in severe cases it may end in death in from seven to ten days. In average cases exacerbation succeeds exacerbation for from twenty to forty days. As improvement occurs, the remission may be observed to become more marked, until the temperature finally falls to or beyond the normal, the case being in fact converted into one of intermittent fever.

Diagnosis is often difficult. It is especially liable to be confounded with enteric fever. The mode of onset, however, of the two diseases is, as a rule, different, that of enteric being gradual, that of remittent sudden, a difference well evidenced by the characters of the temperature curves. The eruption, iliac, gurgling, and peculiar stools of enteric fever are absent in remittent. There seems to be, however, some reason to believe that the course of enteric fever may be materially modified by the co-existence of the malarial poison, and that some at least of the cases described as TYPHO-MALARIAL FEVER (*vide infra*) are to be thus accounted for.

From yellow fever the diagnosis may sometimes be difficult in latitudes where both are met with. It must be borne in mind that yellow fever is a continued fever, without morning remission, and is liable to cause death in three or four days. It tends to spread as an epidemic, and has a very high rate of mortality. In yellow fever hemorrhage from the mouth, nose, eyes, ears, bowels, and kidneys (all or some) is the rule, whereas in remittent

fever epistaxis and blood-stained vomit or stools are rare, and hematuria is very rare.

Prognosis.—More serious than in intermittent fever. During the War the mortality among the cases of remittent fever under treatment was 13.45 per thousand. The unfavorable elements in prognosis are a history of alcoholism, marked typhoid symptoms, collapse during remission, a tendency to hemorrhage, severe offensive diarrhœa, hiccough, or slight and short remissions. The favorable signs are long and distinct remissions, free action of the skin, a tendency for the exacerbation to be less severe, and for the temperature during remission to reach nearer to the normal.

The *morbid anatomy* of remittent fever is greatly modified by the co-existence of the consequences of malarial cachexia. The blood presents to a very marked degree the changes already mentioned under Intermittent Fever; the spleen is always large, congested, and pigmented; the liver commonly presents similar changes. Congestion of the gastric and intestinal mucous membrane is present to a greater or less degree.

Treatment.—The two main indications are to bring the system under the influence of quinine, and to prevent the temperature from reaching a dangerous height. At the onset it will probably be necessary to combine a purgative with the quinine; for this purpose Livingstone's pills or a combination of calomel, ext. colocynth co. and scammony, about 3 grains of each with a few drops of oil of black pepper, may be given. This may be supplemented or, in cases where purgatives have to be avoided, replaced by lemonade containing bitartrate of potassium. Some physicians wait until the remission occurs before giving quinine in large doses, but with this partial exception all are agreed that there is no contra-indication to its use; scruple doses are given every four hours until three doses at least have been taken; if vomiting prevents retention of the quinine, it must be given by enema, a half-dram dose repeated once; if this also fails, by hypodermic injection (*see* INTERMITTENT FEVER). Warburg's tincture is highly valued by many physicians, and may be given in the manner described above (*see* INTERMITTENT FEVER). During the hot stage, with a view of quieting the pulse and diminishing restlessness, drop doses of tincture of

aconite may be given every quarter of an hour until m. xij have been taken. Vomiting is best met by a small dose of morphia given with dilute hydrocyanic acid, alone or by hypodermic injection; sucking lumps of ice is a useful adjuvant and is grateful to the patient. At the same time a cold damp towel, sprinkled with chloroform, may be placed over the epigastrium. Drop doses of liq. arsenicalis have been recommended. High temperature is best treated by the cold bath. Maclean recommends a bath at 90° F. cooled down to about 85° F., or sponging of the skin with water, the temperature of which is gradually reduced, as in the case of the bath. Collapse, which is most apt to come on at the beginning of the remission, must be treated with stimulants, of which the best are champagne, brandy with aerated water, and white wine whey.

Pernicious Malarial Fever is a convenient term under which to classify cases of malarial fever, chiefly remittent, presenting aberrant symptoms of a serious character.

In the *Algide*, or *Congestive* form, the patient passes, sometimes quite suddenly, into a condition of stupor from which it is difficult or impossible to arouse him. The surface is cold, livid, and often moist, the face pinched, the pulse slow, small and irregular, and the pupils dilated; diarrhea may be present. This form is extremely fatal. Our army statistics show a mortality among such cases of 239.1 per mille. The treatment of a paroxysm of this type may be commenced by the application of warmth to the surface, or of cold or iced water followed by vigorous rubbing; one-sixth of a grain of morphia combined with one fiftieth of a grain of atropine should be given by hypodermic injection, or one-fifth of a grain of pilocarpine administered in the same manner. Either morphia or opium may be given by the mouth combined with large doses (℥i to 3j) of chloroform suspended in mucilage; chloral hydrate is also recommended, especially for rectal injection. Quinine ought also to be given at once—a scruple of the sulphate by the mouth, or half a dram by the rectum, or 5 grains of the neutral sulphate, by hypodermic injection. The administration of quinine should be continued in doses of 10 to 20 grains (by the mouth) after the paroxysm has passed

away, in the hope of arresting the onset of another. Warburg's tincture is also highly recommended in these cases. If the probable length of the intermission be known, the patient should go to bed before the next paroxysm is due, should take hot stimulating drinks, and an extra dose of quinine combined with an opiate. After the first paroxysm, the object should be to induce mild cinchonism and to maintain it until one or more paroxysms have passed.

The *Syncopal* form described by French writers appears to be a variety of the above. The onset is so sudden that the patient may fall while going about his business. As the syncopal condition continues, the faint evidences of organic life may be overlooked by careless observers, and cases are on record where persons thus affected have been prepared for burial.

In the *Comatose* form the onset of the symptoms is less sudden, the patient complains of throbbing headache, and a sensation of heat and general discomfort, he then becomes drowsy, and finally unconscious, lying motionless, with stertorous breathing, a hot turgid yellowish skin, and full bounding pulse. In the treatment the main indication is to give quinine in full doses at once in one or other of the ways above mentioned; a mercurial purge is also generally required, followed by lemonade containing bitartrate of potassium (℥j to O. j).

The *Asthenic* or *Adynamic* form occurs in persons debilitated by privation or excesses; vomiting early becomes serious, and the rejected matters are deeply stained (by bile or altered blood). A large proportion of the cases formerly classed under this head are now believed to be examples of enteric fever, perhaps complicated by malaria (Typho-malarial Fever; *vide infra*), or of Mediterranean fever (*q. v.*).

The *Hemorrhagic* form is comparatively rare and is not a distinct variety. A liability to ecchymosis or to hemorrhages from the mucous surfaces appears to be developed in some persons long exposed to malaria; the hemorrhages occur during the chills. As has been already stated, hematuria occurs in a certain small proportion of cases. Two varieties of malarial hematuria have been described—(a) A mild form following or accompanying intermittent fever, in which

the urine sometimes contains hemoglobin but no corpuscles. It is doubtful whether these cases ought to be distinguished from paroxysmal hemoglobinuria (*q. v.*). (b) A malignant form characterized by the ordinary symptoms of severe remittent fever; the urine is of a dark red or porter color, and jaundice is present. The urine contains blood pigment but few blood corpuscles, and the jaundice is undoubtedly hematogenous. In these cases, which form the most typical examples of the hemorrhagic type, bleeding may also occur from the nose, bowels, or uterus, and the vomited matters contain altered blood. In the treatment of these cases, the administration of quinine must be accompanied by the use of stimulants and easily assimilable foods. The administration of ergot, combined with gallic and sulphuric acids, has been recommended in the hope of controlling hemorrhage.

Typho-malarial Fever is a term which has led to much controversy. It does not denote a specific form of disease; the majority of cases are instances of enteric fever occurring in persons who have also been exposed to malaria; others are probably examples of remittent fever with diarrhea, in which asthenic symptoms are early and severe; others again are probably examples of the fever commonly known as Mediterranean fever (*q. v.*).

Malarial Cachexia, is the condition of ill-health produced by continued exposure to malaria. The paroxysms of malarial fever may continue for many weeks or months if untreated. In any case relapses very frequently occur, and this even after removal from the malarial district. Persons residing in such districts either after suffering from the disease in a well-marked form, or without such an attack, are liable to become subject to latent intermittent fever, the so-called "dumb-ague." The paroxysms are not well developed, but the patient periodically suffers from malaria, loss of appetite, furred tongue and nausea. The temperature rises during the period of indisposition, which is often described by the patient as a bilious attack. The enlargement of the spleen is at first present only during the paroxysms, and is due to congestion, and the organ may then be ruptured by a blow, may rupture spontaneously, or may

become the seat of infarcts, leading to suppuration or even to gangrene. When the disease has become chronic the spleen is permanently enlarged, owing to fibroid overgrowth, producing the typical "ague-cake"; its capsule is thickened, and may be adherent to other organs. The liver undergoes similar changes, though to a less extent. Whether malaria also produces fibroid kidney is doubtful, but in the cases in which the spleen is much enlarged, and there is anasarca, albuminuria is not uncommon.

Anæmia is an early symptom, and may after a few paroxysms of intermittent fever be sufficiently severe to produce extensive anasarca; the skin has a sallow or yellow tint, and the patient has an aged appearance. Patients who are already suffering from malarial anæmia are peculiarly susceptible to scurvy if exposed to causes tending to produce that disease. During the acute attacks also, the serum of the blood may become pigmented from destruction of red corpuscles. This probably plays some part in the deep pigmentation of the brain, liver, spleen, and other organs, observed in persons who have died while suffering from malarial cachexia, but to a large extent it is due to the presence of particulate pigment, probably indirectly derived from hemoglobin. When melanæmia is well established, the pigment granules may be seen in the white and red corpuscles of the blood, and in the parenchyma of the spleen, liver, osseous medulla, lymphatic glands, and central nervous system, giving these organs a slaty or slaty-brown color. The existence of the malarial cachexia, or it would seem the mere fact of having at one time suffered from malarial fever, tends to impress a periodic character on many disorders; this has been observed in bronchitis, pneumonia, and many other diseases. Neuralgia, especially of the first division of the fifth nerve, is so common an accompaniment of the malarial cachexia, that the term "brow-ague" is in popular use. The malarial cachexia may be congenital.

Treatment.—The first indication is to remove the patient from the malarial district; if this involves a journey from a tropical or sub-tropical to a temperate climate, great care is called for, especially as to clothing. The systematic use of Carlsbad and Friedrichshall waters com-

bined, with careful employment of Turkish baths, is to be recommended. The anæmia must be combated by iron or arsenic or both combined, as in the pill mentioned in the section on Intermittent Fever. The phosphates of iron, quinine, and strychnine are conveniently combined in the syrupus ferri, quininæ et strychninæ phosphatis, which is a useful remedy. The following prescription is a substitute for this syrup: Take of phosphate of iron 16 grains, of quinine 12 grains (=sulphate 16 grains), of strychnine $\frac{1}{2}$ grain, of syrupy phosphoric acid 20 drops or q. s. Triturate the strychnine with the phosphate, mix all the ingredients quickly, and divide into sixteen pills. In the treatment of enlarged spleen, rub the ointment of the biniodide of mercury, a piece the size of a walnut, into the skin of the hypochondriac region, and the part exposed to the heat of a fire until the smarting becomes too severe to be borne; the process should be repeated the same day, and again in a fortnight if necessary. The ointment should contain 13 grains of the biniodide to the ounce of lard—*i. e.*, a little less than the ung. hydrarg. iod. rubr. (B. P.).

DAWSON WILLIAMS.

Symptomatic Indications.—*Aconite* in the hot stage reduces the force and frequency of arterial action; *gelsemium* is useful in cool climates, confusion of mind, great prostration of the whole muscular system; also in infantile remittents. *Cinchona*, when the remission is marked, great fluctuation of the pulse, humming in the ears; *eupatorium*, bilious remittent, with bone pains, sore muscles, with nausea, burning fever, profuse bilious stools. *Belladonna* is useful in comatose form; *arsenicum* and *baptisia* in adynamic; *ipêcacuanha*, gastric symptoms predominate.

MALINGERING.—Deliberate shamming is more common among prisoners, soldiers, and schoolboys than in the community at large. Even where there are good grounds for suspecting that an illness is feigned, great caution should be exercised in giving expression to such suspicion. The best way to detect the malingerer is to appear to believe all his statements, but to keep him under very close observation, when he will probably betray himself, because he does not think that he is being watched. It is often very difficult to distinguish between hys-

teria and malingering, or to say where the one begins or the other ends.

MAMMA.—See BREAST, DISEASES OF.

MAMMILLA, MALE DISEASES OF.—The affections of the male organ relate to its condition in a perfectly rudimentary state, and when there is a gland developed. Soon after birth the organ becomes tumid, and a secretion forms within the ducts. If left to nature, no difficulty arises. At puberty the gland usually enlarges, is painful for a few days, and then slowly decreases until nothing but the nipple is perceptible. But if the part be irritated, inflammation running on to the formation of abscess will be excited. In delicate men the gland is sometimes largely developed—hypertrophy. This may occur on one side only, or on both sides. The circumstance generally excites annoyance, but no ill result; although the curious may see in pathological museums breasts of this kind which have been removed and labeled “scirrhous.” When these breasts are painful, the improvement of the general health is indicated, and all local pressure must be avoided.

The male is subject to deformities arising from excess of mammillæ: thus we have seen a man with four nipples. We have met with a man who had one only, on the right side. The defect was associated with absence of the lowermost fibers of the left pectoral muscle.

The diseases of this organ are of the same kind as those in the female, but they very rarely attack this part in a man. We have seen a sebaceous cyst developed close to the nipple, and elevating it, and so closely resembling the bluish-red tint of a tuber of cancer just about to ulcerate as to excite grave apprehension: but it was excised with the happiest result.

Carcinoma is the new growth most commonly developed in the male breast. It occurs generally between forty and fifty years of age, either in the infiltrating or tuberos form, generally, however, in the former, extending slowly, and affecting the integuments in its progress. Its treatment is similar to that adopted in the case of a like disease in the female.

JOHN BIRKETT.

MANIA.—A form of insanity broadly characterized by exaltation of nervous action, the symptoms being in many respects the direct antipodes of those which obtain in melancholia.

Thus, while in melancholia the cardinal characteristics are nervous depression and mental pain, in mania we observe exalted self-feeling, and general nervous excitement. At times but little noticeable, at others strikingly predominant, these are the features which most attract the attention of the onlooker, and appear to be the essential elements of the disease. A closer examination will, however, show that this excitement is the result, not of excess of nerve force but of defect of inhibitory power—that the excess of nerve-action in one direction connotes a corresponding failure in another.

The real pathognomonic element, then, in mania—the factor which alone can be said to be common to all cases alike—is *defective inhibition*, in other words *loss of control*.

Symptoms.—An attack of acute mania may begin with considerable abruptness, but it is more usually ushered in by a period of incubation, in which the individual becomes dull, depressed, and apparently self absorbed: this constitutes the so-called “stage of melancholia” which is such a frequent prelude to an attack of mania, and which may last a variable time—from a few days to a week or two, or more.

The fully developed attack presents considerable variety as regards the grouping and intensity of the symptoms. The patient appears gay and happy, sanguine and confident, and his exuberance of feeling finds expression in general muscular activity. He is ever on the move, pacing up and down the room, dancing about and performing all kinds of antics; his arms are thrown about in various positions, and he assumes all sorts of attitudes.

The facial expression is continually changing, the tongue may be thrust out, the eyeballs rolled about, and grimaces of all kinds indulged in. The fantastic and the scornful, the sublime and the ridiculous, follow one another in quick succession, and are grouped in the most incongruous ways. Loquacity is usually pronounced, and the patient may be singing, shouting, and talking, almost inces-

santly; though there are sometimes interludes of quietude, the chatter is not unfrequently kept up from morning to night with scarcely any intermission, and the patient may be as noisy and talkative at night as he is by day.

His talk, too, presents some interesting features. There is almost always some want of connection between the sentences—in other words, *incoherence* is exhibited; this may be very slight, and evidenced merely by a too rapid transition from one subject to another, or so extreme that even the individual words seem to stand by themselves without apparent connection. It is not, however, to be understood that there is no association of ideas in mania; on the contrary, such association can often be clearly traced, but from the suppression of intermediate links it very generally happens that two sentences are placed in juxtaposition, which are apparently in no way related to each other.

There is not unfrequently a tendency to rhythm in the speech, and actual rhyming is often observed. This may be exhibited merely in the terminations of sentences; or a string of words or syllables, resembling one another in sound, may be repeated in quick succession. It is frequently the case that a word spoken by a bystander is taken up by the patient, and acts as the starting-point of a series of verbal associations of this kind.

The conversation is at times foul and obscene, even in the case of those who, when well, are perfectly correct in the matter of morals.

The behavior is similarly at times indecent; or it may be aggressive and blustering, and the patient indulge in coarse and insolent personal remarks at the expense of the bystanders.

The faculty of attention is almost always more or less impaired. In mild cases, indeed, the impairment may be but slight; the patient may readily be got to answer questions, and even to give some account of himself; but in the severe forms he is with difficulty recalled to himself for however short a period, and even if got to answer a question he immediately afterward resumes his stream of talk without paying any regard to his questioner.

Memory is usually impaired in proportion to the severity of the attack. It is not that no cognizance is taken of sur-

rounding things, but the degree of attention paid to any one object or occurrence is usually so slight that sufficient time is not afforded for a permanent impression to be made. Events are, however, sometimes remembered by patients in a most unexpected manner. Some recollect clearly all they have gone through. The senses are usually active and may be over-acute.

Hallucinations and illusions of the different senses are frequently met with. Hallucinations of sight and hearing are the most common, the patients hearing voices and seeing visions which have no objective existence. It is exceedingly common for patients to mistake the identity of those around them, and to address strangers as familiar acquaintances.

Ideation is active although irregular. Ideas, more or less vague and ill-formed, seem to arise in great numbers in the patient's mind, either simultaneously or in quick succession; his rapid talk is, as it were, a reflex of this, and his very incoherence may in part be due to this cause, one idea being supplanted by another before there is time for the full expression of the first. It is, however, scarcely correct to say that in an ordinary case of this kind a patient labors under delusions, for his ideas are of too random and fleeting a character to come with strictness under this designation.

Frequently, though by no means constantly, the patient exhibits strong destructive propensities, and will tear his clothes, or destroy any articles of furniture within reach.

As mentioned at the outset, the patient is usually exhilarated and appears in a general good humor—especially is this the case in the milder forms of the disease; but it is by no means always so; on the contrary, annoyance and anger may predominate, or a state of happiness and contentment may be disturbed by fitful gusts of passion. When this is the case the patient is often violent and dangerous to those around him, especially if, as is generally necessary, his disorderly actions have to be restrained.

In a mild case a patient may be correct in his habits, and conduct himself with a certain amount of propriety, but in proportion as the case becomes severe it is usual for the calls of nature

to be unattended to, and for urine and fæces to be passed without regard to locality; especially at night.

There is a great tendency in most cases to untidiness and slovenliness of person, and it is common for patients to remove their clothing and strip themselves naked, if permitted; this practice is resorted to by night as well as by day. The physical condition of a maniacal patient varies according to the intensity of the attack.

Insomnia is usually marked even in mild cases, while in severe cases sleep may be almost totally wanting.

The general sensibility of patients is often much diminished, so that they take no notice of changes of temperature, and appear not to feel injuries or sores of which they would be acutely conscious in health. The pulse is usually accelerated, and its rapidity is generally proportionate to the degree of muscular activity and the severity of the attack. The temperature in mild cases may not be raised, but if the case be at all severe it is common to find a rise of one or two degrees, or even more.

The digestive functions are usually disturbed. In a case of any severity the tongue gets thickly loaded with fur, and tends at times to become dry; while, if there be much loquacity, ropy saliva accumulates about the corners of the mouth and sordes collect on the teeth. When this condition prevails, the appetite is usually interfered with, and there may be much difficulty in administering food; but in mild cases the patient often takes his food well, at times, indeed, in excess, while in the more chronic forms a ravenous appetite is common. The bowels are usually constipated.

In women menstruation is generally arrested—at any rate for a time.

A patient who is actively maniacal always loses flesh, often to a great extent. The nutrition, indeed, of the whole body suffers, as evidenced by harshness of skin, dryness of hair, and the like.

The foregoing symptoms may last a variable time—a few days, or weeks, or months—but sooner or later, if recovery is to take place, the restlessness gradually subsides, the loquacity ceases, and the patient instead of being lively and talkative becomes dull and taciturn. In some cases, indeed, the patient may pass

almost directly into his normal sane condition, but it is more usual for a longer or shorter period of mental depression, or dullness, to be passed through, before the mind is restored to its previous state.

Even, however, when recovery takes place convalescence is not always uninterrupted, but the process of amendment may be interfered with by a relapse, and this may occur on more than one occasion and yet the patient may ultimately be restored to vigor.

The above described symptoms in various degrees of combination form a picture of the ordinary forms of mania, as most usually presented to us. But individual cases vary considerably from this type, either in the direction of mildness or severity. The muscular over-activity may be so slight as merely to be evidenced by a little aimless restlessness, and fidgetiness, and incapacity to settle to anything, and the patient in ordinary conversation may appear rational and coherent. There is often also a semblance of wilfulness about a patient's acts and language, which conveys to the clinical observer the impression that he could control his vagaries if he liked. Or such a simple form of mania may declare itself by unusual liveliness, humor and gaiety, and a person may even present a certain mental brilliancy impossible to him at ordinary times.

There are yet other cases in which the morbid change is almost entirely on the moral side of the patient's nature, the intellectual being scarcely affected; as, for example, when a man who has hitherto led a quiet, moral, sedate, business-like life, becomes restless, boastful, extravagant, inattentive to his affairs, and putting no check upon his appetites.

The proof that such cases belong to the class we are now considering, lies partly in the fact that all this is the expression of a *change in the character* coming on, it may be without obvious cause, and partly by the observation that such a condition often occurs as a stage in a typical attack of mania, all these manifestations simply being precursors of an acute outbreak.

At the opposite end of the scale a class of very severe cases is met with which has been described as a special disease under the name **Acute Delirious Mania**. In this form the physical symptoms are so severe as to rank co-ordi-

nately with the mental. The muscular restlessness and excitement is extreme, the patient pours forth a volume of incoherent talk, and his attention is so much in abeyance that he usually takes no notice of surrounding things and cannot be got to answer questions; he appears, in fact, to be almost unconscious of his environment.

There is combined with this excitement much physical prostration. The temperature rises often considerably; the pulse is small and rapid, the tongue gets dry and brown, and sordes forms on the teeth and lips. There is often great difficulty in administering food. Sleep is absent, or nearly so. The patient, in fact, often passes quickly into a typhoid condition, and death frequently ensues. These cases form one of the varieties of so-called "brain fever."

Pathology and morbid anatomy.—That the brain of a maniacal patient is in a hyperæmic condition is a legitimate conclusion from clinical facts, seeing that an excess of nervous action cannot go on, unless an excessive supply of nutrient material is furnished by the blood. And this conclusion is also borne out by the facts of morbid anatomy, for when death occurs in the acute forms of the affection, evidence of hyperæmia, both of the brain and its membranes, is constantly found.

On stripping the membranes the surface of the cortex is found to present a pink staining, which is either uniformly diffused or occurs in irregular patches. The cortex, too, on section exhibits congestion of its deeper layers—those adjoining the white matter. In some cases also the puncta cruenta of the white matter are numerous, and there are signs of excess of blood in the basal ganglia.

Microscopically, in addition to the evidences of vascular engorgement, there may be some swelling of the nerve cells of the cortex, but this is not constant, and the cells may appear quite healthy.

The excess of blood is, however, at least in the majority of cases, secondary, being the result of an increased demand upon the part of the brain cells.

The question then arises, whence comes this increased demand? mania is an affection of the highest controlling plexuses of the brain, which results in the loss of the inhibitory action of these centers, in consequence of which the

lower centers escape from their control, and acting over-vehemently and discordantly, attract to themselves an inordinate supply of blood. On this view the maniacal manifestations are the result of over-activity of certain healthy portions of the brain, this over-activity being permitted by abeyance, or loss of function on the part of other portions. There would therefore be a negative and a positive condition in the brain of a maniacal patient—negative as regards the higher centers, positive as regards the lower. The primary affection would thus be located in the highest controlling and coordinating plexuses, and their tendency to implication is explained by the fact that they are the latest developed in the course of evolution, and are consequently the most unstable, and the most liable to give way.

Ætiology.—Mania may occur at all periods of life from youth to old age, but is most common in young adult life. The most powerful predisposing cause is hereditary taint, by virtue of which people come into the world with unstable brains, ready to fall into abnormal lines of action on meeting with adverse conditions in the environment.

The exciting causes are not peculiar to this special form of insanity. Anxieties and worries, domestic bereavements and mental shocks of all kinds, may precipitate an attack. Intemperance in drink is probably the most common exciting cause. Injuries, especially cranial injuries, form a frequent cause, especially in the male sex. In woman parturition and the puerperal state account for a large number of cases.

Terminations.—(1) *Recovery.*—This is the most frequent termination, the majority of cases recovering from a first attack. It is not however always complete, even when the patient is apparently well, a change of disposition being sometimes noted.

(2) *Death.*—This seldom occurs in the ordinary forms of the affection, but may happen if the patient be old, or much debilitated at the outset, or the subject of organic visceral disease. It is, however, frequent in the acute delirious form.

(3) *Chronic Mania.*—This is a chronic form of the acute affection. The limit between the two is an arbitrary one, but if a case last more than a year it is usually

included under this head. The noisy, dirty, destructive patients who fill asylum wards are of this class. Chronic mania is, however, almost always associated with a certain amount of dementia.

(4) *Monomania.*—Not unfrequently after an attack of acute mania has subsided a delusional state is left—that is the patient may appear rational on ordinary topics, and his memory may be good, but he nevertheless exhibits perverted judgment or actual delusion on one or many subjects.

(5) *Dementia.*—There are all degrees of this. An attack of mania may pass off and leave a person apparently well with the exception that the fine edge of his faculties is taken off, and he can no longer face the world as before. Or it may leave the mind a wreck, and the patient may henceforth live a vegetative existence, unconscious of his surroundings and entirely dependent upon the ministrations of others for his continued existence. And between these two extremes every variety is met with. The dementia which is consecutive to mania is as a rule more profound than that which is sequential to other forms of mental disease.

Prognosis.—This is good in proportion as the onset has been rapid and dependent upon a definite cause, and according as the patient is young and the reserve of nerve force good. It is unfavorable when the patient is old and debilitated, or when the disease assumes the acute delirious form. It is a good sign if in the acute form the patient takes nourishment freely. Probably more than half the cases recover perfectly. The prognosis becomes bad if the disease lasts over a year.

Hereditary tendency is not unfavorable as regards recovery, but connotes a greater liability to the recurrence of the disease.

Treatment.—It might appear at first sight a simple matter to quiet the excitement of a maniacal patient by means of sedative drugs, and undoubtedly the most violent mania can thus be subdued for a time. But experience has not endorsed the value of this treatment, for the effect of the drugs soon passes away, and continued persistence in their use appears to have a deteriorating effect on the nervous centers.

Nor is it advisable to restrain the patient's disorderly actions by mechanical means, such measures having in most

cases a decidedly injurious effect upon the brain.

The best measure in an ordinary case of acute mania is to get the patient out in the fresh air as much as possible and allow him to work off his excitement by muscular exercise. Walking a patient about all day long between two attendants in the open air will often prove the best possible hypnotic, and sleep obtained in this way is of much more value to the patient than that got by the administration of chloral or other sedative drugs.

But, if the temperature be much elevated and the patient too debilitated for outside muscular exercise, as when the disease approximates to the acute delirious form, he should be placed in a bed on the floor of a room which has been well covered with mattresses so that he may not injure himself. A padded room is preferable, though not always essential. In cases of this kind, much benefit is sometimes obtained from a prolonged warm bath with cold affusion to the head; this requires, however, to be used with caution. The wet pack has also its advocates, and may be tried in similar cases. It must be admitted, however, that these measures are often utterly futile.

The question of food administration is important. In the acute forms a patient will sometimes refuse food altogether, and if so, there need be no hesitation in at once feeding him with the stomach-pump, as it is very important that abundance of nutriment should be introduced into the system or fatal collapse may ensue. Strong soups, beef essences, and liquid custards may thus be given.

Stimulants are undoubtedly often useful, and should as a rule be given with food. Sometimes a glass of porter at night will act as a genuine hypnotic. A dry tongue is as a rule an indication for pushing the administration of food and stimulants, but, if the latter increase the excitement, as they sometimes do, their use should be interdicted.

Cases of acute mania are with difficulty treated at home, and early removal to an asylum is as a rule called for. Even in the milder cases where the excitement is not great it is generally advisable to take the patient away from his home surroundings, the subjection to discipline and the moral control exercised in an asylum often acting as distinct aids to recovery.

JOSEPH WIGLESWORTH.

Symptomatic Indications.—The best remedy for acute mania, characterized by furious rage, is *stramonium*; it allays irritation and induces tranquil sleep; useful in puerperal mania and nymphomania. Pupils dilated with furious aspect; or dull besotted expression with convulsions. Also in religious mania. *Belladonna* is useful in marked hyperæmic state of the brain, athenic and congestive delirium, mania-a-potu, acute maniacal delirium; monomania with fixed hallucinations. Headache, flushed face, dilated pupils, intolerance of light and noise. *Hyosciamus* is valuable in violent intermittent forms to procure sleep and allay violent delirium. Hallucinations with little or no congestion, startings and mutterings; hypochondriacal monomania. *Opium* is sometimes useful in furious mania, with distortion of the face, rage, fear, etc. *Cannabis indicus* may be serviceable when there is over-exaltation of the senses; horror of darkness, fear of insanity, spasmodic laughter, desire for constant motion. *Aurum* in suicidal or religious mania, sexual excitement, great depression of spirits, speaks continually in questions, quarrelsome. *Acid phosphoricum*, mental disorder from brain fag, sexual excess, with depression.

MARASMUS (Atrophy; Wasting), including Infant Feeding.—The term marasmus is usually reserved for the wasting of infants, though strictly it may be used for such a condition at any period of life.

As regards adults, such a degree of wasting as to merit special notice may be met with in organic disease of any of the viscera, in diabetes, and in the voluntary starvation of hypochondriasis, hysteria, or madness.

Congenital syphilis is usually associated with wasting, and organic disease of the lungs or other viscera may also lead to wasting. Catarrh of the stomach or intestines, apart from any dietetic error, may produce it, otherwise the cause must be sought in some defect in the feeding of the child, either as to the quantity or the quality of its nourishment. Marasmus is much more frequently encountered in those brought up by hand than in breast-fed infants.

The concomitants of wasting in young infants are constipation, with flatulence and griping pains, or sometimes diarrhea

and vomiting, the vomited matters consisting mainly of curdled milk. When these conditions, or any of them, are present, it is clear that the feeding is at fault; if the child is being suckled by its mother it is more than probable that it is put to the breast too often, as this is the universal panacea for a crying babe; it is not good for an infant any more than for an adult to be fed too often or to take too much at a time.

The health of the mother must be inquired into, as this will have a most important influence over the quality of her milk, which, as is well known, may vary not only at such times as the menstrual periods, but may be affected by purely emotional disturbances. If the mother be in good health and the child is not put too frequently to the breast, a chemical and microscopical examination of the milk should be made to see in what particular it departs from the normal. Where a wet nurse is employed, the infant may waste from the fact that the date of her lactation is in advance of that which is necessary for the child, since changes in the character of the milk take place during the whole period of lactation.

In children who are brought up with the bottle, the malnutrition is very frequently due to the kind of bottle used; a long india-rubber tube and a sour cork do not make the milk which passes through them agree with the infant, and they are conditions which largely prevail; even when the tube and cork have been successfully kept sweet, the child is often allowed to go on sucking at the tube after the bottle is empty, a procedure which must lead to indigestion. Frequently all possible trouble has been taken with the milk that is placed in the bottle to make it agree with the child, but finding that the infant did not thrive, its diet has been supplemented by the addition of sop or boiled bread, and yet the infant continues to waste. In such cases a return to a most approved dietary or the procuring a wet nurse does not always suffice to avert a fatal result. It seems as if the child's digestive powers had been so completely and permanently deranged as to be beyond the reach of improvement.

In the majority of cases, however, the prognosis is good, no matter how late the patient comes under observation.

The order to wean an infant because it does not thrive is one that ought very

rarely to be given, unless it be obvious that the mother's state of health renders it imperative. Careful treatment of the mother and attention to her diet will materially alter and improve the quality of her milk, while, if it seems too rich for the infant, weak barley-water may be given alternately with the breast, or a few teaspoonfuls immediately before being put to the breast.

JOHN ABERCROMBIE.

Infant Feeding.—The best food for babies is, of course, their mother's milk. The child should be put to the breast three times in the first twenty-four hours, and afterward every two hours for ten minutes at a time. During the first twenty-four hours the secretion of milk is scanty, but a healthy child does not suffer from this. The only proof that the mother's milk is healthy and sufficient for the child, is its well-being and steady increase in weight. If it be fretful and cease to gain weight, it is possibly because the mother's milk is poor in quality and insufficient in quantity, and in that case breast-milk must be supplemented or replaced by other food. The milk supply may be deficient from the first, so that the child has to be brought up entirely "by hand," as it is called.

The most easily obtainable substitute for human milk is cow's milk. This differs from human milk chiefly in containing much more casein. The casein is coagulated by the gastric juice into lumps or curds much larger than those formed by the casein of human milk. These large lumps are digested slowly and with difficulty. Hence cow's milk must be diluted. In the first month one part of milk should be mixed with two of water and sweetened. Of this the child should have from 1 pint to 1½ pint in the twenty-four hours. As the child gets older the proportion of milk to water must be gradually increased, and the quantity taken also increased. Pure cow's milk should not be given till the child is at least six months old. The best milk is that which is last expressed from the teat and known by dairymen as "strippings" or "afterings;" it contains more cream than the rest of the milk.

This is the simplest diet on which to bring up a child that cannot be suckled. But there are many children who cannot digest this; they vomit, pass undigested curds in the fæces, and do not thrive. In

such a case the diet must be altered so as to increase the digestibility and the nutritive value of the food.

To prevent the coagulation of the casein into large masses, the milk may be boiled (a measure which has the further advantage of preventing it from carrying infection), or it may be diluted with barley water or with lime water, or it may be peptonized by means of peptonizing powders.

To increase its nutritive value, it may be diluted with whey (milk from which the casein has been separated) as in the so-called "artificial human milk;" and cream and raw meat juice may be added. If milk continue to disagree, however administered, the child may for a day or two be fed upon cream, diluted and sweetened, and raw meat juice.

The latter is made by finely mincing fresh rumpsteak, and stirring it up with water, one part of water to four of meat. It should soak for half an hour. Then the meat is put between folds of muslin, and the juice expressed by twisting.

Condensed milk is often used, and has the advantages that it keeps perfectly, and that its casein coagulates in smaller masses. The objection to the canned form is that to preserve the milk much sugar is added, which is apt to undergo acid fermentation after being taken. Therefore *unsweetened* condensed milk is the best kind. Such as the Highland brand of Evaporated Cream (Helvetia Milk Condensing Co.). It must be remembered that for young infants condensed milk must be diluted much more than the instructions given with the package direct.

Milk may be given with the addition of farinaceous foods. It is common for ill-informed mothers to thicken the milk with corn-flour, bread, arrowroot, or biscuits. Such food disagrees with young infants, because they cannot digest starch. Farinaceous foods are made in which the starch is more or less perfectly converted into sugar. These may be divided into three chief classes.

(1) *Malted Foods*.—In these malt is mixed with wheat meal, and by the action of the diastase in the malt upon the starch in the meal, the starch is changed first into dextrine, then into maltose, then into grape sugar. In some this process is only commenced, and is set going again when the food is mixed with water, being then completed in 10 or 15 minutes, and

in some the process is complete. Among the malted foods may be mentioned Mellin's, Horlick's, Savory and Moore's.

(2) *Baked Flour*.—In these preparations the starch is by heat partly converted into sugar. This is excellent for older children, but not good for very young ones. Of this kind are Ridge's and Neave's foods.

(3) *Pancreatized Foods*.—These are made of wheat meal with pancreatic ferment. This ferment converts starch into dextrine and grape-sugar, and proteids into peptones, and emulsifies fat. This is the most easily digested food of any, but some think that it relieves the stomach from too much of its work, and thus may retard the development of digestive power.

Meat juices, meat essences, jellies, etc., are often recommended, and are useful, but none of them so good as the raw meat juice described above.

G. E. HERMAN.

Symptomatic Indications.—*Arsenicum* is useful in general emaciation with debility, dry parchment-like skin, pale and œdematous swelling of the face, great restlessness and tossing about, painful, offensive, undigested stools. *Baryta carb.* when there is swelling and induration of the glands, emaciation, bloated face, swollen abdomen, constant desire to sleep. *Calcarea carb.* in children having a large head with open fontanells, dry and flabby skin, enlargement and hardness of the abdomen, general emaciation with good appetite; debility and weakness after the least exercise, diarrhea, with clay colored stools, much perspiration about the head. *Phosphorus*, pale and bloated face, sunken eyes with blue margins, great debility and oppression after the least exercise, diarrhea, with white, watery, undigested stools.

MASSAGE (including the **Weir Mitchell Treatment**).—Massage properly so-called includes systematic, skilled manipulation and scientific rubbing.

To properly carry out this mode of treatment, the operator (masseur or masseuse, as the case may be) must have had a thorough training under one skilled in the different methods, and should have a good general notion of the surface anatomy of the body, and the position of the chief organs.

Massage has been at times brought in-

to discredit by patients being allowed to fall into the hands of ignorant persons calling themselves medical rubbers, who are possessed by the idea that rubbing will cure everything. Serious harm has in this way often resulted, and it need hardly be insisted upon that massage should be carried out only under the direction of a medical man, who has taken the trouble to make himself practically acquainted with its processes and methods.

Several different forms of manipulation are included under the general term massage. One form consists of a kneading and pressing or squeezing of the muscles, with a certain amount of rotatory movement. If, for example, it is wished to act upon the muscles of a limb, the operator begins at the lower part and works steadily and uniformly toward the trunk, taking up one muscle or group of muscles at a time, firmly grasping and rolling them. In dealing with the smaller muscles one hand will suffice, but in the case of the limbs both hands are used, and they should follow each other with such regularity that no part is missed.

In another form, the palm of the hand is made to pass over the part that is being operated upon, in a direction toward the body. It may consist of a mere gentle stroking of the surface, or pressure intended to affect the deeper structures may be employed. One hand follows the other in a regular, rhythmic manner, so that when the stroke of one is finished the other is in position ready to commence.

A third method, known as *friction*, consists in stroking or sliding one hand over the muscles, combined with pressure of the tips of the fingers of the other hand in a somewhat rotatory manner. This is frequently of use in dealing with affections of the tissues in the neighborhood of joints. In another form different kinds of percussion are made by means of the finger tips, or by the palm of the hand, or by its edges. The different procedures may be employed in some instances singly, or two or more may be suitable in combination, according to the circumstances of the particular case.

General massage, that is, when the manipulations are applied to the whole body, is useful when it is desired to stimulate the nutritive functions generally, to promote tissue change in the different

organs, and to increase the excretion of waste products. Hence, when for any reason the patients cannot take sufficient exercise, general massage is an excellent substitute, for under its use not only are the muscles passively exercised, but the internal organs also are stimulated and rendered functionally more active. Improved appetite, better assimilation, and increased weight are the results.

By local massage the circulation in the blood vessels and lymphatics is accelerated, probably both on account of the increased contractions of the muscles, and by the effects of direct pressure. The nutrition of the part acted upon is greatly increased, waste and effete matters are more speedily and effectually removed, the muscles become firmer, and there is a marked increase of muscular power.

Marked benefit is obtained in many cases of infantile paralysis from a well-regulated course of massage, commenced gradually and carried out systematically. Again, in cases where splints or supports have been in use for a long time, the resulting attenuation and weakening of the muscles rapidly disappear under its use. In hysterical affections of joints and limbs, massage has been found of the greatest value, and it is often helpful in cases of long-standing paralysis, even when due to some organic lesion.

Massage applied to the abdomen, in patients suffering from atonic dyspepsia with flatulent distention, and from constipation, is often attended with good results. In constipation, a course of systematic kneading and rubbing over the colon, commencing at the cæcum, and carried along its course to the left iliac region, is followed by gradual relief of the symptoms and usually leads to the establishment of regularity in action, although the time taken to accomplish this desirable end varies considerably. In some cases the bowels begin to act regularly at the end of the first week, but in others not until several weeks have elapsed. The result is to be attributed mainly to the stimulating effect of massage upon the intestine, by which peristaltic action is increased, and not to any mechanical effect. In the case of fæcal accumulations, however, which can be felt and which yield to pressure by the fingers, probably also undergoing modification in shape by that means, the

mechanical agency is not without its effect.

Weir Mitchell Treatment.—In this form of treatment general massage plays an important part. The success, however, that attends this method, especially in cases of hysteria and of nerve prostration, is attributable to the combination of the several factors that constitute it—namely, (1) rest, (2) isolation, (3) systematic feeding, (4) massage, and (5) electricity.

The combined elements of the treatment must not be forgotten—isolation with rest, massage, with or without electricity, and excessive feeding. Dr. Weir Mitchell lays least stress upon electricity, observing that, if he had to omit one part, he would have no hesitation in leaving out the electrical treatment. Although the patients who derive most benefit from such a course of treatment are those of the neurotic type, often more or less markedly hysterical, still the method is not restricted to the hysterical class alone.

Isolation takes them away from and out of their old and often too sympathetic surroundings, thus giving the nervous system a fair chance of recovering its tone and stability. Under the influence of properly regulated massage, their nutritive functions receive a notable stimulus. Massage more than supplies the place of exercise, tissue metamorphosis becomes rapid, and waste products are more effectually eliminated. A steady increase in flesh and color, along with improved muscular and nerve power, is the result.

The duration of the treatment will vary, but six weeks may be said to be the shortest time that should be allowed for such a course, and ten or twelve weeks are generally required. During the first four to six or eight weeks, in extreme cases, the patient should be kept altogether in bed, being lifted onto a couch only for, perhaps, an hour in the morning and evening. The room should be airy, with, if possible, a sunny aspect; but in cases of extreme sensitiveness to light and noise, the quietest room available may have to be selected for the commencement of the treatment, and the change made as the case progresses. Much depends upon the choice of the nurse; she must not only be a perfectly trustworthy woman, but she should also

combine brightness and cheerfulness, with tact and firmness. It rarely happens that one person can be both nurse and masseuse.

Milk not too rich, and slightly warmed, should, during the first few days of the treatment, constitute the entire diet. It should be given in small quantities of three or four ounces at first, every two hours, and should be sipped very slowly. The quantity taken at a time may be gradually increased, and the interval between the supplies correspondingly lengthened. Constipation is usual, and may often be obviated by giving a small cup of black coffee early in the morning. If that does not suffice give some slight aperient.

In five or six days, a small breakfast, consisting of a cup of cocoa and a slice of bread and butter, may be added. A few days later, a mid-day dinner of fish or mutton chop, with a little milk pudding, still keeping up the same quantity of milk as before. At the end of a fortnight, a light evening meal, like breakfast, or of strong soup with bread, will complete the dietary. Extract of malt and some preparation of iron are useful adjuncts to the treatment.

This large amount of food, with vigorous massage, is kept up for three or four weeks. At the end of that time, the quantity of food is gradually lessened, and the massage and electricity applied at longer intervals.

Passive movements of the limbs are then begun gradually; the patient is allowed to sit up in bed for a short time, and soon to sit up in a chair for a few minutes daily. This is increased by degrees along with exercise, until, at the end of the treatment, the patient is only required to rest for three or four hours daily.

The return to the ordinary ways of life must be gradual. In many cases, a sea voyage, or a prolonged tour, does much to confirm the cure. Unfortunately, relapses occasionally recur, but as at present, equally successful results are not obtained by any other means, this fact does not tell against its adoption in suitable cases.

R. W. BURNET.

Physiological Effects.—What, then, are these physiological effects?

1. Soothing and gentle stimulation of *cutaneous nerves* by stroking the skin.

2. Encouraging venous and lymphatic *circulation* by stroking toward the heart. The vessels reached will depend on the part and on the depth of pressure. Following from this, there results increased activity of the circulation of the part so treated, *i. e.*, dilated arteries and capillaries, and a more rapid current of blood, and, in consequence, increased warmth, more active nutrition, and the removal of effused material. Muscles after massage have their electrical conductivity as well as their voluntary motor power greatly increased, and they recover from exhaustion much more rapidly than when left to themselves.

3. Mechanical stimulation of the *tissues*, leading, probably, to molecular changes, and resulting in increased activity of circulation and of metabolism. The tissues most usually affected besides the blood-vessels are the muscles, nerves, and in pathological conditions, inflammatory exudations. There is no reason why gland-tissues might not be affected in a similar way.

Objects aimed at in Massage.—These effects of massage are applied :

1. To stimulate the circulation locally or generally, increase metabolism, and encourage nutrition, whether in special groups of muscles, or in the body as a whole. Also to equalize the circulation, and draw blood away from congested areas (*e. g.*, shampooing to induce sleep).

Eccles has shown that superficial centripetal rubbing increases the pulse rate, probably by returning the blood more rapidly; while deep muscular shampooing slows the pulse, probably by dilating the vessels in the muscles.

2. To promote absorption of recent or old-standing inflammatory products, and to remove recent effusions of chronic thickenings and adhesions. These latter may be in and around joints, muscles, glands, or nerves, producing corresponding results.

3. By exciting molecular changes to remove certain neuralgias, *e. g.*, some forms of sciatica, and myalgias of the recent rheumatic or lumbago type.

4. Owing to its influence in stimulating the circulation and increasing metabolism, it forms part of the treatment of advanced hysterical emaciation, and has been advocated in narcotic poisoning, and for those apparently drowned. Although an almost endless number of methods of

manipulation have been advocated, the chief ones only need be described here.

The movements employed.—The simplest subdivision of the movements is that adopted by Schreiber, who classifies them as “*stabile*” and “*labile*.” Under the first he includes pressing, tapping (or beating), hacking, pinching, and concussing; under the second, stroking, rubbing, and kneading.

(a) *Stabile movements.*—(1) “Pressing” may be done with the tip of one or more fingers, with their phalanges



FIG. 1.—Pressure—Rapid Lateral Movements.

(especially 2d), or with the knuckles. The simple pressure may be modified by lateral or rotatory movements, or by passing into a rubbing or kneading movement. The amount of pressure employed will vary with the depth to be reached, and the object to be attained (Fig. 1).

(2) “Tapping, thrusting, hacking” (*i. e.*, “*tapotement*”) indicate sudden effects produced more or less forcibly.

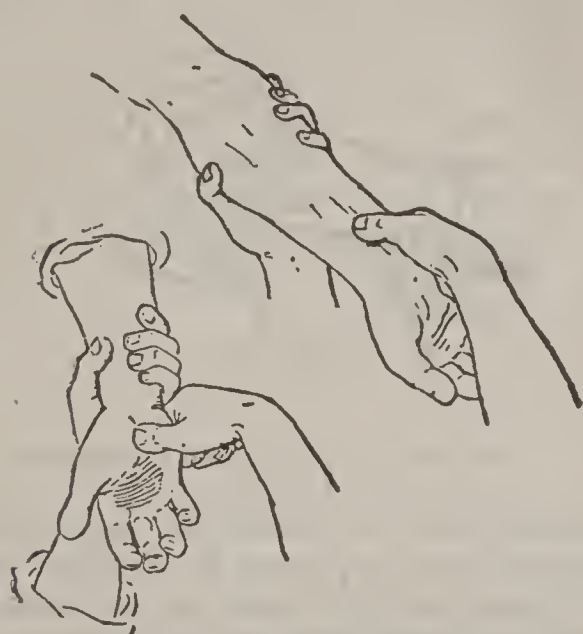


FIG. 2.—“Hacking.”

“Tapping” is done with the pulp of the fingers from the wrist, as in percussing the chest, or by knocking, as at the door, with the knuckles. “Thrusting” is really

poking up the deeper parts with the tips of the extended fingers, knuckles, or with the closed fist. "Hacking" is just striking the muscles with the ulnar edge of the opened hand or fingers, according as more or less force is required. It is used in dealing with the larger groups of muscles, and with deep nerves (Fig. 2).

(3) "Pinching," as its name denotes, is a grasping of the soft parts, either with the tips of the thumb and fingers, or with the pulp of the same. This is applied



FIGS. 3 and 4.—"Pinching."

specially to muscles and groups of muscles. A series of pinches, following one another along the muscles in a centripetal direction, is said to force onward the venous blood and lymph. This may result, to a certain extent. Those who insist most, however, on the necessity for anatomical knowledge in the masseur seem to forget that to a certain extent in all muscles, and very markedly so in some, the blood vessels enter the muscles at certain points from which they afterward radiate. We would, therefore, believe that the chief value of this manipulation is the mechanical disturbance produced.

A modification of pinching consists in "squeezing the tissues between the ball of the thumb and the tips of the fingers, after the fashion of what schoolboys term a horse-bite"—one of their numerous forms of mild torture.

(b) *Labile movements* comprise stroking, rubbing, and kneading.

(1) Centripetal stroking or "milking," when applied to the veins and lymphatics, is known as "*effleurage*." This increases

the circulation, and aids absorption. It precedes and follows most other movements to clear out the main trunks and prepare for their being filled, and afterward to sweep away accumulations within them. It is carried out either with the flat of the hand or with the edges of the spread-out forefinger and thumb, followed up with the palm of the hand. Muscles and groups of muscles are to be so treated as well as the subcutaneous textures.

(2) Friction, "kneading" (*pétrissage*), or rubbing proper, consists in firm pressure moved over special spots. It is specially applicable to inflammatory thickenings, in and round joints and tendon-sheaths, and in the substance of muscle. It may be done with the finger-tips or knuckles: but the pulp of the thumb will be found specially useful. The operator tries to dispel the thickening, as if by his own efforts, although he knows that probably the chief benefit will result from the after-vital changes which he sets up.

Time necessary.—The time to be occupied at each sitting is a matter of opinion. Dr. Grant, writing after a visit to von Mosengeil's clinique, believes that in this country the period is generally too much prolonged. His view is "That when once the muscles have been fairly and completely emptied of venous blood, lymph, and waste products, and when once an active afflux of arterial blood has been established, nothing more can be done for the time." In general massage, "every muscle should be subjected to *two successive processes of effleurage-pétrissage-effleurage*," and this, he holds, should be done by rapid movements in from ten to fifteen minutes. In local massage, about the same time may be occupied, except where inflammatory thickenings have to be got rid of, when a somewhat longer time may be taken. Once a day is generally considered sufficient.

Surgical conditions in which massage is applicable.—The commoner surgical conditions in which massage will mostly be required, are:

(1) *Stiff joints*, resulting from prolonged fixation for any reason, or following simple inflammation in and around the joint.

(*Caution.*—The stiffness following "strumous" arthritis is generally in old, and always in recent cases, best left alone, lest the original mischief should be re-excited.)

In these cases, the massage is applied to get rid of inflammatory thickenings, and to stimulate the growth and activity of muscles, which have been atrophied from disuse. To massage must be added hot and cold douching over the joint and muscles, progressively increased passive and active movements, and faradization.

(2) *Inflammatory Thickenings* in any accessible part—*e. g.*, round urethral strictures, in callous ulcers, in the testis after orchitis, etc.

(3) *Rheumatic Contractures and Thickenings*, where similar applications are made upon the affected muscles and the skin over them.

(4) *Recent Effusions* to promote absorption by *effleurage*. Some also advise the promotion of absorption of synovial distention in the same way.

MANIA, PUERPERAL.—See PUERPERAL INSANITY.

MASTODYNIA.—See NEURALGIA.

MASTOID DISEASES are usually the result of an extension of purulent inflammations of the tympanum. Extension of the inflammation from the tympanum outward along the periosteum of the meatus results in periostitis of the outer surface. A frequent consequence of this extension is a mastoid abscess (*see* EAR, DISEASES OF.) In healthy adults the bony walls of the mastoid cells usually resist disease, but in debilitated persons and children the bone is liable to become necrosed or carious.

In the chronic form of mastoid periostitis pain is not a marked symptom, and there may be little or no swelling, so that the bone may become carious without any external signs appearing, this occurring not infrequently in strumous persons. Cases are recorded in which the destruction of bone has gone on until all of the bony wall of the ear has separated as a sequestrum. In these cases, if opening has not occurred spontaneously the integument should be incised quite to the dividing of the periosteum, and the wound kept open by a tent or reopened daily with a probe, and washed out with a solution of carbolic acid, and if there is an opening into the mastoid cells, syringed out the aperture so as to throw the water into the tympanum, to make exit from the meatus.

Granulations often spring from the

cavity of the cells and will require evulsion and cauterization. All pus should be cleaned out, cutting down and trephining, if necessary, to secure its liberation.

Disease of the mastoid cells varies in character from a simple catarrh of the mucous lining from extension of inflammation of the tympanum, which may subside without producing any noticeable result, to an inflammation of the mastoid cells which may be so violent as to cause destruction of the bone, from caries, with much exfoliation. The inflammatory action may extend to the brain, giving rise to abscesses, with plugging and obliteration of neighboring sinus. Pyæmia and septicæmia may also occur, with not infrequently death. There are no characteristic signs of the disease, and the symptoms may be almost unnoticed, the patient in some cases being up and about as usual.

Treatment of mastoid cell inflammation.—If an incision has been made and discharge takes place freely, and especially if there is ready communication between the wound in the mastoid and the tympanum, and pain or head symptoms no longer exist, nothing more in an operative way may be required.

The parts should be kept clean by syringing with carbolic acid solution or warm salt and water. Granulations may require treatment as before suggested. If the discharge suddenly diminishes or ceases, with cerebral or febrile symptoms, the wound should be examined, and if there is evidence of retained discharge, any dead bone which may interfere with a free discharge removed with gouge or trephine, for the tendency of the disease is inward rather than outward. For removing dead bone a dental drill, propelled by the dentist's engine, is very efficacious and does not cause a great amount of pain.

Pot. iodid. in large doses, or the pot. bromid., or they may be combined, are indicated for any head symptoms. If these are ineffective, ergot may be used. Counter-irritation at the nape of the neck is desirable. An iced bag may sometimes be applied to the head, but if it causes pain, use hot water. It is well not to be too anxious to remove dead bone, for as a rule, it separates spontaneously, without trouble. If there is pain in the side of the head and about the ear, that resists ordinary treatment,

it will be justifiable to cut down on the mastoid, and whether a fistulous opening be found or not, open freely into the cells by the drill or trephine, and thus endeavor to ascertain whether retained secretion be present.

The general health should be looked after and nourishing food ordered if necessary.

Symptomatic Indications.—*Aconite* in the early stage or when febrile symptoms develop. *Belladonna* where the parts are congested, red, with throbbing pain. *Calcium sulphide* when suppuration appears inevitable; *silicea* when pus is thin, offensive, or when bone becomes necrosed or carious; *cinchona* sustains during abundant suppuration.

MEASLES (Morbilli; Rubeola).—

A highly infectious, acute disorder, characterized by an eruption which spreads over the whole body in the course of thirty-six hours, and is preceded and accompanied by marked fever and catarrh of the eyes, nose and respiratory passages.

Symptoms.—As a rule, the health is undisturbed during the period of incubation. The stage of invasion is ushered in by febrile symptoms—viz., malaise, headache, anorexia, nausea, drowsiness, and fever, the temperature reaching perhaps 103° F., or even higher, but it is common for it to fall to normal the next day, causing an erroneous belief that the illness is at an end. Catarrh of the eyes, nose, and air-passages appears, and the suffused look about the eyes, the frequent sneezing and the hard cough, put the experienced observer on his guard. Epistaxis is not uncommon at this stage. The soft palate will be found to present a well defined blush with numerous small red spots on it, and these spots may also be seen spreading onto the cheeks; the tongue is coated. In children predisposed to them convulsions often occur at this period.

The stage of invasion usually lasts till the fourth day, when there is an increase of the general symptoms and the eruption makes its appearance. This is first seen, as a rule, either on the cheeks, or temples, or in the neck, just behind the jaw, and consists of small, dark red maculopapules, the color being darkest in the center. These increase in size and become slightly elevated, they have a velvety

feel, and are roundish or crescentic in outline, their margins being sharply defined. The intervening skin is pale or injected, and the patches tend to coalesce, forming larger blotches or a diffuse redness, which disappear on pressure.

The eruption comes out rapidly, the face being covered in a few hours and the rash spreading onto the trunk and finally to the limbs; it is generally complete in twenty-four hours. While it is coming out a peculiar odor is sometimes noticeable. When the eruption is at its height there is a certain amount of subcutaneous infiltration, the face appears swollen, and the hands and feet feel tight and uncomfortable. The fever continues to rise after the eruption has appeared, and its greatest height corresponds to the greatest intensity of the rash. The pulse is generally proportionate in frequency to the degree of fever.

The general symptoms are aggravated while the rash is coming out, there is marked photophobia and lachrymation, profuse secretion from the nostrils, and a troublesome, hard, hoarse cough. In rickety children the cough and breathing are often croupy in character. The tonsils are sometimes swollen and there may be deafness from extension of the catarrh along the eustachian tubes; the glands behind the jaw and in the groin are occasionally enlarged. The urine is scanty and high colored, but rarely contains albumen. Profuse diarrhea is frequently among the early symptoms; if so it usually subsides spontaneously.

The rash fades in the order of its appearance, clearing off the face first; its total duration is usually four days; it leaves reddish brown stains, which may persist for two or three weeks, and a slight branny desquamation, only perceived, however, on the parts which are uncovered—*e. g.*, the face and hands. With the disappearance of the rash the temperature rapidly falls to normal, and the other symptoms gradually subside.

Sometimes no prodromal fever is observed, the malady appearing to commence suddenly with the rash; in some there is no catarrh, or the rash is absent. Such cases could only be recognized during an epidemic of the disease. All degrees of severity may be met with, from the mildest to the most malignant form, in which the eruption is hemorrhagic (black measles). In the severer forms great

prostration is at once the most marked and important feature, the pulse is very frequent, small and feeble, the respirations hurried, and although the temperature is very high, the extremities are cold. The rash in such cases is imperfectly developed or of a livid tint, there is delirium or subsultus tendium, and convulsions or coma may precede death.

Variations in the character and site of the first appearance of the rash may be met with. For instance, it may begin on the buttocks, and at first the eruption may be quite papular, but it is never vesicular. In a few cases a relapse of the eruption has been observed.

Diagnosis.—The catarrhal symptoms are of the greatest importance; they are not met with in any of the other acute infectious disorders. Another diagnostic point is that the fever does not subside on the appearance of the rash, but goes on increasing. In rōtheln the eruption is similar, but the spots are paler and less crescentic, and there is no catarrh and often there are no prodromata. The enlargement of the lymphatic glands in the latter disease is another important diagnostic feature. In scarlet fever the period of incubation is much shorter, the temperature higher, the pulse more frequent, vomiting is often present, there is no catarrh, but the throat is sore and the tonsils red. The eruption consists of minute bright red spots followed by flaky desquamation.

In variola there is lumbar and sacral pain and vomiting, but no catarrh; the fever subsides when the rash appears; the papules are shotty and speedily become vesicular; vesicles may be found in the mouth. In syphilitic eruptions there will be other evidence of syphilis; catarrh is absent and the face is often unaffected.

Complications and Sequelæ.—These are more numerous and of greater gravity in relation to the original disease than in any of the other infectious disorders.

Capillary bronchitis and catarrhal pneumonia are the most common and the most dangerous; some catarrh of the air passages is always present, and in young children, especially the rickety, this is very likely to spread to the smaller tubes, the condition being then very serious. Under these circumstances the lividity of the lips and the amount of recession of the chest will form the best guides

both in prognosis and treatment. Enteritis, colitis, laryngitis, and epistaxis may also occur at this stage. At a later period otitis, with perforation of the tympanum, is common. Ulceration of the gums, chronic laryngitis, and chronic broncho-pneumonia are apt to follow. Caseation of the bronchial glands, with subsequent general tuberculosis, is not uncommon, while empyema is also frequently seen: gangrene and noma of the face or vulva are rare complications. Membranous pharyngitis and laryngitis may occur together or separately, the condition then for all practical purposes being diphtheria. Whooping cough is so often met with as a sequela of measles as to suggest that there must be something more than an accidental connection between the two disorders. Scrofulous children are especially liable to have some sequelæ left by the measles; it may be chronic ophthalmia or otorrhœa, enlarged glands in the neck, or some lung mischief.

Prognosis.—This is generally favorable, but much will depend upon the state of health of the patient; a very guarded opinion should be given in the case of rickety children. The probability of some sequela resulting in the case of scrofulous children should also be borne in mind. The character of the epidemic must also be considered, as they vary much in degree of severity. Usually high fever during the stage of invasion is of bad omen, also the persistence of the fever after the rash has faded, as this is an indication of the presence of some complication. Great prostration is an unfavorable sign, and "black measles" is almost invariably fatal. The presence of any complication naturally increases the danger.

Pathology.—The eruption is due to hyperæmia around the orifice of a sebaceous follicle; this is followed by congestion and the exudation of a certain amount of plasma, which is the cause of the swelling. The rash disappears after death and there are no characteristic post-mortem appearances, though inasmuch as the lung complications are usually the cause of death, some evidence of this and some enlargement of the bronchial glands will generally be present.

Ætiology.—On this subject very little is known, no specific contagium having

as yet been discovered. There is the best evidence that the disease may be communicated by the breath or by the nasal mucus, and it is also certain that it may be carried by fomites in the clothes of a third person. The risk of infection is very great during the period of invasion and while the rash is coming out, and it continues for two or three weeks after this, but there is no reason to believe that it can be communicated during the period of incubation, the duration of which is about ten days. All ages are susceptible to the disease, and as most people have it in childhood it follows that it is most common among children. As an epidemic disease it is less common in the summer months, but in populous cities it is practically endemic. The recent epidemic in the Fiji Isles shows that when it attacks a people who have no protection, hereditary or otherwise, it is a serious malady. Some persons are so susceptible that they have a second, third, and even sometimes a fourth attack; in such cases each attack is often very severe.

Treatment.—In a mild case it will be sufficient to keep the patient in bed for a week and in the room or house for two or three weeks more. While the fever lasts he should only be allowed liquid diet. Diaphoretics may be useful. The diarrhea need not be checked unless it be very severe and persistent, and in that case cold compresses should be applied to the abdomen, and astringents and bismuth given internally. The inunction of lard or vaseline with a little carbolic acid is often useful. If the temperature be very high, quinine or some other antipyretic drug should be given, and the patient packed or treated with cold baths. It is a mistake to attempt to bring the rash out again if it disappear early, as such cases are often of an asthenic type and require a stimulating treatment. The cough and hoarseness will often be relieved by wet compresses to the front of the throat, and by painting the fauces with glycerin or glycerin and borax.

The various complications must be treated as they arise. As regards the general management of the sick-room and the means for preventing the spread of the complaint, see DISINFECTION.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Aconite* is useful in the first stage for the febrile

symptoms, and to arrest catarrhal pneumonia; often the only remedy required. *Pulsatilla*, following aconite for the catarrhal ophthalmia, nasal and intestinal catarrh. *Ipecacuanha* may be required when there is much cough, nausea or vomiting, also for nose-bleed. *Belladonna* may be required when there is sore throat, spasmodic dry cough, tendency to delirium, sopor or stupor, convulsive startings. *Camphor* is valuable when eruption is imperfectly developed or retrocedes; patient, although cold, does not want to be covered. *Cuprum acet.* when the eruption recedes, with marked cerebral symptoms. *Arsenicum* is valuable in the malignant form, emaciation, restlessness, prostration. *Kali bichrom.* does good service when cough is troublesome. *Calcium sulphide* is useful for hoarse, barking cough following measles.

MEDIASTINUM, ANATOMY OF.

—The mediastinum is the space in the thorax between the two pleural sacs. This interval is, for the sake of convenience, divided into two parts, according as they are situated before or behind the heart, and the term anterior or posterior mediastinum is applied to these parts. In the upper part of the anterior mediastinum are contained the remains of the thymus gland, and the origin of some of the hyoid and laryngeal muscles. It is narrowed at the center, and in the lower part there is some areolar tissue, together with the left triangularis sterni.

The posterior mediastinum, or the part behind the heart, is larger than the anterior. In the posterior mediastinum are contained the aorta, the vena azygos, and the thoracic duct, the esophagus with its nerves, the trachea, the splanchnic nerves at the lower part and some lymphatic glands. Some authors describe a middle mediastinum, and give as its contents the heart and the great vessels connected with it, and the bifurcation of the trachea.

F. DE HAVILLAND HALL.

MEDIASTINUM, EMPHYSEMA OF.—The presence of air in the cellular tissue of the mediastinum.

Dr. Champneys has directed attention to the frequent occurrence of mediastinal emphysema in fatal cases of tracheotomy; thus in twenty-eight cases of tracheotomy

Money found it present sixteen times, and in two of these cases it was associated with pneumothorax; sometimes it exists apart from emphysema of the neck. It has also been found in fatal cases of diphtheria in which tracheotomy had not been performed. The route taken by the air has been proved, by experiment, to be behind the deep cervical fascia. The existence of mediastinal emphysema, especially when combined with pneumothorax, may account for some of the deaths occurring after tracheotomy. The conditions favoring the production of mediastinal emphysema are division of the deep cervical fascia, obstruction to the air passages, and inspiratory efforts. The dangerous period during tracheotomy is the interval between the division of the deep cervical fascia and the efficient introduction of the tube. The incision in the deep cervical fascia should not be longer than necessary in the direction of the sternum. It should on no account be raised from the trachea, and this should be particularly remembered during inspiratory efforts.

F. DE HAVILLAND HALL.

MEDIASTINUM, INFLAMMATION OF (Mediastinitis).—Inflammation of the cellular tissue found in the mediastinum.

Symptoms.—The two prominent symptoms of inflammation of the anterior mediastinum, when the condition has gone on to suppuration, are dyspnoea and constant, severe pain referred to the post-sternal region. The usual constitutional symptoms attendant upon the formation of pus are, of course, present. On physical examination nothing may be detected, but if a large formation of matter occur, a fluctuating tumor may be felt above the episternal notch, or in one of the upper intercostal spaces, usually on the left side, and this bulging may have an impulse on coughing, or an apparently expansile pulsation may be communicated to it from the heart.

The symptoms of posterior mediastinitis are still more vague; there may be local pain and tenderness, and possibly dysphagia from pressure on the esophagus. Physical examination does not render much assistance in the diagnosis.

Diagnosis.—In most of the cases of abscess of the anterior mediastinum some history of the cause is obtainable; in its

absence it may be very difficult to distinguish a pulsating swelling due to suppuration from an aneurysm.

Prognosis.—This must be guarded, in view of the possibility of pus making its way downward and bursting into the lung or pleural cavity.

Pathology.—Suppurative mediastinitis may be set up by the extension of inflammation from the neck, as after tracheotomy or when, in treating bronchocele by injection the fluid has passed into the connective tissue of the thyroid gland instead of into its substance. Tubercular disease of the lymphatic glands is another cause. Many cases own a traumatic origin, resulting either from blows on the sternum, or from the impaction of foreign bodies.

Treatment.—Surgical treatment is imperative as those cases of mediastinal abscess which have been operated on and freely drained have recovered, whereas if the pus remain pent up a fatal termination of the case is almost certain. In a case reported by Ballance trephining the gladiolus was followed by recovery.

F. DE HAVILLAND HALL.

MEDIASTINUM, TUMOR OF.—A new growth, taking its origin from the anterior or posterior mediastinum.

Symptoms.—Obscure, a frequent pulse and increased rapidity of respiration, with vague pains through the chest, perhaps attributed to rheumatism, may be all that exist to awaken suspicion. In fact, until the tumor attains sufficient bulk to cause symptoms due to pressure on neighboring parts, it may be impossible to speak with any degree of certainty as to the nature of the case. The symptoms of mediastinal tumor are almost entirely due to direct or indirect pressure. The first to attract the patient's attention as a rule is *pain*. This may be so slight as to be hardly noticed or may be extremely severe. It may be limited to the affected side and fixed to one spot, or it may radiate over the chest and arm; the pain may be either dull or lancinating in character. In some cases the attacks of pain resemble angina pectoris.

Dyspnoea is a constant symptom in cases of mediastinal tumor, and, as a rule, it comes on early and is progressive; it may, however, be paroxysmal, and bouts of distressing orthopnoea may occur. The dyspnoea is due to a variety

of causes ; for instance, the trachea may be compressed by the tumor, though tracheal stenosis is an infrequent sequence in mediastinal tumors ; more frequently there is compression of one or other primitive bronchus. Besides being due to direct pressure on the air passages, the dyspnœa may be of laryngeal origin due to paralysis of the crico-arytenoidei postici from pressure on one or both pneumogastric nerves or on both recurrent laryngeal nerves. Dyspnœa may also be due to the changes brought about in the lungs as the two-fold result of the pressure and irritation of the new growth, *i. e.*, pleurisy, bronchitis, and œdema or gangrene of lungs. Obstruction to the vascular system by pressure on the blood vessels may also cause dyspnœa.

Cough generally demands attention in connection with dyspnœa. In some cases it is of a particularly harsh, reverberating character, causing the patient much distress ; in others it comes on in paroxysms like whooping-cough.

Expectoration varies much both in character and amount in individual cases. In some patients the cough may be quite dry, in others one of the most troublesome symptoms may be a copious watery or muco-purulent expectoration. In cases where erosion of blood vessels has occurred or a vascular growth has given way, the sputa may be blood-stained or the hemorrhage may be so profuse as to cause death from suffocation or from mere loss of blood. A gangrenous condition of the lung will be commonly revealed by the fetor of the breath and expectoration.

The *voice*, as in cases of aneurysm, may be affected by pressure on the recurrent laryngeal nerve causing the corresponding cord to assume the cadaveric position, or the hoarseness may be due to the chronic laryngitis resulting from extension upward of inflammatory changes in the lungs or trachea. In addition to the anginal symptoms already referred to, the patient may complain of *palpitation* and discomfort in the cardiac region. In a few cases the only symptom of which the patients have complained has been *dysphagia* ; that is particularly apt to occur when the malignant growth starts in the posterior mediastinum.

Emaciation is the rule in mediastinal growths, and is, of course, especially

marked when there is any obstruction to the lumen of the esophagus.

Temperature.—Fever is a symptom which cannot be associated with pressure. In some cases a regular daily rise and fall of temperature has been recorded, and it has been suggested that the rise of temperature is more characteristic in cases of lymphadenoma than in cancerous disease. In many cases, however, a very probable explanation of the rise of temperature is to be found in the presence of an intercurrent pleurisy.

In making a physical examination of the patient it is most important to pay attention to the combination and succession of the physical signs.

On *inspection*, the patient may be found pale or cyanosed, or may possibly have the aspect of health. Distended veins, and œdema of the head, trunk, or extremities, especially when confined to one side, are very important signs. In one case a lympho-sarcomatous mass extending along the heart had exerted so much pressure on the inferior vena cava that œdema of the lower extremities, and enlargement of the superficial veins on the abdomen were the most prominent symptoms. The fingers may be clubbed. On examining the chest, loss of movement, diminished or increased bulk of one side, obliteration or retraction of the intercostal spaces, and the presence of local bulgings may be noticed. Contraction of the affected side is met with, especially in cases of pressure on the main bronchus. The apex beat may be much displaced. In one case in which during life the impulse of the heart was felt in the right axillary line, the apex was found at the autopsy in this position. The results obtained on *palpation* are variable ; if there be a mass pressing upon and occluding one bronchus, there will be a great diminution, or even entire absence of any vocal fremitus ; but in cases where there is a solid mass intervening between the chest wall and the bronchus, without compressing the latter, the vocal fremitus may be augmented. The *cyrtometer* may be employed to show the changes in shape which the thorax has undergone. On *percussion*, a marked sense of tactile resistance is experienced if the growth extend to the surface ; in some cases a characteristic amphoric note may be elicited if healthy lung be compressed by the tumor : in other cases the dullness

may be due to collapse of the lung from pressure on the main bronchus, but in a case observed by the writer, notwithstanding that the respiratory murmur was absent, the note on percussion was hardly to be distinguished from that on the sound side, though the post-mortem examination showed that the bronchus was occluded by the pressure of a cancerous mass. If there be great œdema of the chest walls it is frequently impossible to attain any correct results from percussion.

On *auscultation* the respiratory murmur is usually suppressed over the site of the tumor; at times, however, when the tumor exists as a solid mass intervening between chest wall and bronchus, without obliterating the latter, bronchial breathing may be heard over the dull area. Vocal resonance, like vocal fremitus, is usually absent. The heart-sounds may sometimes be so well conducted through a solid mass as to suggest a suspicion of aneurysm.

As regards the *pulse*, an inequality in the radial pulses, as is met with in aneurysm, is not of infrequent occurrence; it is generally brought about by pressure of the tumor on the subclavian artery of the side corresponding to the weaker pulse. The *pupil* also exhibits changes similar to those seen in aneurysm, *i. e.*, at first the pupil may be dilated from irritation of the sympathetic, and later on complete paralysis of the sympathetic supply to the iris leads to uncontrolled action of the third nerve, and consequent contraction of the pupil.

Laryngoscopically, the changes met with in aneurysm may also be seen in mediastinal tumors, but perhaps not quite so commonly in the latter as in the former. At first the vocal cord may be seen in the position of phonation, this being due to the abductor filaments of the recurrent laryngeal nerve succumbing first to the pressure; after a time the adductor filaments are affected, and the cord falls into the cadaveric position, *i. e.*, the position midway between phonation and inspiration.

Diagnosis.—From aneurysm and pleural effusion. The differential diagnosis of mediastinal tumor from *aneurysm* will be first considered. As regards symptoms, there are none which are of any value in distinguishing between the two conditions, and this will be readily admitted when it

is remembered that in both these diseases the cause of the symptoms is one and the same, *i. e.*, they are either directly or indirectly the result of pressure. It has been stated that in malignant tumor of the mediastinum the onward progress of the disease is much more sure and steady than in aneurysm, in which the patient is liable to alternations of improvement and retrogression, but the writer can recall at least one case which controverts this view—*viz.*, the case of a patient suffering from a malignant growth in the mediastinum (as was proved post-mortem), in whom the improvement, which ensued after the administration of iodide of potassium and the enforcement of rest, was so great as to strengthen the idea that an aneurysm was the real cause of the trouble. It therefore appears that one must rely almost entirely on physical signs for the diagnosis, though such conditions as the youth of the patient, the female sex, and a healthy state of the arteries, may assist in deciding adversely to an aneurysm.

In favor of a tumor would be the absence of the sounds of the heart, or of any impulse over the dull area, especially if this be large and the evidence of extension of the tumor in several directions at the same time. The existence of glandular swellings or lumps in the thoracic parietes also go to prove the presence of a tumor. For the diagnosis of an aneurysm the diastolic shock, particularly when combined with pulsation, is of the greatest value. Severe pain, especially pain felt posteriorly, is in favor of aneurysm.

The diagnosis of mediastinal tumor from *effusion into the pleural cavity* is sometimes a more difficult matter than to distinguish it from aneurysm. In one case the whole of the left pleural cavity was filled with a mass of round-celled sarcoma, not much more solid than thick pus; there was uniform dullness over the whole of the left chest, the dullness transgressing the median line; the heart was displaced, and there was an entire absence of respiratory murmur, vocal resonance and fremitus, in fact all the physical signs usually met with in pleural effusion were present. In favor of the diagnosis of a tumor as against effusion, is the limitation of dullness to the apical region and the comparative clearness at the base, the respiratory murmur being audible there; or irregularity in the dullness; resonant patches cropping out in the midst of the dull re-

gion; the presence of unilateral œdema; glandular swellings or tumors in the chest walls. The aspirator will often give valuable information, *i. e.*, a blood-stained fluid is in favor of pleurisy set up by a malignant growth.

Prognosis.—In the case of the malignant growths the tendency is slowly but surely toward a fatal issue, death usually occurring in from about three to six months after the commencement of symptoms of pressure, life being seldom preserved for over a year. Inasmuch as it is almost a matter of impossibility to diagnose the nature of the tumor, it is, therefore, advisable always to give a guarded prognosis, though if the symptoms be due to gumma they may clear up under the exhibition of full doses of iodide of potassium, and occasionally enlarged bronchial glands may subside if the patient be placed in favorable circumstances.

Pathology.—Though at one time almost all the tumors met with in the mediastinum were considered to be carcinomatous, and usually described as encephaloid cancer, primary carcinoma of the mediastinum is rare, and the majority of the growths belong to the class of sarcoma or lymphoma, or partake of the structure of both, and are therefore termed lympho-sarcoma. Gummatous tumors have also been met with in this situation. The lymphomata occur as masses of enlarged glands in tuberculosis or in Hodgkin's disease.

It is usually difficult to decide as to the point of origin of mediastinal tumors; the lymphatic glands, the remains of the thymus gland, and the connective tissue itself are regarded as the points of departure.

Ætiology.—Nothing is known as to the causation of tumors of the mediastinum. All that can be said about them is that the sarcomata are more frequently met with in young people, and the carcinomata occur later in life. The majority of cases of mediastinal tumor have occurred under thirty. As regards sex mediastinal tumors are perhaps slightly more frequent among females, whereas aneurysm of the aorta is much more common in males.

Treatment.—Must be almost entirely of a palliative nature, except in those rare cases in which the tumor is of a gummatous nature, when iodide of potassium in full doses will generally have a striking effect. Even when there is no reason to

suspect any syphilitic affection iodide of potassium often benefits the patient, and should therefore always be tried. Relief from pain must be sought for by the use of morphia, preferably hypodermically. Rubbing in the liniment of belladonna or the application of a belladonna plaster will sometimes alleviate the radiating pains over the chest. Where there is inability to take food from stenosis of the œsophagus, the patient must be fed per rectum, or gastrostomy may be undertaken. If dyspnœa be increased by effusion into the pleura, the patient may be relieved temporarily by paracentesis, but recurrence of the exudation is almost certain.

F. DE HAVILLAND HALL.

MEDICINAL RASHES.—An eruption on the skin is a not uncommon result of the internal administration of certain drugs. The occurrence may be due to the administration of the drug in excessive doses or for an undue length of time, but generally depends upon an individual susceptibility of the subject.

Idiosyncrasy also modifies the nature of the eruption, the same drug giving rise to different forms of rash in different persons. In individuals possessing a natural proclivity to diseases of the skin, drug eruptions may persist indefinitely, even after the complete elimination of the drug from the body. Minute doses of certain drugs (bromides, iodides) appear to be more apt to produce rashes than large ones.

Medicinal rashes may be conveniently divided into two groups:

(1) Those which usually become pustular. *Bromine* and the *bromides* cause acneiform or furuncular pustules, in which, however, the sebaceous glands are not specially involved. The eruption occurs upon the face, back, and chest, especially in persons with thick, oily skins. Macular discolorations, pale papules about the elbows and knees, *large, dusky, purple, suppurating, papillomatous-looking nodules*—often arising from scar-tissue—bullæ, rupioid lesions and conditions resembling erythema nodosum and urticaria, have been occasionally observed. Their appearance is often prevented by the simultaneous administration of arsenic.

Iodine and the *iodides* may cause erythema, sometimes papular, on the arms face and neck, or a weeping and itchy

eczematoid condition of the scalp, scrotum, chest, or limbs, but the commonest rash resulting from their use is pustular and acneiform, and has a similar appearance and distribution to that caused by the bromides. The bullous iodide rash is a rare but severe form which attacks chiefly the head and neck, hemorrhage into the blebs occasionally occurring. Purpura from iodides generally occurs on the legs; it may simulate purpura hemorrhage and sometimes even proves fatal.

Renal disease and cardiac weakness strongly predispose to the occurrence of bromide and iodide rashes owing to the deficient elimination of the drugs in the presence of such conditions.

(2) Those which are erythematous in character. These often cover extensive areas, develop suddenly, are sometimes preceded by a chill and accompanied by pyrexia and gastric disturbances. They disappear rapidly after discontinuance of the drug. *Belladonna* rash resembles scarlatina, and the throat is usually dry and red. *Chloral* rash is erythematous or urticarial; it itches, often involves the fingers and hands, and may terminate in hemorrhage, ulceration, and sloughing. The *copaiba* rash is a multiform erythema affecting by preference the hands, arms, feet, knees, and abdomen. *Mercurials* occasionally cause an erysipelatoid condition, beginning on the face and spreading over the trunk. *Opium* and *morphia* cause itching, followed by a scarlatini-form rash on the trunk and inner and flexor sides of the limbs, followed by desquamation. *Quinine* may give rise to an erythematous or urticarial rash, accompanied by irritation of the conjunctivæ and fauces. *Salicylates* and *antipyrin* produce severe erythema with œdematous swelling, especially of the eyelids, and sometimes ecchymoses. *Arsenic* may cause an erythematous or urticarial rash, especially on the face and neck, more rarely a pustular eczema or purpura; herpes zoster develops with apparently undue frequency during its administration, and diffuse deep brown pigmentation often results from its free employment.

Erythematous rashes are said to occur occasionally from the use of cannabis indica, cubebs, digitalis, santolin, stramonium, quinine, strychnine, and turpentine. Borax is supposed to cause a rash

like psoriasis, and phosphoric acid to cause pemphigoid blebs.

Treatment consists in stopping the causative drug. The dose of bromide or iodide, if small, may be tentatively increased, and often with advantage.

J. J. PRINGLE.

MEDITERRANEAN FEVER is a convenient term under which to describe a specific febrile disease observed at many points in the islands and littoral of the Mediterranean. It is characterized by long, irregular pyrexia, frequent relapses, rheumatic complications, constipation, and the absence of ulceration of Peyer's patches. It has been variously described under the names febris complicata, febris audoralis, gastro-bilious fever, fæcomalarial fever, Mediterranean gastric remittent fever, Malta fever, Italian fever, and Neapolitan fever.

The *symptoms* commence after an incubation period of six to nine days, and as a rule, the onset is insidious. The earliest symptoms are loss of appetite, nausea, severe headache, pains in the limbs, and general malaise. The tongue is large, indented by the teeth, and has a thin, yellowish fur; the pharynx is congested, the bowels as a rule are constipated, and the spleen and liver enlarged. There is slight cough, but no distant bronchitis. Lumbar pain is frequently a troublesome symptom, and sciatica is not uncommon. Perspiration is profuse and may produce sudamina, but no other eruption is present. The temperature curve is not constant; in severe cases it tends to be continuous, in mild intermittent, but the intermittent type may be observed to pass into continuous and *vice versa*.

The temperature is high, reaching 104° to 106° F.; in fatal cases it may run up to 110°. After the symptoms described have lasted ten days, the tongue cleans, appetite partially returns, delirium if previously present, ceases, and the patient sleeps fairly well. But headache, the lumbar and sciatic pains, and perspiration continue; anæmia increases and the temperature remains high. The pulse, which at first was not much increased in frequency, now beats 110 to 120 in the minute, and palpitation is often complained of. In nearly half the cases one or more of the joints, sometimes several in succession, become red, swollen, and

very tender. In this way the case drags on, often for many weeks. Ninety days is a common period to elapse before convalescence is established, and if relapses occur, as is frequently the case, the illness may be prolonged for nine months, a year, or even two years.

The *diagnosis* requires to be made from enteric and from remittent fevers. From the former it may be distinguished by the irregular character of the pyrexia, the absence of diarrhea, tympanites, and gurgling in the iliac fossa, the absence of rash, and the long duration of fever. From remittent fever the diagnosis is more difficult, and by many physicians this fever is classed with the remittent fevers. It is, however, unaffected by quinine, and the temperature curve does not, as a rule, present regular periodic remissions.

The rate of mortality does not exceed two per cent. The most unfavorable elements in *prognosis* are, very high temperature and rapid pulse. In expressing an opinion the great liability to relapses must be remembered.

The *pathology* of the disease is obscure. It appears to originate in association with imperfect disposal of excremental matters during the warm season.

Treatment is unsatisfactory. The patient should, as soon as possible, be removed from the locality in which the disease was contracted, although the course of the fever is not thus cut short.

Quinine does not exert any directly curative action, and seldom has any beneficial influence. Antipyrin, given to the amount of 60 or 90 grains, reduces the temperature, relieves headache, and favors sleep. A short course of aconite has been recommended at the commencement of the disease. Advantage is derived from the occasional exhibition of calomel in combination with ipecacuanha and rhubarb, or colocynth. Italian writers have recommended the systematic administration of calomel. Salicylic acid and its salts appear to be injurious, depressing the heart and increasing the anæmia. The joint affections and the lumbar and sciatic pains may be treated by the liniments of aconite, opium, or belladonna; blisters are useless. The most important part of treatment is attention to ordinary hygiene and the systematic administration of liquid, easily digested food.

DAWSON WILLIAMS.

Symptomatic Indications.—See REMITTENT FEVER.

MELÆNA signifies the presence of altered blood in the motions, the blood being more or less black in color, and of tarry consistence. Properly speaking, the term should not be used when the motions are found to contain bright blood. It is a condition met with in several diseases. The blood need not have come from the intestines, or the portal system, or even from the stomach or œsophagus, as it may have been taken into the stomach from the mouth, having perhaps originally come from some vessel within the lungs. The presence of blood in the motions is by no means uncommon after a profuse attack of hemoptysis.

MELANCHOLIA.—When the normal sense of well-being is absent, when the tension of nerve-force has fallen below a certain standard, an individual is said to be depressed. Not everyone, however, who is afflicted with lowness of spirits is suffering from melancholia. This affection begins when gloom and despondency prevail for which no cause, or no adequate cause, exists in the environment.

Depressed feeling then is the cardinal and salient feature, and this may exist without any intellectual aberration, or with so slight a degree of it that it may easily be overlooked. The individual becomes dull and moody, listless, incapable of mental or physical exertion. He takes no interest in his surroundings, but is dejected, sad, and weary of existence. At times, however, he may be able to rouse himself, and for a short time may appear to be himself again.

A stage more advanced may be reached without the intellectual faculties being notably impaired. The patient may now sit all day with his hands before him, gloomy and taciturn, taking but little notice of his surroundings, and unable to occupy himself in any way, but yet, if questioned, his answers may be rational, his memory good, and he may even assign plausible reasons for the change in his disposition. No distinct delusions being present, the person may appear to be sane, but the prevailing sense of misery casts its shadow over everything and, tinged with gloom all the patient's relations with the world, causes a false

estimate to be made of things in general.

The more purely organic functions share in the general languor. The circulation is feeble, and the respiratory rhythm slow. The appetite is usually poor, the digestion disordered, and the bowels constipated.

On the physical side there is widespread nervous depression, on the mental side, pain; and these two characteristics sum up the cardinal features of a case of *Simple Melancholia*, which is the mildest form of the disease.

The case may progress no further, recovery taking place; but more often delusions are developed, and with them hallucinations and illusions are often associated. The most common hallucinations in melancholia are those of hearing "voices," ordering, accusing, or reproaching. Hallucinations of sight present themselves in the form of "visions" of various kinds. Perversions of common sensibility may give rise to ideas of electricity being at work. A disordered stomach may lead a person to think that he is poisoned.

It is most important to recognize that in melancholia the derangement of feeling is primary, and the derangement of intellect secondary; that the association of the two is not a mere accident, but that the latter is distinctly developed out of the former. It is common for the delusions of melancholiacs to take the form of self-accusations of imaginary crimes, or the patients may live under perpetual dread of impending imprisonment or death. Their countenances express the terror which lies upon them, nor does the daily experience of non-fulfillment of their fears abate in any way the tenacity of their beliefs. Some patients, again, are extremely suspicious, and believe themselves the object of conspiracies or persecutions.

When the disease has attained this well-marked development, and when delusions constitute a prominent feature of the disease, it is often specially designated *Delusional Melancholia*. Another type, in which the delusions have reference mainly to the state of the patient's viscera, has been described under a special name as *Hypochondriacal Melancholia*.

This form bears much the same relation to hypochondriasis that delusional melancholia does to the simple form of the affection. In it the morbid ideas are

concentrated upon the more purely organic functions. A patient will assert that he has no heart, or liver, or stomach; he will declare that his bowels are sealed up and never act, nor will the demonstration of a copious evacuation in any way alter the idea that has taken possession of him. Delusions with reference to the sexual organs are also very common.

To obtain, then, a picture of the developed form of the disease we have to add to the physical depression and the mental pain the presence of different forms of sense perversion, and of various kinds of delusions. The delusions may lie on the surface, or have to be sought for; they may be frequently and urgently expressed, or hidden in the depths of morbid feeling. But *passivity* may be said to be a feature of all cases alike. Such cases constitute well-marked clinical pictures, which may progress no further, and from which complete recovery may take place.

But there are other types of the disease, which may either develop out of what has been described or present their own peculiar characters from the first. The passivity may be so pronounced that the patient is plunged into absolute mental stupor. In a well-marked case of this kind external stimuli produce no effect on the patient, who appears to be perfectly insensible to surrounding things. He will stand like a statue, or sit in a bowed attitude with his head bent forward on his chest, his eyes closed, his hands hanging helplessly by his side. The limbs may be flexible, and sometimes resemble those of a cataleptic patient in remaining for a time in any position in which they are placed. The saliva frequently dribbles from the mouth and saturates the patient's clothes. The urine and fæces are usually passed in the position in which the patient stands or sits without his appearing to be aware of it. He has to be washed, dressed, and fed, and in fact treated in all respects like an infant.

Such cases have received the designation *Melancholia with Stupor*, *Stuporous Melancholia*, or *Melancholia Attonita*. They closely approximate to another form of mental disease, which has been described as *acute dementia*.

In the true melancholia with stupor, however, the face is expressive, not so much of fatuity, as of self-absorption or terror. The mind of the patient is con-

sidered to be so absorbed with the contemplation of some horrifying delusion as to be quite insensible to the environment. That this is so in certain cases is probable, both from the expression of countenance and the statements made by some patients after recovery, but it cannot be safely affirmed of all cases.

Allied to stuporous melancholia is a form which has been described as a special type under the name of *Resistive Melancholia*. This is best looked upon as a variety of the stuporous form, although some cases present much resistance and little stupor, and others much stupor and little resistance.

In this form the limbs, instead of being flexible, are rigid, and become more so when attempts are made to move them. The patient is sullen, morose, obstinate, and taciturn; he resists more or less strongly everything that is done for him, and is fed and kept clean with much difficulty.

Cases of melancholia may, however, vary in a direction directly opposite to that of stupor, and instead of passivity, *activity* may prevail. The patient indeed is so restless that this type has received the designation *Excited* or *Motor Melancholia*, or *Melancholia Agitans*. Than it, no form of mental disease is more distressing. Here the mental agony rises to such a height that it finds expression in muscular reactions. The unhappy patients may pace wildly up and down the room, as if endeavoring to escape from the terror which appalls them. Despair is depicted on their countenances. Sometimes they will tear at their throats, or pull out their hair till their scalps are bald; or they will tear their nails off, and pull pieces out of their flesh; or again, gnaw their lips and bite their fingers, or be perpetually picking them. They are usually very active in the expression of their delusions, which are all of the melancholic character, such as, that their souls are lost, that they are eternally damned, that they are to be tortured and executed, etc., etc., or they may be continually asserting their innocence of some imaginary crime.

Patients in this condition are almost always actively suicidal; to escape from the terrors which hang over them, they will, if possible, terminate their existence. They often refuse food in the most obstinate manner, with the deliberate inten-

tion of destroying themselves, and would indeed succeed in their endeavors were they not forcibly fed. A variety of this form occurs in which the patients are worked up into a perfect frenzy of panic and alarm; they rush wildly about the room, and are so completely possessed with terror as to be absolutely incapable of understanding anything said to them. In this state they may commit acts of violence of which they are quite unconscious afterward when the panic has subsided. Such a condition seldom lasts long, but is liable to recur at different periods in the course of the case.

We have six leading types of the affection: (1) simple melancholia; (2) delusional melancholia; (3) hypochondriacal melancholia (a variety of No. 2); (4) stuporous melancholia; (5) resistive melancholia (a variety of No. 4); (6) excited or motor melancholia.

It must not be understood that the above are distinct forms of disease; they can scarcely even be said to be varieties. These names simply stand for groups of symptoms which are presented to us in practice, and which it is convenient to remember.

There are certain other points in connection with the mental condition of melancholiacs which require consideration. It was mentioned at the outset that in the milder forms intelligence might be apparently perfectly retained, and especially that the memory might be quite good. It may now be added that even in the severer forms in which distinct delusions are present, the patient, on ordinary topics unconnected with his delusions, may still appear rational, and his memory may still be perfectly retained, though this is by no means always the case. But in proportion as these cases are receded from, either in the direction of mental stupor, or in that of mental agitation, grave impairment of memory, in addition to other mental defects, is commonly observed. This may, especially in stuporous cases, be due to incapacity on the part of the brain-cells to register new impressions; but it is frequently dependent upon want of attention, the patient being too much absorbed in his own misery to care for, or to take any notice of, surrounding things, and hence these pass to a great extent unregarded.

The suicidal tendencies observed in melancholia constitute an important feature. It would not be correct to say

that every melancholiac is suicidal, but it is certainly the case that every such patient has the potentiality for self-destruction, and the immense majority exhibit such tendencies at some period or other of the case. The excited cases are probably on the whole most prone to suicide; but the tendency is present in many cases of melancholia. Occasionally suicide is directly dependent upon auditory hallucinations, the patient hearing voices commanding him to kill himself.

Though melancholia, as a rule, constitutes a more or less well-marked clinical entity, a melancholic condition is frequently merely a stage in the development of other mental disorders; thus it very generally precedes an attack of mania, and sometimes ushers in general paralysis, or is associated with this disease throughout its course.

The weakness of the circulation is most pronounced in stuporous cases, in which the extremities may be constantly cold and livid, and even œdema of the feet is not uncommonly observed. There is marked slowness of the respiratory rhythm. More or less insomnia is almost invariable in recent cases, and sleep is often wanting in proportion to the severity of the attack. The digestive functions are very generally disturbed, and the gastric trouble is often an important factor in the disease. The tongue may be dry and thickly loaded with fur, the breath offensive, and the bowels confined; and along with this there may be total lack of appetite and great difficulty in administering food.

This condition may be either a cause or a consequence of the melancholic state. In some cases, probably, the gastric derangement may actually precipitate an attack of melancholia which may pass off when a healthy condition of the gastro-intestinal tract is restored. But more commonly the derangement has its origin in the general lack of nerve force which has been shown to be so widespread a feature of the disease, or it is dependent upon the refusal of food which is so common in these cases. The stomach always becomes much disturbed in fasting cases. The refusal of food may itself be due to the general apathy and torpidity, or it may be the result of a deliberate resolve on the part of the patient to go without sustenance in order that he may starve. The nutrition of

the whole body suffers, and the patients almost invariably lose weight. Trophic lesions of the nails and skin are not infrequently observed.

In women menstruation is usually suppressed, though in a prolonged case it very generally reappears, even though there be no improvement in the mental condition.

Ætiology.—Melancholia may occur at all periods of life from youth to old age, but it shows a special preference for the epoch of middle life. Any cause which depresses the general health, or any mental shock, may act as the exciting cause of an attack. Thus melancholia is common in women who have been exhausted by prolonged lactation, and it is not infrequent in pregnancy and the puerperal state. Losses in business, domestic bereavement, grief, and anxieties of all kinds operate powerfully in producing the disease. Drink is also a frequent cause. But it is not every brain which has the capacity for developing melancholia, however unfavorable may be the conditions of the environment. For the exciting cause to be operative there is needed a predisposing cause, which is to be found in most cases in the inherited cerebral constitution.

Hereditary tendency is obvious in a large proportion of cases and exists in many others in which it cannot be traced. By hereditary tendency is to be understood not merely the direct transmission of insanity, but the existence in the ancestral tree of any form of neurotic taint, including alcoholism.

Pathology.—This is obscure, but a few facts may be noted. In death from acute melancholia, the cerebral changes to be observed are slight. In the recent forms there is commonly evidence of excess of blood in the cerebral cortex, the surface of the convolutions frequently presenting a more or less diffused patchy pink staining, and there being in places congestion of the deeper layers of the cortex. In the chronic forms the brain may appear absolutely normal to the naked eye, or there may be nothing noticeable beyond a little unusual pallor.

The chief *microscopical change* observed has been the presence in excess of the so-called "fuscous degeneration" in the brain cells, these being more or less filled with clusters of yellow granules. This change, however, is by no means

confined to melancholia. It is met with extensively in dementia, and occurs normally to a slight extent as age advances. It appears to connote a defective power of energizing on the part of the brain cells, and hence when occurring to any extent in early adult age, it must be looked upon as distinctly pathological.

There can be little doubt that in melancholia the brain cells, from some inherent or acquired defect, are incapable of appropriating sufficient nutriment to admit of their discharging in the normal manner, and that the tension of nerve force is exceedingly low.

The melancholic diathesis, indeed, connotes a perennial difficulty in keeping up the brain nutrition to the proper standard, and a great liability for it to fall below the minimum of working power upon the occurrence of the least adverse change in the environment.

The pulmonary lesions in melancholia are important. As might be expected from the slowness of the respiratory rhythm and the general immobility of these patients, a large number of them fall victims to phthisis, which is indeed the most common cause of death in this disease. Occasionally, indeed, phthisis precedes the mental disorder and acts as its cause. It is, moreover, common, especially in the acute cases, for a low form of pneumonia, which is fatal, to be developed. Actual gangrene of the lungs is also frequently noted, either as a primary affection, or as a sequel to the pneumonia just mentioned. It appears that this is sometimes occasioned by minute particles of food passing into the larynx and getting drawn into the smaller bronchi, in cases in which there is much difficulty in administering food, and when, as often occurs, the food is retained for a long time in the mouth and back of the fauces before it is swallowed. Pulmonary disease may develop in a very insidious manner, and all the ordinary symptoms may be latent until the fatal termination is within sight.

The occurrence of organic disease within the abdomen is much less frequent. It appears, however, occasionally to occur in direct association with the melancholic state, and visceral delusions seem to have thus at times a visible origin, but it is much more common for these latter to exist with abdominal organs apparently perfectly healthy.

Diseases of the uterus and its appendages, such as prolapsus, tumors, etc., are common, and occasionally stand in a causal relation to the disease.

Terminations.—(1) *Recovery.*—This is by far the most common termination, especially in the simple form of the disease. The great majority of the cases that recover do so within a year from the first onset of the symptoms.

(2) *Death.*—This occurs in various ways. It may result, especially in the acute forms, from sheer exhaustion of nerve power, all the residual stock of nerve force being used up and collapse ensuing; or it may be and frequently is, occasioned by some intercurrent affection such as simple pneumonia or phthisis, to which the low nervous vitality of these patients renders them peculiarly prone. Or, again, it may be the result of suicide.

(3) *Chronic Melancholia.*—This is merely a chronic form of the acute affection. Although it occasionally issues in recovery, the more usual course is a gradual lapse into the following state:

(4) *Dementia.*—This is simply mindlessness of greater or less degree, and is the goal toward which all forms of insanity tend. At times it is a somewhat rapid sequel to the acute forms of the disease; but it is more usually of slower onset and of less degree of intensity than when it occurs in succession to other kinds of mental disease.

(5) *Mania.*—A few cases terminate in subacute or chronic mania. That is, after melancholia has lasted a few months, a year or more, the character of the symptoms entirely changes, maniacal excitement is developed, which lasts a variable time, and from this the patient, as a rule, gradually lapses into fatuity.

Prognosis.—This is good in proportion to the youth of the patient, the suddenness of onset, and the absence of well-marked hallucinations and delusions. It is unfavorable according as the reverse of these conditions obtains. Persistent refusal of food and loss of body weight are bad signs. The severer forms of melancholia agitans are unfavorable, especially if the excitement be long continued. Cases of deep melancholic stupor frequently make excellent recoveries. The longer a case lasts, the less chance there is of permanent recovery.

Treatment.—It is of no avail to attempt

to argue a patient out of his delusions, or to point out to him that his hallucinations are purely subjective phenomena. Attention should be concentrated upon removing the condition of brain upon which the morbid feeling depends, and the intellectual defects will usually disappear *pari passu*. The first and most obvious indication is to endeavor to improve the general health and restore the exhausted nerve force by abundance of fresh air, good food, and nervine tonics. In warm weather it is desirable for the patients to live as much as possible in the open air, without, however, fatiguing themselves by too much muscular exercise. In the early stages the stimulus of foreign travel is at times highly efficacious, but a quiet rest in some suitable health resort is more beneficial to the majority of cases. Complete rest, indeed, with change of air and scene are the first requisites. Such measures will frequently suffice to restore a case which has not progressed far.

It is often unnecessary to send a patient of this kind to an asylum, provided he has sufficient means to insure his being properly looked after; for the suicidal tendencies of melancholiacs should always be borne in mind, and it is never safe or advisable to allow them to be by themselves. Hence, if sent from home, it should always be under suitable escort, and it is well to be very cautious in prescribing sea voyages, on account of the facilities thus afforded for the gratification of suicidal impulses. There is no question, however, that removal to an asylum is often productive of great benefit, the change to an orderly, settled life, and the subjection to discipline being highly efficacious in many cases.

Gastric derangements must be combated by ordinary means. Refusal of food is often an exceedingly troublesome symptom, and one most difficult to treat. If obstinate it must be overcome by the use of the stomach-pump, and the patients must be forcibly fed two or three times a day with milk, meat extracts, liquid custards, etc. The food may, with advantage, be peptonized before administration. Stimulants are undoubtedly useful in many cases and should be given with food.

Insomnia is best treated by keeping the patients in the open air as much as possible—all day long if the weather be

favorable, and the strength permit. Hypnotic drugs, such as chloral, morphia, henbane, etc., should be given with caution, as though they may be useful and desirable as occasional adjuvants, continued persistence in them has a deleterious effects on the nervous centers, and lessens the chances of recovery.

In some cases, especially those in which much stupor is present, the continuous current applied to the head is productive of distinct benefit.

J. WIGLESWORTH.

Symptomatic Indications.—*Aurum* gives excellent results, particularly when a suicidal tendency is present. *Cimicifuga* in puerperal or uterine despondency often renders good service, especially with insomnia; feels as if she was in the grasp of a stronger power. *Ignatia* has a soothing effect in great mental depression, especially when from physical causes, grief, fright, etc. *Arsenicum* in melancholy of aged persons is extremely valuable, especially when associated with restlessness, emaciation, fear of death. *Cannabis indica* is sometimes useful in melancholy from nervous exhaustion, aphrodisia, tendency to catalepsy. *Phosphorus* when from nervous exhaustion. *Platina* is valuable for religious melancholy, particularly when from uterine derangement; fear of death. *Pulsatilla* for puerperal melancholia.

MENIERE'S DISEASE (Labyrinthine Vertigo).—See EAR, DISEASES OF.

MELANODERMA.—This includes all cases in which dark stains are produced through some special condition, such as pregnancy, intemperance, etc.

MENINGES, CEREBRAL AND SPINAL, DISEASES OF.—**Acute Cerebral and Spinal Meningitis.**—An acute inflammation of the membranes of the brain and spinal cord.

Inflammation of the dura mater is termed pachymeningitis. Inflammation of the pia-arachnoid is known as leptomeningitis.

Varieties of the disease are recognized according to their intensity, duration, nature, seat, and origin. Purulent and tubercular meningitis affect the pia mater almost exclusively, but tubercles may be seen on the visceral surface of the dura mater of the brain and cord.

Tubercular meningitis is the most common form of brain disease in children. Infants a few weeks or months old are liable to a form of simple, non-tubercular meningitis which is called "occlusive," "posterior," and "leptomeningitis infantum."

1. **Tubercular meningitis.**—*Symptoms.*—These are mainly due to the irritation and destruction of those parts of the brain and cord which happen to be affected, but doubtless many of the symptoms may be termed pure neuroses; at puberty hysterical neuroses are often the first symptoms of tubercular meningitis.

Premonitory symptoms are frequent in children. A history of emaciation, poor health, vomiting, headache, lassitude, fretfulness, altered temper, capricious appetite, irregular action of the bowels, and pyrexia are some of the symptoms; they may be met with in various combinations, but are often so vague that they give no clear indication of the nature of the illness. This period may last from a fortnight to three months or longer. In some cases in children and in many cases in adults no premonitory signs may be observed, or the symptoms have been set down to a "cold" or to existing phthisis.

The symptoms of the actual illness have usually been arranged in three categories representing three periods, but in practice the variations observed in the clinical course are very wide.

The first or *stage of irritation* is characterized by vomiting, which may be frequently repeated, and "causeless," having no special relation to the ingestion of food. There is fever of an irregular remittent type, the temperature not usually rising higher than 102° , but the curve may be inverted—*i. e.*, the highest temperature may occur in the morning instead of the evening. The pulse is usually increased in frequency, but the rate may be unaltered or slower than the normal. When the pulse is slow, vomiting is more common. The respiratory rhythm may show similar changes, and the breathing may be attended with a moan or groan. The bowels are constipated even when there is no vomiting.

Not only is there evidence of perturbation of the functions whose centers are seated in the floor of the fourth ventricle, but mental, motor, vaso-motor, and sensory symptoms may be noted, and are

doubtless due to disordered action of those regions of the brain which subserve such functions. Severe headache, a tender, hot scalp, fretfulness, headache, restlessness, sleeplessness, twitching and rigidity of muscles, tremors, squinting, contracted or unequal pupils, delirium, losses of consciousness, epileptiform attacks, hyperæsthesia of the various senses are some of the principal symptoms. Transient paralysis, such as ptosis or hemiplegia, may be noted, and may be simply neuroses.

In the *middle* or *transitional stage* the "irritative" phenomena tend to subside; drowsiness, low temperature, persistently slow and irregular pulse, irregular respiration, and a general apathetic tendency supervene. The pupils become dilated, optic neuritis may appear or become more marked, the "hydrocephalic cry"—a shrill shriek—may be heard. It indicates irritation, but is often present when the other symptoms indicate absence of irritation. The belly may become boat-shaped or concave, or simply flattened; the *tâche cérébrale ou méningitique* (of no diagnostic value) may be marked.

The *final stage* is but a further development of the paralytic or drowsy stage; collapse, convulsion, and coma are its leading signs. The pulse and breathing become again frequent, and often very feeble. Cheyne-Stokes' breathing may be witnessed—a series of respirations of increasing depth and frequency followed by a series of diminishing depth and frequency, terminating in a period of apnoea, during which no breath may be taken for more than half a minute.

The typhoid state may develop, and is marked by a dry, brown tongue, low muttering delirium, sordes on the teeth and lips, picking at the bedclothes, subsultus tendinum, and great prostration. The delirium and picking at the bedclothes may be absent, coma and paralysis being profound. There may be no pyrexia, or the temperature may sink to 94° , or rise to the hyperpyretic degree as death supervenes.

Duration.—This varies, but many cases die within a fortnight of the commencement of the attack; the duration of the different stages is also variable.

Prognosis.—The disease is generally fatal, but good grounds exist for believing that recovery does occur; when the

termination is favorable it cannot be ascribed with any certainty to the use of any special method of treatment.

Pathology and Morbid Anatomy.—The inflammation is excited by the presence of tubercles in the meninges; the tubercles are developed chiefly along the distribution of the middle cerebral artery. Sometimes, however, no miliary tubercles can be discerned, even in cases in which phthisis or tuberculosis exists elsewhere.

A gelatinous, turbid, but never purulent, infiltration of the loose meshes of the pia mater is present most abundantly about the base of the brain, and along the Sylvian fissures; the sulci elsewhere may rarely show a considerable amount of infiltration. There is an excess of fluid within all the ventricles of the brain, and the fluid is usually turbid and contains leucocytes. The extreme anterior apex of the upper surface of the cerebellum almost always exhibits thickening of the pia mater; this thickening is evidently in direct continuity round the cerebral peduncles with that of the base, and the pressure of it on the venæ Galeni may be one cause of the ventricular dropsy (acute hydrocephalus).

When there is marked hydrocephalus the surface of the pia-arachnoid often feels dry and sticky, the sulci tend to be obliterated, and the convolutions are flattened by the increased pressure. The ependyma of the ventricles may show a granular shagreen appearance. The walls of the ventricles may be the seat of white softening; and when the ventricles are opened, the septum lucidum and fornix may be ruptured. The tubercles may be detected in other parts of the brain than those supplied by the Sylvian arteries; sometimes they are localized in a part of one motor area on the convex surface, and then typical attacks of Jacksonian epilepsy may have been observed. Around and near the tubercular foci capillary blood extravasations and thrombosis may be observed. There may also be larger nodules which may show caseation, and bacilli may be found in their substance.

Ætiology.—The causation of tubercular meningitis is the same as that of tuberculosis (*q. v.*), but various exciting causes, such as blows and falls on the head, chills, excessive sunlight and heat, mental overwork and anxiety, must be recognized.

2. Simple meningitis.—*Symptoms.*—The number and combination of symptoms, and the clinical course of this variety of meningitis have a general resemblance to the tubercular form, but the prodromata are usually absent; a differential diagnosis between the two varieties may be impossible, owing to the fact that either form may be markedly erratic in its mode of origin, course, and progress. Any nervous symptom and any combination of symptoms may appear.

Headache, delirium, convulsions, vomiting, optic neuritis, hyperæsthesia, and mental apathy, with retraction of the head, are common symptoms. Convulsions are said to be more frequently present, and to be more dominant symptoms in this form of meningitis; this is probably true only when the motor area is most involved.

Duration.—The clinical course of this affection is, as a rule, shorter than in the case of tubercular meningitis. Death may occur in a few days, fulminating varieties being described in which the symptoms precede death by only a few hours or a day or two. In the case of an infant aged four months, convulsions lasting two hours were the first and last signs of a purulent cerebro-spinal meningitis.

Pathology and Morbid Anatomy.—There is no special predilection for the base of the brain, the products of inflammation being often most abundant on the vertex; the material exuded is frequently purulent, spotted hemorrhages and thrombosis of veins may be noted as in tubercular meningitis. It is not uncommon to find the whole brain and cord coated with an even layer of green pus which is beneath the pia-arachnoid membrane; the fluid in the ventricles is often purulent also.

Ætiology.—Most cases of meningitis occur in children under the age of puberty, illustrating the doctrine that growing tissues are more prone to disease than finished organs, even when the exciting causes are the same.

The causes are numerous and difficult to group; they include blows and falls on the head, sunstroke, local and general pyæmia, as in disease of the bones of the middle ear and skull generally; facial carbuncle, necrosis of the jaw, erysipelas of the face and scalp, acute specific

fevers—typhus, typhoid, measles, scarlet fever, pleurisy, and pneumonia, and syphilis.

The association of pus over the brain with pus over the pleura, pericardium, and peritoneum has been noted several times. Granular and large white kidneys have been associated with meningitis. Inflammation may extend from the skull to the meninges; simple or syphilitic caries or necrosis of any part is liable to be followed by meningitis; caries of the petrous portion of the temporal bone is perhaps the commonest. In suppurative disease of the nose and orbit the mechanism of the meningitis which sometimes results is of the same kind. Otitis without bone disease is frequently found with meningitis, but the sequence of events is uncertain. Otitis may be cause, consequence, or companion of the meningitis.

Prognosis.—This is serious, but least so in the traumatic cases. The early supervention of deep coma is rarely followed by recovery. The less severe and acute the symptoms the better is the chance of recovery. Recovery may be slow and lingering, and yet finally perfect; occasionally it is rapid and complete. It is, however, only in exceptional cases that health is fully restored.

3. Leptomeningitis Infantum.—*Symptoms.*—These are few in number, as the symptoms of any form of meningitis are apt to be in very young infants. The disease occurs during the first months of life. As a dominant symptom cervical opisthotonos (retraction of the head) is most important. Optic neuritis is rare.

Prognosis.—This is less serious than in most forms of meningitis; a few cases recover, some end in chronic hydrocephalus.

Morbid Anatomy and Pathology.—The region affected is the posterior part of the base of the brain, whence the names “posterior” and “basilar.” The under surface of the cerebellum is glued to the posterior fossa of the skull and to the posterior boundaries of the fourth ventricle, thereby shutting up the foramen or foramina of Magendie, by means of which the cerebro-spinal fluid communicates with the sub-arachnoid space and the cerebral ventricles. This occlusion leads to the development of hydrocephalus and gives the disease its other name, “occlusive” meningitis.

Ætiology.—Syphilis is one of the causes of this affection. Otitis without bone disease is believed to be a common cause.

Treatment.—Daily inunction of blue ointment into the back of the neck is a useful measure.

4. Epidemic cerebro-spinal meningitis.—*Symptoms.*—There are a few symptoms of meningitis which occur more frequently in this than in the other forms. The severity of the pains in the limbs and trunk may be ascribed to the irritation of the posterior nerve roots. The prevalence of cutaneous eruptions, apart from the cerebral maculæ, is a noteworthy feature. Erythemata, urticaria, herpes, and purpura may be noted alone or in combination. The onset is usually sudden, with chills, high fever, and vomiting. Deafness is apt to remain after the disappearance of all other symptoms, and headache is sometimes a sequela. The deafness is occasionally accompanied by a difficulty in maintaining the body equilibrium; both symptoms may be due to effusion into the labyrinth.

Pneumonia is a rather frequent complication.

Duration.—The average duration is about two weeks; it sometimes lasts much longer, even some months. In two such cases a collection of pus was found beneath the cerebellum; the clinical course resembled that of abscess of the brain.

Prognosis.—If deep coma intervene within a week of the onset of the illness recovery is almost unknown. Still the prognosis is less grave than might be expected from the nature of the illness, and the case should never be abandoned as hopeless.

Morbid Anatomy and Pathology.—The inflammatory products are often purulent, the changes are much the same as those found in simple meningitis.

Ætiology.—The disease is believed not to be contagious, or only slightly so; it most frequently affects young males under the age of twenty; it is epidemic; the actual cause may be an organism like that supposed to cause malarial fevers.

Diagnosis of all forms of acute meningitis.—Brain symptoms like those occurring in meningitis may be due to altered blood states in any severe illness. In children brain symptoms are very frequent and marked. Definite signs of

local paralysis may not be present in meningitis. If these considerations be borne in mind, no wonder need be expressed that a correct differential diagnosis is sometimes most difficult and even impossible. Typhoid fever sometimes mimics meningitis by causing constipation and a retracted belly. Tuberculosis may give rise to abdominal symptoms—tympanites, rose spots, delirium, pea-soup stools, large spleen—very like those of typhoid fever. The concurrence of headache with delirium is held to be diagnostic of meningitis; in fevers headache subsides as delirium comes on.

If there be disease of the middle ear, purulent meningitis is most probably present. If phthisis exist, or scrofulous scars, or hip-joint disease, or vertebral caries, the diagnosis should be tubercular meningitis; but with any of these affections hysterical symptoms may occur resembling those of meningitis. Under the age of one year tubercular meningitis is rarer than after that period.

Choroidal tubercle may be noted during life.

It is not always possible to diagnose abscess of the brain from purulent meningitis; nor crude tubercles or other "coarse" brain lesions from tubercular or simple meningitis. Since meningitis may commence its clinical course with hemiplegia, with epileptic fits, with signs like those of delirium tremens, or even like those of uræmia, the question may arise whether the case is not one of these latter affections.

The occurrence of skin rashes in meningitis sometimes causes a resemblance to rheumatic fever, and this the more so since multiple arthritis has been noted in alleged cases of epidemic meningitis.

Severe lumbago sometimes suggests small-pox, which also begins suddenly with high fever, chills, and headache; but the supervention of muscular rigidity is special to meningitis. Meningitis may arise as a complication of the specific fevers of inflammation and blood poisoning, thus increasing the difficulties of diagnosis.

Treatment.—If the meningitis be secondary to disease of the middle ear, surgical treatment of the latter affections may still be advisable, if only for the reason that many of the symptoms may be due to the condition of the ear.

Powerful antiphlogistics, strong counter-irritants, blood-letting, severe purging, and free blistering are measures which should be avoided. Absolute rest for the mind and body in an agreeable apartment is essential, the chamber being so situated that quiet and darkness can be obtained. It should be well ventilated, and kept at a temperature of about 60° to 65° F.

The bowels should be kept regularly open by simple means. The diet should be digestible and nutritious. Stimulants should be prescribed only when the state of the pulse and breathing indicates their use. Ice-bags or cold applications may be applied with advantage to the shorn scalp to relieve headache, vomiting, insomnia, and mental or muscular restlessness. The same symptoms may be abated by the use of bromides, chloral, hyoscyamus, paraldehyde, sulphonal, or opium. Injections of cocaine or morphine may be used to relieve pain. Leeches behind the ears may be employed with advantage if there be great heat of head and circulatory excitement. Iced or effervescing drinks, or; rarely, hot drinks, may relieve vomiting. Saline purges may reduce the cerebral and circulatory tension.

Mercurials may be employed to the extent of just "touching the gums;" the most useful preparations being calomel and gray powder in small doses. Iodides and mercury are useful to promote the absorption of inflammatory products, and they may be used at the termination of the acute stage, and with this object in view in cases which are more subacute and chronic. The limbs and trunk may be kept in good condition by shampooing and warm ablutions during the period of convalescence and during the treatment of chronic cases. The inunction of iodoform ointment into the scalp in cases of tubercular meningitis is valueless.

Chronic Meningitis.—This chiefly affects limited parts of the brain or cord, and generally leads to adhesions between the pia and dura mater. The disease often occurs in the form of chronic hypertrophic pachymeningitis. Its pathology is a matter of contention; when the cerebral meninges are affected, the condition has been described as hematoma of the dura mater. Some authorities believe that the meningitis precedes the extravasation of blood; others teach that blood is first extravasated, and that this sets up

meningitis and leads to fibroid formation.

Hematoma of the dura mater (*Pachymeningitis Hemorrhagica*).—*Symptoms*.—These are by no means unequivocal. Epileptiform or apoplectiform attacks, headache, a full, slow pulse, drowsiness, contracted, dilated, or unequal pupils, coma and convulsions, and slight hemiplegia have all been noted. It may be stated that there are no symptoms distinctive of the affection.

Duration.—The clinical duration of the disease is variable. Death may result soon after the occurrence of an epileptiform or apoplectiform attack, or the subjects of the disease may have been long resident in an asylum.

The *diagnosis* is exceedingly difficult. In cases of chronic syphilitic meningitis the diagnosis rests on the following points and is often easy: a history of syphilis, physical evidences of this disease in other parts of the body, unequal and irregular distribution of paralysis of cranial nerves, and occurring frequently on both sides of the body. Of course, headaches, giddiness, vomiting, impairment of sight with optic neuritis, or atrophy, may be present as with any kind of meningitis. In one case, for example, the right seventh nerve was paralyzed, its muscles wasted, and the faradic reactions lost; there was right hemiplegia of the graduated kind, with paralysis of the left external ocular rectus, and hemiatrophy of the left half of the tongue. The necropsy revealed a gumma on the right facial nerve at its superficial origin, and one on the left hypoglossal nerve; the left sixth nerve was compressed by thickened meninges. There was also thrombosis of the left Sylvian artery and wasting of the motor convolutions.

The *prognosis* is as variable as the duration.

Morbid Anatomy.—The pia mater and dura mater are bound together by the products of the disease. The lesions are usually unilateral and most marked over the convexity of the brain. Recent blood extravasation or brick-red or ochre-yellow discoloration is found in or between the new-formed membranes. There are superimposed layers of membrane on the inner surface of the dura mater. These are soft and vascular when recent; but tough, white, or brownish and fibrous when old. The hemorrhage takes place

into the sub-dural space; the affection is sometimes bilateral. The membranes on this view result from condensation and organization of the blood clot. Virchow's view is that membranes are formed one within another, and that they contain thin walled capillaries which burst and yield blood—a condition to which the term pachymeningitis hemorrhagica is applied. The layers are often so arranged as to form cysts which may inclose a serous fluid, and then the disease is a form of external hydrocephalus. Cysts may also develop in the substance of the brain as the result of hemorrhage into it; this is also a form of hydrocephalus externus.

Chronic meningitic thickening may be associated with syphilitic arteritis as well as with atrophy and sclerosis of the brain. Gummata may be found on the cranial nerves, aneurysms on the cerebral arteries, and thrombosis of the vessels may be present.

Ætiology.—The disease is most frequently observed in men of advanced age, especially in those who have been hard drinkers. Alcohol and syphilis are recognized causes; insanity is often associated.

Treatment.—Anti-syphilitic treatment should be tried in all cases.

Chronic hypertrophic pachymeningitis of the cord.—This disease usually affects the cervical enlargement of the cord.

Symptoms.—Exceedingly severe "root" or "radicular" pains shooting down the arms and neck are the most important early symptoms; anæsthetic areas may be found on the arms, shoulders, or neck. Amyotrophy of these regions subsequently supervenes; weakness of the trunk and legs usually occurs later, and is associated with rigidity of the affected muscles, and the phenomena of hyperkinesia, exaggerated knee jerks, ankle and rectus clonus, and front-tap contraction.

Any sensory, vaso-motor, or motor symptom may be noted in the arms; sometimes they are pale and cold, at others blue and cold, and they may, however, be hot, burning, and sweating, or there may be sweating without any flushing. Eruptions may appear along the path of the lightning pains. Spasms may occur in the limbs, and a clawshape of the hand may appear as the result of the wasting as the muscles supplied by the

ulnar nerve which comes from the lowest part of the cervical cord. The pupils may be contracted; they may not dilate when they are shaded, nor when the cervical skin is pinched or faradized.

The disease begins insidiously, and slowly advances in the course of months, the hyperæsthesia and pains being the first symptoms.

Duration.—The affection lasts from one to two years or longer.

Diagnosis.—This has to be made from amyotrophic lateral sclerosis, sub-acute spinal atrophy, and from progressive muscular atrophy, but none of these diseases are accompanied by the agonizing pains and sensory disturbances which mark the affection under consideration. In an advanced stage rheumatoid arthritis of both shoulders may be simulated, owing to the existence of pains and amyotrophy, but grating in the joints does not occur as a rule in meningitis. The simultaneous onset of severe sensory symptoms in both arms is an important element in the diagnosis of meningitis of the brachial enlargement. The absence of pain is the most conspicuous feature of myelitis. The presence of pain and muscular spasm are the most conspicuous features of meningitis as contrasted with myelitis. A limited area of anæsthesia on the trunk or a limb is almost always due to meningitis.

Prognosis.—This is always grave and nearly always devoid of hope.

Morbid Anatomy.—This consists in concentric laminated thickening of the dura mater with compression of the nerve roots and cord; the spinal marrow may be softened or diffuent; secondary degenerations may be noted above and below the seat of compression.

Treatment.—Iodides and mercury should be prescribed. Half-dram doses of bromides, given frequently, sometimes relieve pain better than injections of cocaine or morphine.

ANGEL MONEY.

Symptomatic Indications.—*Aconite* is frequently useful in the traumatic form, when inflammatory symptoms appear. *Belladonna* is valuable in all hyperæmic conditions of the brain and spinal cord, especially if delirium is present, spasmodic distortion of the face, grinding of the teeth. *Hyosciamus* is valuable in subacute form, severe cerebral pains, de-

lirium, aberration of sight. *Gelsemium* is often serviceable, particularly in children, with torpor of mental faculties, wild, incoherent delirium, headache, nausea, giddiness, and blindness. *Opium* in comatose conditions, low, muttering delirium, stertorous breathing. *Bryonia* is frequently valuable for serous inflammation in stage of effusion, mild delirium, severe pain, shooting, tearing. *Pulsatilla* when suppressed otorrhea. *Cimicifuga* is especially valuable when associated with rheumatic or neuralgic complications, spasmodic jerkings, rigidity of muscles of neck and back.

MENOPAUSE (Change of Life).—

The cessation of menstruation.

This event usually occurs at about the age of forty-five, but it may precede this age, or be postponed until a later period, without any detriment to health. The complete cessation of menstruation is often preceded by a period of irregular menstruation, known by women as the "dodging time." This irregularity, and the final stoppage of menstruation, is, as a rule, not attended with any disturbance of health. But in some cases it appears as if the cessation of the rhythmical increase of vascular tension and accompanying loss of blood, which are parts of the menstrual process, in some way interferes with the normal vaso-motor tone, and in consequence vaso-motor disturbances occur. Women thus often complain of palpitation, chills, "flushings," "heats," and perspirations, occurring without known cause. The liability to these troubles sometimes lasts for two or three years after the cessation of the menses, but ultimately, and often in less time, these symptoms cease. During the "dodging time," the hemorrhages which occur are sometimes excessive, or may be unusually prolonged, without there being any change in the uterus appreciable by the methods of examination known to us. Hemorrhages from other parts, as from the nose, or from hemorrhoids, may occur, and this at such intervals that the hemorrhage may appear to replace the missing menstrual flow. The presence of fibroids in the uterus usually delays the menopause. When premature menopause is brought about artificially (by splaying) the same vaso-motor disturbances are apt to occur, as are noticed at the natural menopause.

Women are very apt to accept "change of life" as an explanation of almost any symptoms occurring between forty and fifty, and eminent authorities have taught that many diseases are prone to attack women at this epoch. Among these are vertigo, epilepsy, cerebral hemorrhage, dipsomania, hypochondriasis, melancholia, flatulent dyspepsia, pseudocyesis, (*q. v.*), obesity, gout, gall-stones. These are diseases prone to develop in advanced life; but there is no scientific evidence to show that they are more common at the menopause than in the years which follow it.

Treatment.—The vaso-motor disturbances which occur at the menopause are best treated by saline purgatives. If the patient be florid, and there be any pelvic discomfort, benefit will be found from leeches to the cervix uteri or inguinal regions. Hemorrhages, so long as they do not make the patient anæmic, should not be checked. If they render the patient anæmic, they must be treated according to the methods usual for such hemorrhage at other periods of life. The menopause should not without careful examination be accepted as a sufficient explanation of uterine hemorrhage occurring in a middle-aged woman, for such hemorrhage may be the first symptom of disease, the early detection of which is extremely important. G. E. HERMAN.

Symptomatic Indications.—*Aconite* is a soothing remedy, for nervous palpitations, restlessness, or fidgets. *Cimicifuga* is useful for sinking at the stomach, distressing headache, mammary pains. *Nitro-glycerine* is most efficient for head symptoms, congestion to the head, throbbing, beating, roaring noises in the ears. *Lachesis* rarely fails to relieve the flushes, headache, insomnia. *Sepia* for congestions due to failure of the menses is frequently serviceable. *Nux vomica* for headache, burning pain on vertex, or head feels as if opening and shutting.

MENORRHAGIA.—An increase of the menstrual flow. The causes which lead to increased hemorrhage at the normal times commonly soon induce hemorrhage at times other than the normal period; such hemorrhage is called METORRHAGIA (*q. v.*).

MENINGOCELE.—A congenital hernia of the membranes of the brain.

When such a tumor contains brain, it is termed an encephalocele.

Causes.—Probably a combination of imperfect development of the skull wall with a tendency to hydrocephalus.

Symptoms.—A tumor situated in the line of one of the sutures, usually in the median line and toward the occiput, sometimes at the root of the nose, or even in the pharynx. Occasionally there is a peduncle, bluish, or color of natural skin, transparent, pulsating with the brain and with respiration. Sometimes compression of it will cause convulsions. More or less marked by hydrocephalus almost always coincident.

Prognosis.—Almost hopeless as to ultimate recovery. A small, pedunculated tumor without symptoms of hydrocephalus offers the most hope.

Diagnosis from nævus or from congenital cysts is difficult. The diagnosis of meningoceles and encephaloceles rests first upon their congenital occurrence and position, at one of the membranous portions of the fetal head; next upon their fluid nature; third, upon their considerable and decided increase in volume or tension, with strong expiratory efforts; fourth, upon their reducibility in part or entirely; and finally, upon their sharing in the motions of the brain.

Treatment.—Support carefully and gently with a smooth, soft pad and bandage. Puncture is justifiable when increase is continuous. Injection of iodine has been tested with doubtful success. Ligature and excision was successful in a somewhat exceptional case.

MENSTRUATION, VICARIOUS.—See VICARIOUS MENSTRUATION.

METACARPUS, DISLOCATION OF.—See DISLOCATIONS.

METACARPUS, FRACTURE OF.—See FRACTURES.

METACARPUS, DISLOCATION OF.—See DISLOCATIONS.

METATARSUS, FRACTURE OF.—See FRACTURES.

MENSURATION.—The act of measuring. A means of physical diagnosis especially applicable in diseases and deformities of the chest. The methodical examination of the chest concludes with mensuration, by which means the actual shape and dimensions of the chest as a whole, and the relative measurements of

corresponding parts on the two sides, may be ascertained and recorded.

The instrument in general use for this purpose is the *cyrtometer*, which consists of two lengths of soft metal united by a short piece of india-rubber tubing. The center of the junction is applied to the vertebral spine at the desired level, and the metal pieces are accurately molded to the chest wall, and are marked where they overlap in the mid-sternal line on a level with the point of application to the spine. The instrument is now removed and placed upon a large sheet of paper and a tracing taken of its outline. The antero-posterior, transverse, or other measurements are then determined.

In medical practice such records are chiefly of value in cases of pleurisy in the stage of effusion, or subsequently when collapse of the lung has occurred, and treatment is being directed to promote its re-expansion; also in cases of phthisis in the stage of quiescence, or arrest, when it is desired to ascertain the effect of climatic or other treatment upon the capacity of the chest.

It is necessary to bear in mind that the outline is that of the chest wall only, and that its shape will be altered by the development of muscle or the deposition of fat as well as by expansion of the lung, a source of fallacy which to some extent militates against conclusions derived chiefly from this method of examination.

By means of a tape the circumference of the chest can be determined, and differences on the two sides, either during expansion or in repose, can be determined by the use of single or double tape measures.

For the detection of sub-clavicular depression the trained eye is of more service than any instrument.

J. K. FOWLER.

MERCURY, POISONING BY.—The effects of the absorption of the salts of mercury are manifested in an **acute** and **chronic** form, the difference depending mainly upon the length of the period during which the poison has been gaining entrance into the system and the quantity absorbed.

Large doses of soluble salts of the metal administered at short intervals are likely to produce the train of symptoms which characterize the former affection, whereas chronic poisoning as a rule

results from the administration of small doses of the less active preparations or from the inhalation of vapors charged either with the metal or its compounds.

Acute Poisoning.—The salt most frequently taken is the perchloride or corrosive sublimate.

The *symptoms* of acute mercurial poisoning are a metallic taste in the mouth, with constriction in the throat and an intense burning pain extending down the esophagus to the stomach. The patient speedily becomes collapsed. The mucous membrane of the mouth becomes white and shriveled; nausea and vomiting soon set in; the vomit may contain blood. Purging and griping pains in the abdomen, increased by pressure, will also be present; the urine is scanty or suppressed.

Fatal Dose.—A dram of corrosive sublimate nearly always causes death.

Post-mortem Appearances.—The mucous membrane of the mouth and esophagus is whitened; that of the rest of the alimentary canal more or less inflamed. Ecchymoses are common in the stomach, the cæcum and colon are inflamed and sometimes ulcerated, the kidneys are usually inflamed.

Treatment.—Vomiting must be promoted by the administration of such emetics as mustard ($\frac{3}{4}$ ss in water) or sulphate of zinc (gr. xx in water). It is generally recommended that the stomach pump should not be used. Albuminous substances, such as unboiled white of egg in water should be given in unlimited quantities, in order to render the poison inert; or, failing this, flour and water, arrowroot, or barley-water may be given freely.

Chronic Poisoning.—Mercurialization may manifest itself either by salivation or tremor. Salivation may result from the medicinal use of mercury, tremor is only found in those exposed by their trade to the effects of the metal—*e. g.*, water-gilders, looking-glass makers, and barometer makers. In the former case the gums are swollen and recede from the teeth so that these may fall out; the breath has a peculiar fetor; the amount of saliva is increased, and in bad cases the flow of it is incessant; the whole face may be swollen, and sloughing of the tongue or cheek may follow. In those who are the subjects of renal disease the chances of recovery are very small.

Mercurial tremor is preceded by a general loss of power; the trembling first shows itself in the arms, involving the legs at a later date; ultimately the sufferer is incapacitated from all employment; he cannot even stand alone; and his mental faculties undergo deterioration. There is usually also profound anæmia and a dark line along the gums.

Treatment.—The essential measure to attend to in all those cases is the removal of the exciting cause. Where the person is taking mercury internally, the medicine must be stopped. In a case of tremor, the patient must change his trade.

J. AMBERCROMBIE.

MESENTERIC GLANDS, DISEASES OF.—**Acute Inflammation and Congestion.**—Inflammatory conditions of the mesenteric glands are generally found associated with acute affections of the intestines; with catarrhal diarrhea, cholera infantum, enteric fever, dysentery; it is in the two last named only (*q.v.*) that the condition is of importance.

Chronic Inflammation.—Chronic enlargement of the mesenteric glands may be due to chronic or often repeated intestinal catarrh, the glands may, in children, even undergo caseation.

Tubercular Disease.—Tubercular disease of the mesenteric glands is the most important affection to which they are liable; it is secondary to tubercular enteritis or peritonitis exceptions to this rule are rare, and probably all more apparent than real. See LYMPHATIC SYSTEM, TABES MESENTERICA; TUBERCULOSIS.

Atrophy.—In old age and after enteric fever the mesenteric glands may atrophy. They not infrequently undergo calcareous degeneration, probably as a sequel to tubercular disease.

Malignant Disease.—The glands are liable to be affected secondarily in cancer of the intestines. Lymphadenoma may affect these glands, and in this disease they often attain a very large size.

METRORRHAGIA. — Hemorrhage from the uterus—*i. e.*, hemorrhage from the unimpregnated uterus, excessive in frequency, duration, or quantity. It may arise from either general or local causes. Both are very numerous and include:

1. *General.*—Hemophilia; purpura; scurvy; phosphorus poisoning; acute

yellow atrophy of the liver; Bright's disease; acute fevers, such as scarlet fever, small-pox, typhus, measles, etc.; diseases obstructing the return of blood from the uterus in a slight degree, such as heart, lung, or liver disease (these conditions in high degree lead to amenorrhœa); fatigue, over-exertion or excitement; residence in hot climates.

2. *Local.*—Among the most common local causes of hemorrhage from the womb are fibroid tumors and polypi; endometritis; malignant diseases; retroversion and retroflexion; sub-involution; inversion; retained membranes or placenta; and disease of the uterine appendages.

Treatment.—The hemorrhage is generally a symptom, and the cause must be sought for. In a virgin, or a patient who objects to examination, we must treat the symptom. No drug is comparable to ergot in its efficiency against uterine hemorrhage, although there are many that have been recommended. If ergot fail and the hemorrhage, judged of by its effect on the color of the skin and mucous membranes, be injuriously great, it is advisable to insist on an examination. If bimanual examination fail to detect a cause for the hemorrhage, then it will be necessary to dilate the cervix and explore the uterine cavity. G. E. HERMAN.

Symptomatic Indications.—*Ipecacuanha* is useful when the flow is bright red, with nausea. *Hamamelis* is valuable when the flow is dark, painless, steady; venous hemorrhage; also when flow is midway between periods. *Sabina*, when, from hyperæmic uterus, passively congested; bright red discharge, does excellent service. *Crocus* is valuable in functional form, black lumpy discharge, best for young women. *Ergot* painless flooding in cachectic women; atonic condition. *Bel-ladonna* for bright red discharge, uterine tenesmus, hyperæmic condition; bearing down pains. *Calcareo carb.* is serviceable when period anticipates or is excessive; hemorrhage from malnutrition. *Trillium* in active hemorrhages does good service.

MICRO-ORGANISMS.—Among the micro-organisms or microbes of especial interest and importance in medicine are **Bacteria** and **Protozoa**. They belong respectively to the vegetable and animal kingdoms.

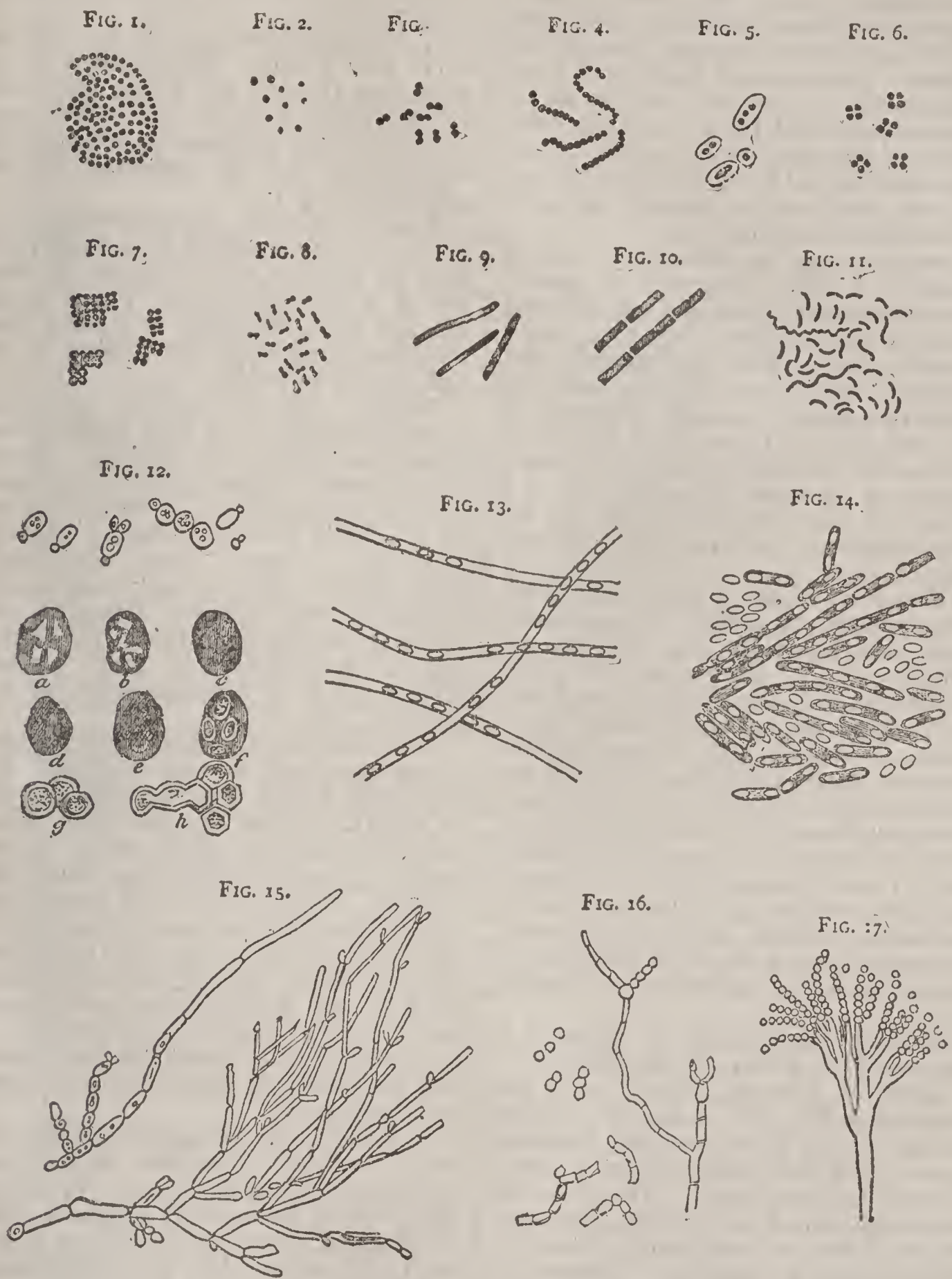


Fig. 1. Cœcci in a mass or swarm (Zooglœa).
 „ 2. Cocci singly and varying in size.
 „ 3. Cocci in pairs (Diplococcus).
 „ 4. Cocci in chains or rosaries (Streptococcus).
 „ 5. Cocci encapsuled (Bacterium pneumoniæ crouposæ).
 „ 6. Cocci in groups of four.
 „ 7. Cocci in packets (Sarcina).
 „ 8. Bacterium termo.

Fig. 9. Bacillus lepræ.
 „ 10. Bacillus malaris (after Klebs)
 „ 11. Spirillum cholerae Asiaticæ.
 „ 12. Torula cerevisiæ.
 „ 13 & 14. Bacillus anthracis.
 „ 15. Saccharomyces mycoderma, or Oidium albicans.
 „ 16. Fungi of Favus.
 „ 17. Penicilium glaucum.

Bacteria at one time were included among the minute organisms which stand on the borderland between animals and plants. They are now considered to be vegetables, as they are able to derive their nourishment from ammonia compounds; but they differ from the higher vegetable cells in being unable to split up carbonic acid into its elements, owing to the absence of chlorophyll.

Bacteria may be defined as minute vegetable cells destitute of nuclei. They possess a cell wall and cell contents. The cell wall consists of cellulose. Some bacteria are capable of bending and twisting, while others remain perfectly stiff; this depends on the property of the cell wall, which is either pliable or rigid. Of the cell contents, the protoplasm is in some homogeneous and in others granular, and varies in its microchemical reaction in different species.

The effect of the aniline dyes, which are employed to render the organisms more clearly visible, depends on the affinity of the protoplasm for dyes. Hence the different methods employed in the preparation of microscopical specimens. The protoplasm in some bacteria contains starch granules, which give the iodine reaction; in others it contains sulphur granules, and in others again certain coloring matters. In some cells, either as the result of secretion from, or absorption and swelling up of the cell wall, a gelatinous envelope develops, and sometimes this forms a matrix in which numbers of bacteria are embedded—a *zooglaea* (Fig. 1).

Bacteria differ greatly in shape, but certain typical forms are recognized.

Spherical and egg-shaped cells are called *cocci* (Fig. 2). A coccus increases by fission, and if the resulting elements remain attached to each other, a *diplococcus* (Fig. 3) is formed. These may in turn divide, and if the resulting elements remain linked to each other, a *streptococcus* (Fig. 4) is produced. Streptococci vary considerably in length, sometimes consisting of only a few elements, and sometimes stretching right across the field of the microscope.

When a cell divides in two directions the four daughter cells form a *tetrad* (Fig. 6); and if in addition, those elements divide in a third direction, eight elements result from the division of a

single cell, and form a *sarcina-coccus* (Fig. 7).

A common form-type is the rod; a short rod is often distinguished as a *bacterium* (Fig. 8), and a long rod as a *bacillus* (Figs. 9, 10, 13, 14). The bent rod or *vibrio* is intermediate between the straight rod and the corkscrew rod or *spirillum* (Fig. 11).

There are also filamentous forms, which are distinguished as *leptothrix* if they are straight, or *spirochaeta* if they are of a wavy character. There is an unusual form, the result of a wavy filament becoming curled and twisted on itself, termed *spirulina*.

Bacteria may be divided into four classes according to their form-types: *Sphæro-bacteria*, or globular forms (micrococcus); *Micro-bacteria*, or short-rod-forms (bacterium); *Desmo-bacteria*, or long-rods (bacillus, vibrio); *Spiro-bacteria*, or spiral forms (spirillum, spirochaeta). This is not scientifically correct, as these different forms are not constant for all microbes. The same species, if polymorphic, may exhibit several forms at different stages of its growth.

Some bacteria are motionless; others are endowed with locomotive power. By examining a drop of any putrefying liquid or vegetable infusion under the microscope, the peculiar characteristic movements of many species may readily be studied. Some appear to undulate; others glide along, or spin round like a top, or progress with a peculiar tremulous motion; others appear to move backward in one direction, then turn round and progress in another; others have a very characteristic corkscrew movement. The movement of micrococci is probably only brownian.

In some cases locomotion appears to be due to the contractility of the protoplasmic contents of the cell. In others, movement is produced by a delicate lash-like filament, which may be present at one or at both ends of the micro-organism as in *Bacterium termo*. *Spirilla* are exceedingly active in their movements, and the flagella can be readily demonstrated by suitable methods of staining.

Bacteria reproduce their like by a very simple process, *division*. Hence they are called *fission-fungi*. A single cell increases in size, and a constriction takes place in the middle. This goes on until

the two parts are divided one from the other. These new individuals may pass an independent existence, or remain linked together.

By another process representing true fructification, spores are formed. In the anthrax filaments, for example, under suitable conditions the protoplasm becomes granular, and a little speck appears which gradually increases, becomes highly refractive, and has a sharply defined contour. It grows at the expense of the protoplasm, and develops into an oval spore. Finally, the sheath of the bacillus gives way, and the spore is set free. These spores have a thick investment, consisting of two layers. It is probably owing to this that they possess the property of retaining their vitality when dried, and also of resisting heat, chemical, and other agents to a remarkable degree.

It is because of the power of spores to resist destruction that outbreaks may occur again and again in a district which has once been infected with anthrax. Spores cannot be stained by the ordinary methods, but require special treatment, so that the dye may penetrate the tough capsule.

Bacteria, like all living structures, must be supplied with food. They require nitrogen, oxygen, carbon, water, and certain mineral salts. Access to free oxygen is necessary for some, but others can derive it from the oxidized compounds in the medium in which they grow. Nitrogen is necessary for building up the protoplasm of which bacteria consist. It can be derived from albumins or from ammonia and its derivatives. Carbon is derived from such substances as cane-sugar, milk-sugar, glycerin, and the splitting up of complex proteid bodies. Water is also essential to their growth.

In the laboratory various liquid media are employed for growing bacteria; chicken broth, beef broth, hydrocele fluid, liquid blood serum, milk, urine, decoctions of carrot, cucumber, turnip, or grape juice; or solid media, such as nutrient gelatin, nutrient agar-agar, solid blood serum, potatoes. All these media have to be rendered sterile, and precautions have to be adopted in carrying on the cultivations to prevent the access of foreign micro-organisms.

Nutrient jelly, for example, which

usually consists of beef juice, salt and peptone, stiffened with gelatine or agar-agar, is prepared as follows: First of all, the glass vessels and test-tubes employed in the process are thoroughly cleansed. Test-tubes and flasks are stoppered with a plug of cotton-wool, and then placed in the hot air chamber at 150° C. for an hour. All pre-existing micro-organisms in the cotton-wool and in the glass vessels are thus completely destroyed. In pouring the liquid jelly into the test-tubes there is danger of contamination with the germs in the air, therefore they must again be submitted to sterilization. They are placed in a steaming apparatus for fourteen or fifteen minutes, on three or four successive days; the tubes containing the nutrient medium will then be perfectly free from any pre-existing organisms, and may be kept without change for any length of time. To inoculate the test-tubes an inoculating needle made of platinum wire fixed at the end of a glass rod is used. By holding the wire in the flame any organisms that may be upon it will be destroyed. In a few moments the wire is cool; it can then be dipped into the material to be examined. The cotton-wool plug is quickly removed from the test-tube, and by tracing the needle on the surface the bacteria are sown upon the jelly. In this way a series of cultivations of different species may be obtained.

When bacteria are grown in this way, very striking results are obtained. The bacteria may be divided into four classes, according to the effects produced on the media in which they grow. Living animals are included among these media, for inoculation affords a means of cultivating certain organisms, more particularly those which refuse to grow on any artificial nourishing soil.

The four classes are:

The *Chromogenic*, or pigment forming;

The *Zymogenic*, or fermentative;

The *Saprogenic*, or putrefactive; and

The *Pathogenic*, or those which produce disease.

The **Chromogenic** produce various color stuffs. One of the most striking is the *Micrococcus prodigiosus*, which forms a blood-red growth in bread, potato, and other media. *Bacillus violaceus* produces a violet pigment, and *Bacillus pyocyaneus* a delicate green. The magenta micrococcus forms a

brilliant magenta growth with a metallic luster. In this species the pigment is retained within the cells. The surface of sterilized potato is a very favorable medium for the cultivation of the chromogenic groups.

The **Zymogenic** are those which produce fermentation, such, for example, as the bacterium which produces acetic fermentation in wine. Owing to the growth of this organism the alcohol takes up oxygen and is converted into vinegar and water, $C^2H^6O + O^2 = C^2H^4O^2 + H^2O$. Other examples are afforded by the fermentation of urea and the conversion of sugar of milk into lactic acid.

The **Saprogenic** or putrefactive bacteria produce changes, very similar to fermentation, in complex organic substances. They are present in all putrefying substances. They abstract the elements they require for their growth, and the remainder enter into new combinations. Associated with these changes in media undergoing putrefaction, poisonous substances or *ptomaines* are produced.

The **Pathogenic** species are believed to be the active agents in producing certain diseases in man and animals, but before bacteria or other micro-organisms can be regarded as the contagia of disease they must fulfill the following conditions:

1. The micro-organisms or bacteria must be found in the blood, or lymph or diseased tissues of man or animal suffering from or dead of the disease.

2. These micro-organisms must be isolated from the blood, lymph or tissues and cultivated on suitable artificial media, and these pure cultivations must be carried on through successive generations.

3. Such pure cultivations must, when introduced into the living body, produce the disease in question.

4. Lastly, in the inoculated animal the same micro-organisms must again be found.

Statements that micrococci or bacteria are found in this or that disease are by themselves of little value. The bacteria must be isolated and successive cultivations carried on, and if on inoculation of a susceptible animal, the disease be produced, then, and then only can they be asserted to be pathogenic. The bacillus of septicæmia in mice, for

example, may be cultivated for several generations, and such a cultivation will reproduce the disease on inoculation. The tubercle bacillus may be cultivated in blood serum or glycerin-agar-agar, and a trace of such a cultivation will produce tuberculosis. And until some fallacy is pointed out in these experiments, we must accept as proven that the tubercle bacillus is the principal agent in the production of tuberculosis.

Another well-known pathogenic micro-organism is the *bacillus anthracis*; this also may be sown in artificial media, cultivated for successive generations, and with an artificial cultivation the disease can be readily reproduced in any suitable animal. The bacillus grows readily on the potato, and the scraped-off growth may be mixed with sterilized water and silk threads impregnated into the spores. The silk threads may be kept for years, and the minutest portion introduced under the skin of an animal will produce anthrax.

It was not until 1877 that Koch, by the methods of cultivating, clearly demonstrated that anthrax could be reproduced, not only by inoculation of blood containing the bacillus, but also by the isolated organism.

Chicken cholera and many different forms of septicæmia in rabbits and guinea-pigs are reproduced by bacteria. In leprosy, Asiatic cholera, relapsing fever, and in the glanders, swine fever, swine measles, and other diseases in man and in animals there are micro-organisms which are intimately related to these diseases.

In other cases, such as small-pox, scarlet fever, foot-and-mouth disease, cow-pox, sheep-pox, and pleuro-pneumonia, bacteria have been discovered and described as the contagia, but the evidence is most unsatisfactory, and in many instances misleading.

There is a great fallacy in these investigations, which it is very necessary to bear in mind. In diseases in which there are lesions of the throat or intestinal canal, micro-organisms may get access to the circulation and be swept into the internal organs. The presence of these bacteria is all the more misleading in that some species, when isolated, cultivated and inoculated, may produce death in lower animals. The bacteria in such cases do not reproduce the dis-

ease from which they were isolated, but they produce symptoms which are frequently misinterpreted. If, therefore, from a disease an organism be cultivated which produces death in lower animals, the organism is not necessarily the virus of the original disease, as is proved by the fact that there are a number of organisms which can be isolated from healthy fæces, saliva, and other discharges which have this effect.

Several explanations have been suggested of the way in which bacteria produce their effects. In examining sections of tissues of animals which have died of anthrax, the small vessels and capillaries are sometimes found to be completely blocked by bacilli. Hence arises the mechanical theory; this, however, falls to the ground when it is found that far more frequently there are, comparatively speaking, very few bacilli present.

Another theory is suggested from analogy to the putrefactive bacteria; the pathogenic bacteria being credited with the production of poisonous alkaloids or ptomaines. From the fact that bacteria are living bodies requiring nutrition, the theory has been suggested that they starve the tissues of their host. But if such were the case, death by a slow process would be expected, and it would be difficult to account for such acute symptoms as are present in anthrax.

That poisonous products are formed is very probable, but at the same time no one has satisfactorily demonstrated that these substances are elaborated by the pathogenic bacteria. Possibly the methods of detecting and isolating these poisons are at the present time inadequate.

Protozoa.—Minute forms of animal life are found in the intestinal and other secretions, but there are others which are found occasionally in the blood of man and animals.

The peculiar bodies found in the blood in malaria are regarded as stages in the life-history of an amœboid organism, and this constitutes the only instance of an animal micro-parasite credited with pathogenic properties. The malarial organisms or microbes of paludism were first observed by Laveran, who described peculiar bodies, or *corps kystiques*, of two kinds, which he called Nos. 1 and 2,

mobile filaments; and bodies called No. 3 or cadaveric forms.

The *corps kystiques* No. 1, or semi-lunar bodies of Laveran, are cylindrical elements with pointed extremities curved in the form of a crescent, and pigmented centrally. They are 8 to 9 μ in length, and 3 μ in width. They are transparent and colorless, and sometimes exhibit on the concave side the appearance of a very fine line uniting the extremities of the crescent, being in reality the edge of a delicate membrane.

Laveran also described oval forms which seem to be intermediate between Nos. 1 and 2. The pigment is often arranged in the form of a crown. These bodies are non-motile; several forms can be observed which vary in shape from the oval to the crescent. These forms are less numerous than the second kind, No. 2. The latter are spherical bodies in the interior of red blood cells and exhibit amœboid movements. They consist of a transparent hyaline mass inclosing pigment grains.

The mobile filaments are three or four times as long as the diameter of a red corpuscle. They are sometimes free and move about rapidly among the corpuscles, setting the latter in movement. Golgi has described another stage, the "rosette" form.

These various forms are believed to be the different stages in the life-history of this singular organism. It has not been cultivated outside the living body. But its presence in the blood in malaria, and its disappearance after the administration of quinine, are considered as indicating a causal relation to the disease.

Flagellated protozoa have been found in the blood of equines suffering from a disease known in India as *surra*. Similar, if not identical, bodies have been found infesting the blood of fish, the hamster, and rats.

The organism in *surra* is believed by some to be pathogenic, but it has never been isolated from the blood and put to the test of inoculation. It is quite possible that the parasites in *surra* are only associated with the disease, the impoverished blood affording a suitable nidus for their development, while contaminated water may be the common source of the organism and the disease. On the other hand, the organism of the rat is found in

apparently perfectly healthy, and in well-nourished animals.

EDGAR CROOKSHANK.

MICROSCOPICAL EXAMINATION OF SECRETIONS AND DISCHARGES.—The microscopical examination of secretions and discharges has now become almost as much a matter of routine as the examination of the urine. The presence of organisms in wounds, blood, or pathological products, is of great significance and interest. An Abbé's condenser of high magnifying powers are to be employed. The fluid should be obtained fresh, and spread on very fine cover-glasses. It is obvious that cover-glasses and instruments must be absolutely pure. The glasses, if dirty, should be soaked in nitrid acid, and may always be kept for use in strong acetic acid, from which they are removed and dried with a clean cloth before use. A drop of the discharge to be examined is lifted on the point of a needle—which has just been purified by heating to redness—and spread in a fine film over the surface of the cover-glass. A couple of films may be obtained by placing a drop between two glasses and pulling them asunder. The film is then carefully and thoroughly dried by holding it for a little well above the lamp. Finally, just before staining, the cover-glass should be drawn thrice through the flame of a Bunsen burner at the rate of a long pendulum swing; this fixes the film, and makes it stain more readily.

Staining.—Place on the film for sixty seconds a drop of a two per cent. watery solution of methyl aniline violet, with twenty per cent. absolute alcohol added; wash off with a gentle stream of distilled water, and examine. In the case of blood, the stain should be a half-saturated alcoholic solution.

Gram's Method.—Prepare a watery solution of aniline oil by putting a drop or two of the oil into a test-tube, adding about half an ounce of water, and after shaking, filter. Add to this eleven per cent. of a saturated alcoholic solution of gentian or methyl violet.

Let the cover-glasses stain in this for 15 to 30 minutes. [Sections require twice as long.] Then *at once* place them in Gram's fluid: Iodine, 1 part; iodide of potassium, 2 parts; water, 300 parts; as a substitute for this, add tincture or liniment of iodine to water, till of a

dark sherry color. They should next be transferred to *absolute* alcohol, and then placed in a weak watery solution of Bismarck brown or eosine for the contrast stain; after which they should be washed in distilled water, laid to drain on blotting-paper, end on, and, before mounting, held about $1\frac{1}{2}$ foot above the lamp to dry. A drop of Canada balsam dissolved in xylol serves for mounting.

The bacilli of tubercle may be stained after the manner of Gibbes. The following method, a modification of Neelsen's, has also been recommended:

Staining Solution.

Fuch sine, 2 grams.....=2 per cent.

Absolute alcohol, 20 cub. cent..=20 “

Water, containing 5 per cent. of
carbolic acid, 80 cub. cent....=80 “

Place some of the solution in a watch-glass over a spirit-lamp, and float the cover-glasses, film downward, on the stain. Heat gently, till steam rises, for five minutes. Place in twenty-five per cent. sulphuric acid for one second; transfer to absolute alcohol till decolorized. A contrast stain is now got by placing the cover-glasses in watery solution of methylene blue for half a minute, after which they must be washed in distilled water and mounted. The tubercle bacilli come out pink and other organisms and structures blue.

MICTURITION, FREQUENT, IN THE FEMALE.—Irritability of the bladder, a common symptom in women, must be distinguished from incontinence of urine. The latter means that the urine cannot be retained, and is continually running away, a result either of a fistulous opening between the bladder and the uterus or vagina, of which injury and cancer are the common causes, or of abnormal patency of the urethra. This latter condition sometimes follows over-dilatation and laceration of the urethra. Incontinence of urine is suggested by the urinous smell of the patient's clothes, and confirmed by the fact that no urine is found in the bladder.

Irritability of the bladder implies that the patient cannot restrain herself from emptying the bladder sooner or oftener than she would like. In this case, although the patient complains that the urine runs away, some urine can be retained in the bladder.

This symptom is present in almost all diseases of the bladder and urethra (in connection with which one important fact to remember is that it may be an effect of retention), also in certain diseases of the kidney, and of the uterus or its appendages; in uterine displacements, in diabetes, and disease of the spinal cord. It may be a reflex effect of almost any irritation of the pelvic organs. It is usually, as in the above-named conditions, a symptom to which a definite date can be assigned, but there are some women who, from infancy, have been unable to retain the urine so long as most. Temporary frequency of micturition occurs at the menstrual period and during pregnancy, and is a frequent result of colds and coughs, and of diarrhea.

Treatment.—The treatment will depend entirely upon the nature of the underlying cause.

G. E. HERMAN.

Symptomatic Indication.—*Belladonna*, when irritability is the principal symptom.

MIGRAINE (Megrim).—A typical attack of migraine readily admits of being roughly divided into two parts, the first consisting of the sensory phenomena and the second of the headache.

Of the former, none are so frequent or so impressive to the patient as the disorders of vision. A blurring of images on one side or the other is noticed, very much like that which is experienced after looking at the sun. In from ten to twenty minutes from the commencement sight again becomes normal. Affections of common sensation are frequent, and consist of a feeling of pins and needles or of numbness, sometimes followed by anæsthesia. They occur most frequently in one or the other arm, less often in the face, and very rarely in the leg. The affection is nearly always unilateral in the face and extremities, but bilateral when it attacks the mouth and tongue. When vision and common sensation are coincidentally affected, the hemiopic defect and numbness are on the same side. Taste, smell, and hearing are very seldom implicated. Aphasia is not at all uncommon, and varies from a simple difficulty in framing a clear sentence to complete loss of speech. It is usually associated with some degree of numbness, commencing, as a rule, in the fingers, and nearly always on the right side.

In the earlier part of the paroxysm there is sometimes a certain amount of psychical disturbance, manifested by a confusion of intellect, temporary suspension of memory, or an unaccountable sense of fear. Vertigo is frequent, and consists of the apparent revolution of surrounding objects or of the patient himself. It has been observed that a hemiplegic weakness sometimes occurs during the preliminary stage. The fact, however, that patients occasionally drop things they hold in their hands may possibly be explained by the loss of the muscular sense.

Any one or any combination of these sensory symptoms may initiate the full migrainous seizure or may exist alone, constituting a larval, or masked form of the disease. In the former case the headache supervenes in from ten to thirty minutes from the commencement of the attack, and, although it generally follows immediately after the sensory symptoms, occasionally the two appreciably overlap one another. It usually commences over an area which can be covered with the tip of the finger, and commonly radiates thence over both sides of the head, though in some cases it is distinctly one-sided. Frequently overwhelming in its intensity, and of a boring, stabbing, or throbbing character; it is greatly intensified by exposure to light and noise, or by any movement.

It is generally markedly cumulative in its nature, attaining its maximum steadily or by leaps and bounds, and then gradually subsiding. During the acme of the pain, vomiting frequently occurs, in some cases inducing almost immediate relief, but in others the accompanying retching only increases the distress. The pulse rate is often reduced in the attacks, sometimes to 48–50.

Many affections of the sympathetic system have been described, but are very inconstant—*e. g.*, contraction and dilatation of arteries, retraction of eye, dilatation of pupil on the affected side, pallor and flushing of face. The duration of the seizures varies considerably in different individuals, and may be as short as two and a half hours, or as long as two and a half days. Xanthelasma palpebrarum and patches of gray hair are comparatively common in those subject to migraine.

Diagnosis.—No difficulty should arise in a fully developed case, but much care

is sometimes required in differentiating some of the masked forms of the disease from dyspeptic headache, neuralgia of the fifth nerve, and even *petit mal*.

Prognosis.—No definite rules can be laid down; some cases are as easily curable as others prove intractable. Generally speaking, the longer the disease has been in progress, the more severe the attacks, and the greater the number of special senses involved in the onset, the more difficult is the cure. It frequently happens, in cases of gouty origin, that with the first outward manifestation of gout, the migraine disappears. As a rule, the attacks diminish in intensity and number with increasing years, till they eventually disappear, in women about the time of the menopause.

Pathology.—Many considerations lead to the belief that migraine is a nerve-storm traversing the sensory centers, and having a fundamental relationship with epilepsy, although differing so greatly in its outward manifestations. If this be so, the discharging centers are probably of about the same level as those which, in the motor region, would give rise to epileptiform, or Jacksonian convulsions.

It seems likely that there is a congenital deficiency of controlling power of one or more of the sensory centers, and that if it be still further weakened by exhaustion, or strained to the utmost by excessive stimulation, or irritation of the lower centers, inhibition eventually breaks down altogether, and a paroxysm occurs.

Ætiology.—Heredity is the most potent predisposing cause of migraine. Sometimes it owns a gouty origin, and occasionally a malarial. It is rather more common in women, and frequently commences at the age of seven or eight, seldom after thirty, but may start at any intervening age. Very often there is some defect of the visual apparatus, an error of refraction, or some weakness of the internal or external recti. Mental or physical exhaustion, whatever may be its origin, is the most frequent exciting cause. Sometimes the attacks occur at the catamenial epochs, more rarely they follow upon some error of diet, or exposure to a bright light.

Treatment.—This is directed toward two ends: (1) to diminish the frequency of the attacks, and, if possible, to prevent them altogether, and (2) to mitigate their severity.

The first indication, after treating any causal influence which may seem to be at work, is to prevent any unnecessary excitement, any over-exertion, mentally or physically, so as to procure for the patient an equable existence. The encouragement of a "healthful life, a healthful growth, and healthful education," is of the very first importance in the young. In all cases the diet should be liberal, the bowels carefully regulated, and moderate exercise encouraged. The most useful of the many drugs recommended are the bromides, alone, or in combination with quinine, strychnine alone, or combined with ergot, cannabis indica, iron, arsenic, cod-liver oil, belladonna, and hyoscyamus. Occasionally iodide of potassium and chloride of ammonium are useful. Patients having a gouty history are treated successfully with alkalies.

During the paroxysm the patient spontaneously retires to a dark room, and seeks absolute quietude. If the feet be cold they should be wrapped in blankets, or immersed in hot water, with some mustard added. A cup of strong tea or coffee is often now of use. In some cases antipyrine, preferably effervescent, in doses of 10 to 20 grains, is able not only to diminish the severity of the attacks, but even to abort them, if given at a sufficiently early stage. Guarana and caffeine have a similar effect in some cases, but are quite useless in others. Hydrate of chloral, in doses up to 20-30 grains, is frequently successful, by inducing sleep.

Other less generally useful remedies are ergot, nitrate of amyl, nitro-glycerine, and the constant current passed from one mastoid process to the other.

WM. GAY.

Symptomatic Indications. — *Belladonna* is useful when face is red, eyes hot, throbbing pain, worse from motion and when lying down. *Iris*, when from hepatic disorder, blur before the eyes, bilious vomiting, does good service. *Aconite* is valuable when the result of cold, pain is severe, paroxysmal, worse at night; anxiety and restlessness. *Arsenicum* when pains are periodic, burning, worse from cold; restlessness; prostration. *Veratrum album* when with sensation of coldness in affected part. *Sanguinaria* is useful when pain occurs at the climacteric. *Ignatia* for clonus, nervous, depressed persons; clonic spasms; diuresis.

MIASM.—See **MALARIA**.

MILIARIA.—*Definition.*—An eruption of small transparent vesicles, chiefly on the abdomen, which contain sweat.

Symptoms.—In the course of an acute disease, in which excessive sweating is a prominent feature, small transparent vesicles suddenly appear. At first sight they look like drops of water upon the surface, but they are hard to the touch. The vesicles contain sweat, which is proved by analysis. When they burst an eczema may result from the irritation of the sweat.

Treatment.—None is required, unless the disease is accompanied by eczema, which should be treated accordingly.

MALCOLM MORRIS.

MILK FEVER.—Generally, in about forty-eight hours the secretion of milk becomes established, and this is occasionally accompanied by a certain amount of constitutional irritation. The breasts often become turgid, hot, and painful. There may be some general disturbance, quickening of pulse, elevation of temperature, possibly slight shivering, and a general sense of oppression, which are quickly relieved as the milk is formed, and the breasts emptied by sucking. One writer noted the most common phenomenon connected with the temperature to be a slight elevation as the milk is secreted, rapidly falling when lactation is established. Another noted elevation, either of temperature or pulse, in only four out of fifty-two cases which were carefully watched.

There can be no doubt but that the importance of this "milk fever" has been greatly exaggerated, and its existence, as a normal accompaniment of the puerperal state, is more than doubtful. However, in a small minority of cases there is an appreciable amount of disturbance about the time that the milk is formed. Many modern writers entirely deny the connection of this disturbance with lactation, and refer it to a slight and transient septicæmia. Hewitt says that it is most commonly met with when the patient is kept low and on deficient diet after delivery, especially when the system is below par from hemorrhage, or any other cause. This observation will account for the comparative rarity of febrile disturbance in connection with lactation in these

days, in which the starving of puerperal patients is not considered necessary. It is certain that anything deserving the name of milk fever is now altogether exceptional, and such feverishness as exists is generally quite transient. It is also a fact that it is most apt to occur in delicate and weakly women, especially in those who do not, or are unable to nurse. There does not, however, seem to be any sufficient reason for referring it, even when tolerably well marked, to septicæmia. The relief which attends the emptying of the breasts seems to prove its connection with lactation, and the discomfort which is necessarily associated with the swollen and turgid mammæ, is, of itself, quite sufficient to explain it.

MOLE PREGNANCY.—A term applied to the production or formation of a fleshy mass instead of the fetus; the life of the ovum is destroyed, and it subsequently appears as a misshapen mass, or the fetus may perish from hydatidiform degeneration of the chorion. The causes are unknown, but syphilis may be a possible cause.

Symptoms are those usual to pregnancy; later, on the death of the fetus, the abdomen ceases to enlarge, and the mammæ become flaccid; finally, discharge of water with small cyst-like bodies. Diagnostic signs are: absence of fetal circulation, softness of the uterine tumor, bimanual examination showing a want of firmness in the uterus, and intra-uterine examination revealing a soft placental-like mass.

Prognosis is favorable.

Treatment.—Dilate the os, and empty the uterus.

MOLLITIES OSSIUM.—See **BONE, DISEASES OF.**

MONOPHOBIA.—See **FEAR, MORBID.**

MORBILLI.—See **MEASLES.**

MORBUS COXÆ.—See **HIP DISEASE.**

MOLLUSCUM.—This name has been given to two distinct and dissociated diseases of the skin, owing to a fancied resemblance in their lesions to some molluscs.

MOLLUSCUM CONTAGIOSUM (**Molluscum Sebaceum**; **Meliceris**; **Epithelioma Molluscum**; **Acne Varioliformis**)

—**Bazim**).—A contagious disease of the skin, characterized by the presence of tumors, generally of small size, but numerous, and presenting peculiar features.

The growths usually vary in size from a pin's head to a split pea, but sometimes attain the dimensions of a hazel-nut, or even greater. They are almost always multiple, sometimes extremely numerous. They grow slowly, and may either remain discrete, or coalesce, to form compound tumors. At first they are sessile, rounded, firm, mortar-like, wart-like, waxy, or horny. The skin over them is sometimes pinkish, but generally pearly white; afterward it often becomes yellowish. In the center of each tumor is a depression, or umbilication, giving the characteristic "mother-of-pearl button" appearance, from which the milky-white, opaque, semi-fluid, or waxy contents can be extruded by pressure. When several of these coalesce, the composite growth presents several such pit-like depressions, the larger growths generally becoming pedunculated.

The favorite seats for the disease are the face (especially the eyelids), the neck, the mammæ (especially in women who are suckling), and the genitalia, but it has been known to occur on any part of the body, except on the palms and soles, and even on mucous surfaces.

The growths may remain quiescent indefinitely, it may be for months; may disappear by spontaneous involution, or may undergo chronic inflammatory induration. Most frequently, however, they suppurate, discharge, and heal; only in the latter circumstance do they give rise to any subjective symptoms beyond disfigurement. They do not necessarily leave scars.

Pathology.—Recent researches prove, almost conclusively, that they arise from the cells of the *rete Malpighii*, and are continuous with that inversion of it which constitutes the outer root-sheath of the hairs. The inter-papillary processes enlarge, the papillæ themselves being thereby narrowed, and finally becoming mere fibrous bands. The fully-developed tumor is surrounded by a firm fibrous capsule, from which septa pass inward to the center which corresponds to the umbilication. The lobules then formed are lined by large, columnar, epithelial cells, those of the outer layer having big oval nuclei like those of the normal mucous

layer. The center of the lobule is occupied by a whitish mass, composed of large, ovoid, opaque, or vitreous-looking cells, along with egg-shaped nuclear bodies—the "molluscum corpuscles"—the result of a degenerative process. These bodies are, however, not "specific," as they are sometimes found in old comedones, and in some epitheliomata, although in less abundance than in molluscum contagiosum.

Differential diagnosis.—Early cases may be mistaken for ordinary warts, or for the simple subaceous tumors common about the scrotum and penis. Inflamed mollusca have sometimes some resemblance to chancres; confusion with molluscum fibrosum seems hardly possible.

Ætiology.—It is common in London, but rare in Scotland, and even more so on the Continent and in America. Occurring chiefly among the children of the lower classes, or in establishments where children are closely aggregated together, little doubt exists that the disease is infectious, and is always communicated by contact with an affected person. Its frequent communication from mother to child at the breast, or *vice versa*, is another evidence of its infectiousness; but many dermatologists, especially in Germany, invoke as its sole cause a special tendency in the cells of the mucous layer of the skin of rapidly growing children toward this peculiar form of degenerative change. Admittedly, inoculation experiments have yielded negative, or, at all events, ambiguous results.

Treatment.—The disease tends to spontaneous, albeit slow, recovery. It is usually advisable, however, to expedite cure by touching the smaller mollusca with nitric acid or the acid nitrate of mercury. Pure carbolic acid is also useful, the growths being afterward covered with flexible collodion. The larger growths are best incised, their contents squeezed out, and the interior lightly cauterized.

J. J. PRINGLE.

MOLLUSCUM FIBROSUM (*M. Simplex*, *M. Pendulum*, *Fibroma*, *F. Molluscum*)—A rare congenital disease in which tumors, usually multiple, grow from the subcutaneous tissue and lower layers of the true skin. Occasionally the condition is hereditary and present in more than one member of the same family. In a certain proportion of cases it is

associated with defective mental development. The growths are generally numerous, sometimes innumerable, their favorite sites being the trunk, head, face, and neck. They are seldom present on the limbs, and, if present, are never numerous. They have been known to occur in the mouth, especially on the cheeks and gums.

They vary in size from that of a small pea to a walnut or an egg, while many of them, especially in early life, are quite subcutaneous, and their presence can only be ascertained by touch. They increase slowly and progressively with age, and, although their existence at birth is indubitable, they are often not noticed before the age of five or ten years.

The growths present an infinite variety of character; some are subcutaneous, others are sessile with a broad base, others distinctly pedunculated, others pendulous: some are tough and elastic, others soft and flabby; some become mere pouches of loose skin, owing to the atrophy of their contents. The skin over them is generally normal in color, but occasionally pinkish from excessive vascularity. In exceptional cases there is diffuse pigmentary change over the skin; sometimes, but more rarely, multiple neuro-fibromata have been associated with the condition. The tumors are painless, and cause no subjective symptoms beyond a sense of strangeness and disfigurement. They do not inflame or undergo malignant degenerative changes unless irritated, and that only very rarely.

Pathologically, the growths consist of all the constituent elements of the skin and subcutaneous tissue (fibrous tissue, fat, vessels) in very varying proportions. The connective tissue in the center is always softer and more gelatinous than at the periphery, where its condensation results in the formation of a distinct capsule, so that, if the skin be incised, the little tumor can be shelled out. There is no special connection with the peripheral nerves.

Dermatolysis.—This condition is only an exaggerated form of the preceding, where large flaps or folds of hypertrophied skin are present, their commonest sites being the neck, face, buttocks and chest. Their appearance is often ascribed to an injury or to a fright to the mother during pregnancy. The skin composing these hideous excrescences is

often deeply pigmented, thickened, indurated and warty; hypertrophy of the bones or other subjacent tissues is also occasionally present. Troublesome dermatitis beginning as intertrigo is apt to arise in these folds of skin, especially if careful cleansing of the parts be not habitually carried out.

Diagnosis.—Fibromata may be mistaken for fatty tumors, fibro-neuromata, multiple sebaceous cysts, molluscum contagiosum, or for keloids, especially their subcutaneous form. Dermatolytic growths must not be confounded with elephantoid conditions.

Treatment.—The small, withered growths may be snipped off; the larger ones excised. If the lesions are few in number, small, and subcutaneous, their destruction by electrolysis has been recommended. Ablation of even enormous dermatolyses has been successfully practised.

J. J. PRINGLE.

MONOMANIA.—This term does not indicate a distinct disease, and generally leaves out of sight the fundamental condition. It may possibly be useful to express the existence of either a fixed delusion, or a set of delusions of the same general character, but such cases fall naturally under the head of chronic delusional insanity, which includes both maniacal and melancholic conditions.

The fixed delusions just mentioned fall under three chief heads, (1) of imaginary greatness, (2) of secret agencies and persecution, (3) of suspicion. It is generally held that monomania implies the power of reasoning upon topics other than the subject of delusions, but this is a familiar feature in many cases which have nothing else in common with monomania.

GEORGE REVINGTON.

MORPHINOMANIA.—A craving for morphine induced by its habitual use.

The habitual use of morphine, in draught or subcutaneous injection, or in one of the patent medicines containing the drug, is generally found to have commenced under medical advice, for the relief of pain or sleeplessness, and to have been incautiously allowed to continue. Occasionally it has been resorted to as a solace in mental trouble. After some weeks or months or years, during which increasing tolerance of the drug has generally demanded augmented doses, the

effects of morphine become very marked. They consist in mental depression, lassitude, restlessness, and a vague sense of discomfort. They are relieved only by renewed administration of the drug, which as the after-effects grow more and more distressing, gradually becomes an imperious necessity. At first, honest efforts are made to break off the habit; but before long the urgent craving gains an easy victory over an enfeebled brain. The moral tone becomes seriously relaxed, the will is paralyzed, and no consideration of truth, honor, or duty is allowed to obstruct the overpowering desire to obtain and ingest the coveted poison.

The confirmed morphine-taker becomes pale, sallow, emaciated, and prematurely old. His normal condition, when not under the direct influence of morphine, is one of dejection, feebleness, and want of interest in life. He is constantly restless, can seldom remain long in one position, and changes his attitudes with sudden jerks or starts. He is liable to fits of tears and to outbursts of violent rage. He suffers from palpitation and tinnitus. His appetite is small and his digestion painful and imperfect. The bowels are usually loose. He sleeps badly, and is troubled with distressing dreams. Fits of sweating often occur. Untrustworthiness is painfully obvious, even when the possession of morphine is not concerned. The sexual powers are diminished or absent. The pupils are usually dilated. The pulse is weak and thready.

If the habit be not discontinued, progressive weakness and emaciation end in death from asthenia or from some intercurrent inflammation, as lobular pneumonia. Sometimes the condition merges into genuine insanity. As to the duration, it is impossible to frame any general statement. Much depends on the quantities taken.

Treatment.—Consists in the total discontinuance of the drug, but it is seldom that it can be accomplished unless the patient can be subjected to external control. His sufferings on first omitting the accustomed dose are very severe. In addition to restlessness, sleeplessness, and mental depression, he experiences a sense of “sinking” at the epigastrium, nausea, and at times, persistent vomiting; and hyperæsthesiæ of various kinds add to his troubles. After a few days the severity of the symptoms usually abates some-

what, and in a few weeks the condition may become tolerable with ordinary resolution.

As a rule, it is best to discontinue the drug at once and wholly, but in some cases a gradual reduction is found desirable. It is chiefly a matter of mental or moral idiosyncrasy on the part of the patient, and it is impossible to formulate any rule on this point. The closest watching is needed to insure genuine discontinuance, the cunning of these patients and their capacity for deception being almost incredible.

Drug-treatment may be of some service. Strychnine and caffeine are useful in combating the mental depression and the anorexia. Both must be used in fairly full doses, 5 minims of the liq. strychninæ and 4 or 5 grains of caffeine being given every six hours. The addition of from 5 to 10 minims, or more, of tincture of capicum and the use of camphor water as a vehicle may tend to relieve the “sinking.” Vomiting is best checked by stimulating applications (mustard plasters, turpentine stupes, etc.) to the epigastrium. A warm bath will sometimes benefit the restlessness.

It may be necessary to procure sleep at night by some drug other than morphine, and for this purpose one should be selected which is not likely to establish another “habit” in place of the morphine taking. From 15 to 20 grains of sulphonal cautiously increased may be employed; but most benefit is obtained from hyoscyamus, alone or in combination with cannabis indica. These drugs may be given in the form of pills made of their extracts, or as a mixture into which their tinctures enter. The hyoscyamus should be prescribed in full doses—8 grains of the extract or a dram of the tincture; the Indian hemp, which is an uncertain drug, in guarded doses at first— $\frac{1}{2}$ grain of the extract or 15 minims of the tincture. Bromides are not often of real service, and alcohol is best avoided altogether. Digitalis may be required if the heart’s action be feeble. A brisk dose of calomel is advisable at the outset, even when diarrhea is present. Should the bowels continue loose, chalk or astringents must be resorted to, with warm applications to the abdomen. Food must be pressed as the capacity for taking it returns.

ISAMBARD OWEN.

MOUTH, PALATE, TONGUE, AND TONSIL, AFFECTIONS OF.

— **I. Deformities.** — **Pharyngeal fistula** — a passage, leading from the outside of the body into the cavity of the pharynx. This fistula usually occurs below the glottis, and may be recognized by introducing a probe, which will project in the pharynx, and can there be seen or felt. It gives rise not only to a disagreeable deformity, but may allow of the passage outward of small quantities of food or of irritating secretions.

Treatment consist in effecting closure of the fistula by cauterization of its interior, or by a slight plastic operation, consisting in freshening the edges, and securing over the orifice a small flap dissected from the adjacent skin.

Hare-lip and cleft palate.—The following varieties of these deformities are met with in actual practice: 1. Simple hare-lip, an incomplete union of the superior maxillary process and frontal process. *Cheilo-gnathus*. 2. Double hare-lip, where the non-union is bilateral. 3. Fissure of the lip and alveolus on one side, where the non-union is more extensive than in No. 1. 4. The same on both sides. 5. Fissure of the hard and soft palates behind the alveolus. *Plato-gnathus*. 6. Fissure of the hard palate only (very rare). 7. Fissure of the soft palate only (including the uvula.) 8. Bifid uvula. 9. Cleft palate, combined with fissure of the lip and alveolus on one or both sides. *Cheilo-palato-gnathus*.

The *origin* of these deformities is unknown. It is generally believed that they are due to failure of development, and not, as was formerly held, to intra-uterine inflammation or other disease. It is probable that they are owing to some fetal affection occurring before the ninth week of pregnancy, as after that time the parts are united. Sometimes there is presumptive evidence of the mother having received a mental shock during pregnancy, and such has been assigned as the cause of the deformity. In some cases other deformities coexist. It may affect more than one member of a family, but no distinct hereditary tendency has been traced.

Hare-lip.—As stated above, this affection may occur on one side only, or on both; it is much more common on the left than on the right side. The cleft presents certain varieties. Its edges may

be placed very obliquely, leaving a wide, much rounded angle; or the re-entering angle may be much more acute, in which case the cleft is deep and narrow. The apex of the angle is toward the external nares, to which it approximates more or less closely. The nose itself is flattened to a greater or less extent, according to the width of the cleft and the separation of its edges, and this flattening increases with age if the cleft be not closed by operation at an early period. When both sides are affected there may be between the two clefts a central projection of the lip of almost normal depth, or this portion may be very slightly developed, or it may be carried forward as an appendage to the tip of the nose. All of these points will influence the details of the operation for removal of the deformity.

Beyond its unsightly appearance, the only trouble resulting from hare-lip is that it renders the infant incapable of sucking, and hence necessitates feeding by hand, with its concomitant annoyances and risks.

In all cases the affection should be remedied by operative treatment, as there is no tendency to natural cure. Operation should not be too long delayed. In time the efforts of the child to talk will increase the deformity, and the older the patient the greater will be the difficulty in obtaining the quietude necessary for closure of the fissure. Hence the period usually chosen is from the third to the sixth month, or earlier, before the troubles of teething have commenced, and after the infant has acquired its first "hold upon life." It is important, before anything be done, to ascertain that the child is in good health, and that it is steadily increasing in weight, while with hospital cases it is well that its vitality should not be depressed by too long residence before or after operation. Precautions of a general nature are the more necessary, as infants bear shock and hemorrhage very badly, and nutrition will have been previously defective.

The operation.—The principles upon which the operation is conducted are: 1. The edges of the cleft must be freshened to allow of their union when apposed. 2. All tension must be taken off the parts by freeing the lip well from its deep attachments, and, if necessary, by approximating the *alæ nasi*. 3. The

edges must, when placed in position, be so arranged that there is no interruption to the continuity of the red line of the lip.

4. During the process of healing the edges must be held in firm apposition. In all cases union of the edges by first intention is aimed at, and if this fail the surgeon must wait until the wound has healed and then operate again, union by granulation rarely occurring.

In an ordinary case the following procedure is to be adopted. The child having been chloroformed, and the head firmly held in a convenient position, in a good light, a pair of forceps is placed on either side of the cleft so as to compress the lip with the superior coronary artery. The edges of the cleft are then pared by transfixing with a small-bladed knife and cutting away a thin strip. These strips may either be removed, or, if the cleft be a wide one, turned down in various ways, to be used in filling up the hiatus. In all cases go through the entire thickness of the lip and cut right up to the angle of the cleft. It is well, in paring the edges, to make the cuts concave toward the middle line, so that when the surfaces are brought together the line of union will be extended and will prevent the formation of a dimple in the lip.

The deep attachments of the lip to the jaw may now be divided, so as to remove all tension, and there is often pretty free hemorrhage from this proceeding. The edges of the cleft are then brought carefully into apposition, the red line of the lip being maintained. They are thus held either by one or two hare-lip pins, or by sutures, preferably of silver wire. Whichever method be adopted, the pins or sutures must be placed deeply, so as to underlie and compress the coronary artery, but must not invert the mucous membrane behind. If pins be used, they are fixed, and the parts steadied by a figure of 8 suture passed several times round their projecting ends. More complete accuracy of position is then secured by as many fine sutures of silver, silk, or "silkworm gut," as may appear requisite. A few fine sutures may be inserted on the inner mucous surface, for which purpose the lip is inverted by traction upon the lowest of the outer sutures. The compressing forceps can now be removed, and the sutures and mutual apposition of the edges will prevent hemorrhage. A piece of strapping is carried across the lip

from cheek to cheek, the cheeks being first pinched together to take off all traction. If the nose be much flattened, the ala should be freed from its deep attachments along with the lip in the second stage of the operation.

In the after-treatment care must be taken to avoid too extensive opening of the mouth during feeding, which can now be carried on by suction. When the wound is to be examined the strapping is removed, and during the process the cheeks are pinched together. It is well to place a small piece of lint, so as to prevent adhesion of the strapping over the wound itself. If pins be used they should not be retained longer than seventy-two hours, or suppuration will occur along their track, leaving a scar. Sutures may be left rather longer. All sutures should be removed within four days, or earlier if they appear to be unnecessary, or to be causing irritation. The ligature which was placed over the pin, and which becomes incrustated with blood, should not be disturbed, as it tends to hold the parts together. Strapping may be retained until complete union has occurred, which will be in about fourteen days.

In *double hare-lip* precisely the same method is adopted, both clefts being treated at once, and pins may be driven right through the flaps, so that the same pin holds both sides and the central portion. Owing to the frequent shortness of the central portion, it is often necessary to turn down the strips taken from the lateral portions and unite them in the middle line, beneath the central lobule, thus obtaining more tissue. In other cases, again, the nose is much flattened, and there is no columnella. It will then be necessary to use the central portion of the lip in order to make a columnella, the two lateral portions being brought together in the middle line beneath it.

The operation may fail, owing to the occurrence of suppuration, or to want of healing power, and consequent non-union, and in either case may be repeated when the child has fully recovered. Sometimes the shock and inevitable loss of blood tell upon the infant's constitution, and cause great weakness and wasting, or even death from exhaustion.

Hare-lip complicated by protusion of the intermaxillary bones.—In many cases of double hare-lip the alveolus is also doubly cleft, and the united inter-

maxillary bones, with their corresponding portion of the lip, project forward, being attached to the end of the vomer, which may undergo some hypertrophy. In these cases, before the ordinary operation can be proceeded with, it is necessary to reduce the protrusion. As a rule this can be done by pushing it back through main force; but if the vomer be much elongated it may be well to remove a wedge of bone from behind the intermaxillary portion; or, if the central lobule be small, and situated near the tip of the nose, it may with advantage be removed altogether, as, even if it be replaced the result will be that the incisor teeth will grow directly backward into the mouth. The operation may then be performed for hare-lip as usual, or it may be deferred for a short period, the prominence being meanwhile held back by a piece of strapping until it has acquired new connections. It is unnecessary to operate upon the alveolar portion, as the edges of the cleft are thus brought into close apposition, and even if they do not unite no harm will result.

Cleft palate.—This may affect the uvula only, or the soft palate, or the hard palate, or both. *Bifid uvula* is an affection of no practical importance, save that in some cases it causes a slight defect in speech. In such a case it may be cured by paring the edges of the cleft, and uniting the freshened surfaces with fine sutures.

Cleft of the soft palate interferes with the proper closure of the posterior nares during deglutition and speaking, and is consequently of greater clinical importance. During infancy it gives rise to trouble, by allowing the regurgitation of feed through the nose, and necessitates feeding the child by means of a spoon with small quantities of fluid at a time. When the child learns to speak there is noticed a peculiar nasal twang, and difficulty in articulating those sounds which are produced at the back of the mouth. To some extent nature will overcome these difficulties by the great development of the levatores palati, which draw upward the two sides of the velum, while the upper fibers of the superior constrictor of the pharynx draw forward the posterior surface of that cavity, and thus aid in shutting off its upper portion. This closure may, but often does not, become complete, and the vocal difficulty is never overcome.

Cleft of the hard palate intensifies the difficulties of deglutition and speech. The cavity of the mouth is thrown directly into that of the nose, and food will readily pass upward and be regurgitated, while the high roof of the mouth and nasal communication impart to the speech a characteristic twang, and render articulation very imperfect. There are two forms of this affection: in one, the rarer, the vomer has its lower border free, and the two sides of the palate are also free, so that both sides of the nose communicate with the mouth. In the other form the vomer is attached to one side of the palate, shutting off from the mouth the nasal cavity of that side, while on the other side the palatine edge is free as before. In all cases the roof of the mouth is high, which aids the surgeon greatly in the operative treatment.

Cleft palate is only of danger to life or health in the infant in whom treatment is impossible; and as in the adult it is solely of importance from the difficulty in speech which it occasions, all operations for its relief must be classed as "operations of expediency;" and hence some surgeons hold that for such a complaint we are not justified in submitting the patient to even the slight risk involved in an operation which, moreover, may prove a failure. With this view various ingenious contrivances have been invented, having for their object the mechanical closure of the orifice. The principle of such appliances is in all cases a firm "obturator" attached to the hard palate, with or without a flexible curtain for the velum.

In most cases, however, parents and surgeons will prefer the slight risk of an operation, which, if successful, constitutes an absolute and permanent cure, and which relieves the patient from the expense and embarrassment of an artificial palate. With very broad clefts only is operation impracticable, as in such a condition the tension on the flaps would be too great for their union.

In choosing the *time* for such an operation there are two contingencies to be avoided. If it be done at too early an age, the child suffers severely from shock and loss of blood; the parts are very small and difficult to manipulate, and it is impossible to obtain the perfect quiescence necessary for union. If too long delayed the patient will have acquired a peculiarity of speech difficult or impos-

sible to overcome. Hence the age usually chosen is about the third or fourth year, when the period of infancy is passed, and speech is not yet fully developed.

The operations required for the hard and for the soft palates respectively are essentially different, and must be considered apart. If only one division of the palate be cleft, that must be united; if both, the two operations may be performed at one time, or either may be done first, the parts being allowed to heal before the second operation is commenced. Chloroform should always be given, as the risk of hemorrhage into the trachea is, with careful assistance, very slight, and the advantage of a quiet patient is inestimable. The head must be well raised and in a good light. Smith's or some other form of gag is used to keep the mouth open. It has been proposed to operate with the patient's head hanging so far back as to occupy an inverted position. The surgeon will then look directly down upon the palate, and blood will run into the nares rather than down the trachea.

Urano-plasty.—In the operation upon the hard palate (*urano-plasty*) two muco-periosteal flaps derived from the sides of the palate are brought together in the middle line. On each side of the cleft, just within the alveolar ridge, an incision is made along the palate, completely down to the bone, and extending slightly on to the soft palate. The edges of the cleft are then completely pared by a sharp two-edged knife. By means of a specially-shaped raspatory the strips of soft tissue between the lateral incisions and the cleft are now elevated from the bone, remaining attached at their ends only. If they are firmly held at the posterior part along the junction of the hard and soft palates, a pair of curved scissors may be introduced beneath the mucous membrane to divide the adhesions. It now only remains to unite these two flaps in the middle line by silver sutures, which may be left *in situ* for ten days or a fortnight. The edges of the flaps will unite, and the patch from which the muco-periosteal flap was withdrawn heals by granulation. A modification of this operation, introduced by Sir William Fergusson, consisted in dividing the palatal process of bone with a chisel, after having made the lateral

incision; but this appears a quite unnecessary complication, and may be followed by necrosis of the bone.

Hemorrhage during the operation may be controlled by digital pressure on the anterior palatine foramina behind the incisor teeth, or the posterior palatine foramina, which may be felt about half an inch anterior to the hamular process, and internally to the last molar tooth. In cases of secondary hemorrhage these apertures have been successfully plugged with wooden spicules, generally made from a common match.

Staphyloraphy.—The operation for closure of the soft palate (*staphyloraphy*) is complicated by the necessity of avoiding muscular traction. With the sharp two-edged knife the edges of the cleft are pared, care being taken, as in all plastic operations, to remove the strip entire, and to freshen properly the angle of the cleft.

The palate being then firmly held in the forceps, sutures are to be passed through both sides. A dexterous hand will pass a curved needle, in an ordinary holder, through both sides of the velum, just as in suturing any other wound; but special contrivances, of various sorts, have been devised to facilitate the process. The simplest of these is, perhaps, a straight needle, in a handle, with the eye at the point; by means of this a silver suture is passed through one side of the cleft and the needle withdrawn; the needle is then passed through the other side of the palate, and is there threaded with the posterior end of the suture; on again withdrawing it, the suture is carried through both sides. Silver sutures are probably the best for this purpose, fine silk being used for the uvula, or small intervals; others prefer "silkworm gut." The edges being brought together, it remains to take off muscular tension. Pollock's method of doing this is to enter a knife, with its point held inward and downward, on the inner side of the hamular process, which is readily felt in the mouth, and then by carrying the handle of the knife downward, to sweep the blade through the levator palati. Fergusson divided the levator palati from behind, before suturing the cleft, by a knife bent at a right angle on the flat, then snipping with scissors the anterior and posterior pillars of the fauces, the former method being

the easier of performance. Sutures may be retained about ten days, and soft or fluid food only should be given, the patient being restrained from speaking. In the case of young children, it is well to train them not to speak for several days before the operation is performed.

In either of the above operations, should the parts fail to unite, the surgeon may, after a time, repeat the procedure; if only foramina are left, these will often, in time, contract considerably, or close entirely; or, if large, their edges may, after a time, be pared and re-united. In all cases, it is necessary, after the clefts have been closed and the parts healed, to teach the patient to speak properly; and there may be difficulty in overcoming the peculiar articulation, but, with care and patience, and if the operation has not been too long delayed, this may be accomplished successfully.

Of the remaining deformities of the mouth, none approach in frequency, or in clinical importance, to hare-lip and cleft palate.

In cases of extreme rarity there has been seen *medium cleft* of the upper lip, and in some of these the intermaxillary bone is absent. Fissure may also occur between the central and lateral excisor. Median fissure of the lower lip is also very rare. Sometimes a cleft extends from the angle of the mouth toward the external angle of the palpebral fissure. In other cases, the division of the superior and inferior maxillary process extends too far backward, and a cleft in the cheek is formed, extending directly outward from the mouth, or *macrostoma*. All of these clefts may be treated upon the principles already enunciated.

Absence of the lips (*achelia*), congenital closure of the lips (*synchelia*, or *atresia oris*), partial closure of the lips (*microstoma*), and imperfect development of the lips (*microchelia*) are curiosities, all being extremely rare, and often combined with other forms of monstrosity.

Macrochelia, or enlargement of the lip, is of more importance. When congenital, it may be combined with macroglossia, or hygroma of the neck. Pathologically, it consists in a dilatation of the lymphatics and lymphatic spaces, which everywhere pervade the tissue of the lip. Accompanying this dilatation, and as a result, no doubt, of the excessive nutrition, there is some true hypertrophy of the tissues.

Treatment is not satisfactory, but attempts have been made to excise portions of the lip. In strumous children, some enlargement of the lips is very common, and appears to be due to an inflammatory process of low and chronic type. It is seldom serious in itself, and is to be met by anti-scrofulous treatment, which will probably be indicated for other graver affections. A similar thickening is sometimes seen in the subjects of syphilis, congenital or acquired.

Small tongue (*microglossia*), and cleft of the tongue (*diglossia*) are very rare. In some cases the tongue appears to be well formed, but not to have arisen from the floor of the mouth, with which its mucous membrane is everywhere continuous.

Macroglossia, or large tongue, may be accompanied by macrochelia or hygroma. In some cases it is said to be due to hypertrophy of the fibrous, or of the muscular tissue, but more commonly is, like macrochelia, an affection of the lymphatics. On section of the tongue are found dilated lymphatic spaces, lined with endothelial cells, forming sometimes cysts, sometimes elongated canals. The probability is that this dilatation is due to obstruction in some part of the lymphatic system, and, pathologically, the condition is assimilated to that of elephantiasis. But the enlargement thus resulting causes, and is intensified by, inflammatory changes. It is usually developed in early life, and many regard it as always congenital, although it may arise in after life. The tongue is, at first, merely slightly enlarged; it then presses upon, and is irritated by the teeth; as it grows it may project from the mouth, where it is very liable to irritation and consequent inflammatory attacks, and where, by constant pressure, it may even cause deformity of the lower jaw. It now seriously impedes deglutition and respiration, and, if not relieved, may cause death from suffocation, during an inflammatory increment of the swelling.

Treatment.—At first endeavor to exercise pressure by various means, as by feeding the child with a large teat, or by keeping the lower jaw closed with a bandage. This has the advantage of retaining the tongue within the mouth, and thus protecting it from irritation. If the organ increase in size, a V-shaped portion may be removed from its tip, bring-

ing the sides together, or more or less of the mass may be excised. In some cases the affection is apparently connected with a strumous condition, and here such remedies as cod-liver oil may prove of service.

Tongue-tie is the result of a short *frænum linguæ*, which prevents the apex of the tongue from being raised, and thus impairs speech. It is a very common and easily-remedied deformity; but many cases which are subjected to operation would probably do equally well without. With a pair of scissors the edge of the *frænum* is slightly nipped, the cut being made as close to the floor of the mouth as possible, and the points of the scissors held down to avoid the ranine vessels. A slight cut having been made, the operation is completed by tearing. The parts may reunite if neglected, but the same procedure can be readily repeated.

In some instances the *frænum* has been too long, and the tongue has slipped back over the larynx, causing death by suffocation. Similar instances of "tongue swallowing" have been noticed after division of the *frænum*.

The chief deformities of the *palate* and *pharynx* have been mentioned above. In some cases the uvula, or, less often, the entire velum palati, have been absent. Congenital closure of the pharynx, or blind pharynx, is very rare, and a child so affected would be non-viable.

II. Injuries.—Injuries of the mouth and pharynx present few peculiarities. It is to be remembered that these parts are very vascular, and hence that there is apt to be severe hemorrhage, or great irritation and swelling, as the results of injury. But, on the other hand, this vascularity renders repair very easy and rapid, and the most serious wounds of this region will often heal in a marvelous manner.

Hemorrhage may be counteracted by the application of cold to the part (by sucking ice if in the mouth, or pharynx), by local pressure, and by pressure upon the supplying arteries. In the case of the lips, a "bull dog" forceps will effectually compress the coronary artery, or the facial may be secured as it passes over the lower jaw. The position of the palatine arteries has been mentioned above. In severe hemorrhage from the tongue, it may become necessary to secure one or both lingual arteries, but, as a rule, it is

possible to reach any bleeding point from the mouth. Heath's method of temporarily arresting hemorrhage from the tongue is invaluable. It consists in passing two fingers over the dorsum of the tongue into the pharynx, and then hooking up the base of the tongue so as to compress it against the lower jaw.

When *sutures* are required within the mouth it is well to use silver, as materials which have to be tied are liable to become loosened when subject to moisture and constant movement.

In the case of cuts of the lip, flexile collodion is a valuable auxiliary means of retaining the parts in position, and acts at the same time as a protective covering. It should be applied along with a little finely teased cotton wool so as to form a firm crust.

Wounds within the mouth are very apt to become foul, which may be obviated by using antiseptic washes, of which Condyl's fluid is one of the most useful. But a better method is to dust the part occasionally with iodoform, or to plug the wound and its neighborhood with iodoform gauze; or, the part being first dried, we may paint it with an ethereal solution of iodoform and flexile collodion. Wound of a salivary duct may give rise to subsequent trouble from the formation of a salivary fistula.

Foreign bodies have not unfrequently been found lodged in the tongue, such substances as grains of corn, bullets, etc., being there met with. They cause much irritation and swelling, which may seriously obstruct respiration and feeding, or, if long retained, they may become surrounded by a hard mass of inflammatory tissue, not easy to distinguish from a tumor or chronic abscess. The treatment consists in removal of the foreign body, the accompanying glossitis being treated as described below.

The pharynx, constituting, as it does, the entrance to the alimentary canal, and with its irregular surface, is liable to the impaction of foreign bodies. As a rule, it is some article of food, as a fish bone or a crust of bread, which becomes here impacted. A large substance, as a piece of meat or bread, a cast of false teeth, etc., may block the lower part of the pharynx, and, pressing upon the larynx, cause suffocation. In such cases an attempt should be made to withdraw or

push down the substance, according to its size and nature; and, if this cannot be done, tracheotomy may be necessary to render respiration possible until further measures can be taken. A favorite seat for the lodgment of small bodies, such as fish bones, is just external to the tonsil, where the pharynx forms a slight pouch. In all such cases there is much pain and irritation, and the foreign body should be removed as soon as possible. Forceps of various curves are used for this purpose, and in some situations which cannot be explored with the finger it may be necessary to examine with the laryngoscope in order to detect the foreign body. The surgeon must remember that the scratching and irritation cause the sensation of a foreign body to remain for some time after its removal, and hence, when the patient applies for advice, the cure may have already effected itself.

III. Affections of the Lips.—One of the most common diseases of the lips is slight *inflammation*, due usually to cold, and resulting in “cracked lips.” The surface is exposed to cold and moisture, the epithelium is cast off, or dries into a crust which peels off, or is cracked upon movement, when there results a slight but painful fissure, which, if neglected, may become steadily deeper, causing serious and prolonged irritation.

The treatment consists in avoiding cold, and smearing the part with vaseline, ung. zinci, or some form of “lip salve,” care being taken not to remove the epithelial crusts. Persons subject to this affection should, on the first commencement of dryness, apply vaseline nightly.

In children the subjects of *congenital syphilis*, a similar affection, is very common at the angles of the mouth, and causes cicatrices which persist throughout life. More severe inflammation results from blows, insect bites, and, in strumous children, from various slight causes. It must be treated by cold, painting with collodion to constrict the vessels; or if of strumous or syphilitic origin, by the usual constitutional measures.

Herpes often affects the lips, and is frequently combined with pneumonia. *Lupus* is also here met with. These affections present no special characters. *Chancre* of the lip is not uncommon, and

may be due to direct inoculation, to conveyance of the virus by the fingers, etc., or, in the case of infants, to infection from the breast of a wet nurse. The only point of importance is not to mistake it for epithelioma, its appearances and treatment being those of chancre elsewhere.

Nævus (angioma) and *papillomata* of the lips are frequent, but present no special characters. *Cysts* of this region are common, owing to blocking of some of the numerous follicles on the inner surface of the lip; they become distended with their watery secretion, and may attain a large size. Their nature is, as a rule, easily made out, there being a tense, shining, soft swelling, which, if large, will give the sense of fluctuation. A free incision should be made, and if this does not cure, may be repeated, the base being touched with nitric acid.

Epithelioma of the lip.—This affection is common, and its frequency is probably largely on the increase. It is almost always met with in the male, and in most cases the patient has been a constant smoker, usually of clay pipes; or some other habitual irritation may be traced. The usual seat of the growth is the lower lip, but the upper is sometimes affected. If not interfered with the result is certain; the submaxillary and cervical glands become affected, and the patient eventually dies from exhaustion, pain, or hemorrhage, with or without visceral dissemination. It is not uncommon for epithelioma of the lip to cause at the commencement so little inconvenience that it is almost overlooked. As a rule epithelioma begins either as a small hard nodule, which soon ulcerates upon its surface; or the first appearance may be an intractable fissure or ulcer, which acquires a hard infiltrated base and margin, and grows steadily. In either case there is a hard, well-defined mass, with an ulcerated surface, the ulcer being shallow, unhealthy-looking, with elevated edges, irregular base, and fetid, sanious discharge. Pain is not a very marked symptom in the early stages, but contact with food, especially food of an irritating nature, causes pain. It is of the utmost importance not to mistake this affection for chancre, or, as is more probable, to treat chancre as an epithelioma. The following points will afford some guide in the diagnosis:

CHANCRE.	EPITHELIOMA.
Usually in the female.	Usually in the male.
At all ages.	After forty years of age.
Commences as an ulcer.	May commence as a nodule.
Duration of a few weeks.	Duration indefinite.
Soon attains its maximum size.	Grows slowly, but steadily.
The cervical glands soon enlarge.	The glands enlarge later.
Secondary symptoms ensue.	Secondary symptoms absent.
May be febrile disturbance.	No fever.
No "cancerous cachexia."	In old cases may be marked cachexia.
Improves under treatment.	Does not improve.

It may also be possible to identify, in a scraping of the growth, cell nests, or other evidences of epithelioma. If there be evidence of visceral cancer the diagnosis is beyond doubt, but it is too late to be of service to the patient.

There is but one principle for the *treatment* of epithelioma. If there be dissemination, we can only palliate symptoms. But if the disease be localized we should at once remove it, taking away also any enlarged or hardened glands. In most cases removal is effected by a simple V-shaped incision, with its apex downward, cutting quite clear of the tumor, the parts affected being freely removed; the edges of the incision are brought together, and allowed to unite as in the operation for hare-lip. When the gap thus left is very wide, it may be necessary to relieve the tension on its two sides by prolonging beneath the jaw two diverging cuts from the apex of the part removed, or by some other form of "cheilo-plastic" operation. In some the lower jaw will be found to be affected, and if so, the part must be removed.

After removal of a localized epithelioma of the lip, the prognosis is better than in the case of most other operations for cancer. The early diagnosis and the comparatively isolated situation of the part contribute mainly to this result. In some cases there is no recurrence, in others it is long postponed. When recurrence does occur it is usually in the cervical glands, but may be at the site of the operation, owing probably to imperfect removal of the original growth.

IV. Affections of the Mouth.—Tumors of the mouth.—*Small papillomata* are not uncommon, and merely require cutting off, the base being cauterized with nitric acid; they may return once or twice, but rarely oftener. In older per-

sons, however, there is a risk of their becoming epitheliomatous, and in a patient over thirty-five years of age the slightest sign of infiltration of the surrounding tissues, or persistent recurrence, should be the signal for immediate and free excision. *Nævus* sometimes affects the interior of the mouth. *Adenoma* of the soft palate is not very rare, and can usually be readily shelled out. Other benign tumors are rather of pathological than clinical interest. Malignant disease is not often primary in any part of the mouth but the tongue, tonsil, and lip, which are elsewhere considered, but it may extend from those situations to any part of the mouth.

Cysts are very common.

Ranula is a large cyst, having probably several pathological varieties. It is due to obstruction of the ducts of one of the glands, in the floor of the mouth, with consequent collection of secretion. The cavity thus produced is lined with a columnar epithelium, similar to that of the duct, and containing a watery fluid, with some albumin and mucus. In some cases, probably, it is Wharton's duct which is thus obstructed; in others one of the ducts of Rivinus; in others that of one of the smaller muciparous glands, especially of that known as the Blandin-Nuhn gland, situated immediately below the tongue. Very rarely a hydatid cyst has been found in the site of a ranula. Whatever be the pathological cause of the cyst, there will be on one side, rarely on both, of the frænum linguæ, in the floor of the mouth, a soft, elastic, painless tumor, which slowly and steadily increases in size. It has no tendency to diminish or to burst, and may become of great size, pressing downward into the submental region, and obstructing the mouth. The diagnosis is simple enough, owing to the obviously fluid character of the contents, the uniform shape of the tumor, and the rarity of other growths in this situation. Puncture with an exploring needle will confirm it. In some cases tapping will suffice to effect a cure, but it is well to irritate the inner surface of the cyst by scratching it with the trocar, or by injecting some irritant fluid. If these means fail to cause its obliteration, the more prominent part of the cyst must be cut off and the cavity plugged, so that it may granulate from the bottom. Or a V-shaped piece of the mucous membrane

covering its surface may be separated, turned into the cavity, and secured there by a suture.

Acute ranula has also been described. It appears to consist, in some cases, of a sudden obstruction of one of the ducts, with consequent collection of fluid behind it. In other cases it is said to be a hemiglossitis, with much swelling of the floor of the mouth.

In the floor of the mouth, also, may be found a cyst due to enlargement of a bursa overlying the hyoid bone. Or a dermoid cyst may be found, either in the middle line, between the genio-hyo-glossi, or laterally, between the hyo-glossus and genio-hyo-glossus. Such cysts must, if not too large, be dissected out from the floor of the mouth, or from below the jaw.

Salivary calculus is not a very common affection, but may give rise to some trouble. It consists of a concretion of carbonate and phosphate of lime. Such a concretion may either remain embedded in the gland, in which case it will give no trouble; or it may be swept on through the duct and then discharged; or it may block the duct. In the latter case there is collection of the secretion behind the obstruction, which may cause a good deal of pain and some swelling of the corresponding gland, always increased by taking food. A salivary calculus may always be suspected when there are pain and swelling in one of the glands (unless, indeed, it is clearly a case of mumps, or secondary parotitis), and its presence can usually be ascertained by feeling with the finger from within the mouth, along the course of the ducts.

When pressed upon, the little mass may yield and pass onward, or if it does not, may be cut out, when the affection will be cured. But if relief be not thus given, a good deal of irritation is set up, and may give rise to suppuration, with fistulous openings. I have seen a calculus in Wharton's duct, which had caused sinuses in the submaxillary region, mistaken for a case of necrosis of the lower jaw, the concretion feeling not unlike a small sequestrum. By bursting the duct, or by suppuration, the salivary calculus will probably eventually escape either inside or outside of the mouth, and there results a "salivary fistula." In all cases the treatment consists in removal of the obstruction as soon as it is detected, with treatment of the fistula if one has formed.

Salivary fistula, or abnormal opening of a salivary duct, may occur either inside or outside of the mouth. It may be due to the lodging of a calculus, with subsequent suppuration, or to blocking of the duct from inflammation, or, especially in the case of the parotid duct, to injury. If the fistula occur within the mouth, it is of no importance, inasmuch as the saliva reaches its proper destination. External salivary fistula is usually connected with the parotid duct. There is a small opening on the cheek over the course of the duct, from which comes away continually a small quantity of watery fluid. On mastication, the quantity of this fluid is much increased, and a teaspoonful may be collected in a few minutes. It will reduce starch to sugar, and gives the ferric chloride reaction of potassium sulphocyanide. A fine probe may be passed into the duct through the opening. The affection is more troublesome than serious; but as relief is easily given, it should not be withheld. If there be any removable cause of obstruction in the duct, as a calculus, it should be removed. If this cannot be done, or if, when done, it fails to allow the saliva to run freely into the mouth, we must make an artificial internal fistula. A probe is passed into the external opening, and its point carried along the duct and rendered prominent in the mouth as near to the original aperture as possible. This is then cut down upon from within, and a free opening made from the mouth into the duct, which opening is kept patent by a probe passed in daily for a short time. The external fistula has its edges touched with the cautery, and will soon heal up, after which the internal opening may be left to itself, and will form the permanent exit for the secretion.

V. Affections of the Tongue.—**Atrophy** of the tongue is not very rare, and is usually unilateral, being due to nerve lesions, as after section of the hypoglossal. It is generally followed by a compensatory hypertrophy of the opposite side, so that the size of the organ as a whole is little if at all altered, and the interference with speech is not great. The condition is of slight surgical interest.

Hypertrophy of the tongue is a sequel of various inflammatory processes, syphilitic and otherwise.

Inflammation of the tongue may be acute or chronic, superficial or deep, sim-

ple or specific, and we have thus various conditions to describe. Simple acute inflammation of the mucous membrane only is a concomitant of catarrh of the rest of the mucous membrane of the mouth in stomatitis (*q. v.*).

Acute glossitis is an acute inflammation limited to the tongue, but affecting that organ more deeply than does stomatitis. It comes on rapidly, often with no very obvious cause; there is pain and swelling of the tongue, with salivation; the organ then becomes smooth, bright red, often very much swollen, so as to project beyond the teeth, and very painful, especially on contact of food or of the teeth. In many cases its origin has been attributed to catching cold, in other instances a similar affection arises from injury, as a blow, or an insect bite, etc. The affection is seldom dangerous, and will usually subside in a few days, but may occasionally give rise to sloughing and death from septic poisoning. The treatment consists in the administration of ice, the use of fluid and non-irritating food, and the usual constitutional measures adopted in acute inflammation. Leeches may be applied under the jaw. In severe cases, with much swelling, rapid amelioration is produced by incision of the tongue. For this purpose a sharp knife is introduced well back, and some two-thirds of an inch externally to the raphe, and then carried forward with a bold sweep, so as to reach a depth of about half an inch. The relief thus produced is most rapid, the swelling going down and the pain subsiding, so that a patient who a few hours before appeared on the verge of asphyxia, may be quite comfortable and almost well.

Hemiglossitis is a similar affection, attacking only one side of the tongue. Its characters differ in no other essential particular from those of glossitis, but the symptoms are naturally less severe.

The above are examples of acute parenchymatous inflammation of the tongue. There is also a chronic parenchymatous inflammation in the form of *chronic abscess*. This is usually due to an old injury, or to the impaction of a foreign body. The abscess is deeply seated, and, having thickened infiltrated walls, gives a solid feel when examined by the finger, which may cause it to be mistaken for a tumor.

It frequently gives rise to successive

attacks of superficial inflammation. The diagnosis from a tumor can only be somewhat problematical, depending upon the duration, the existence of any known cause of inflammation, and the results of incision. The mass should be incised, the somewhat caseous pus cleared away, and the infiltrated walls scraped, or cut away, after which the wound will usually heal readily.

Chronic superficial glossitis.—Under this name are included all the various forms known as leucoma, leucoplakia, psoriasis, ichthyosis, tylosis, and keratosis.

In one form chronic superficial glossitis is characterized by a general redness and smoothness of the tongue—the glazed red tongue. The surface is bright red, devoid of papillæ, and often very sensitive. There may be some swelling, and more acute inflammatory exacerbations often arise, each leaving the tongue worse than they found it. This condition is most intractable, and lasts for years; indeed, it is doubtful whether cure ever occurs. Whether this glazed red form of inflammation is, or is not an antecedent of the form known as leucoma, must still be regarded as doubtful. While Barker speaks clearly of a red inflammation preceding the white, Butlin states that he has not seen such a condition. I am inclined to think the red stage is always antecedent; but the latent nature of the disease in its commencement renders the point difficult of investigation, inasmuch as it is seldom noticed. It appears, however, that the “red stage” is that of a typical superficial inflammation, and that in the “pale stage” there has ensued a fatty degeneration of the infiltrating cells, thus giving rise to the change of color. Such change constantly occurs in inflammatory products, a closely similar case being that of atheroma, due to chronic endarteritis.

Leucoma, or leucoplakia—a development of chronic superficial glossitis—is a well-recognized affection of the mucous membrane of the tongue. It consists in the formation of a more or less extensive patch of whitish, grayish, bluish, or purplish color, covering often a large part of the surface of the tongue. The surface thus affected is hard and dry, often distinctly stiff. Subjective symptoms are not, as a rule, marked, but there may be some pain, and attacks of inflammation are common. This condition is also very chronic, and, probably, incurable. It may

partially heal for a time, usually to break out again, or may disappear at one point while extending at another. Not infrequently there is a similar affection of the inside of the cheeks, or some chronic skin disease.

In a more advanced stage, leucoma gives rise to the condition which has been badly termed "psoriasis," where the patches increase in thickness, and peel off, leaving a sore surface, over which a fresh crust speedily forms. There is no analogy between this condition and psoriasis of the skin.

Yet a further development has been described as "ichthyosis." Here there is still further thickening, the surface of the tongue being rendered hard and stiff, with numerous cracks, between which the epithelium forms hard elevated ridges.

The *ætiology* of these various conditions is by no means clear. Certain influences undoubtedly predispose to, or determine their origin, but how far these conditions are in themselves efficacious is unknown. The female sex is rarely affected, and in the male, cases fall usually between the ages of twenty and sixty years. But this limitation may be, and probably is, due to the prevalence, in the adult male, of other causes. Smoking seems, undoubtedly, to give rise to leucoma, and the so-called "smoker's patch" is merely a small patch of leucoma, arising usually at the point most exposed to irritation. Spirit drinking, and the use of strong condiments, have also been regarded as causes. There is great probability that the friction of jagged teeth, and other irritants of any nature, may produce similar effects. Syphilis is usually stated to be a predisposing cause, but, in the presence of so many other ætiological factors, its efficacy is difficult to prove.

Of importance equally as great as its ætiology is the *result* of chronic superficial glossitis. The affection is, in any of its stages, very intractable, and there is no evidence of complete cure ever resulting. But if it does not pass beyond the stage of inflammation, we have, at most, only a troublesome affection, not endangering life. Unfortunately, however, old cases show a very marked tendency to further tissue changes, resulting in the development of epithelioma. Unquestionably, a very large proportion of cases of leucoma, and, therefore, also of the "red stage" of chronic superficial

glossitis, result, sooner or later, in the development of cancer of the tongue.

The *treatment* may be considered under three heads, viz., prophylactic, palliative, and radical.

a. The prophylactic treatment consists in the avoidance of those habits which are known to produce the disease, and especially immoderate smoking. If the least trace of leucoma be detected it will be well for the patient to give up smoking altogether, if he will, or, at least, to be very moderate; to use pipes with a long stem, cigars or cigarettes only with a holder, and to avoid allowing the stream to play upon the affected part. At the same time, stimulants and condiments must either be entirely avoided, or used in the most dilute forms.

b. Palliative treatment consists in the use of soothing washes to the mouth, such as solutions of cocaine, bicarbonate of soda, borax, etc. The teeth should be kept clean, the mouth washed out after food. Caustics should be rigidly avoided, inasmuch as they increase the irritation, and may thus tend to induce epithelioma. Solutions of chromic acid, or of mercuric cyanide, are said to be useful, and in syphilitic cases the usual constitutional treatment may be adopted. I have found that painting the part with a mixture of salicylic acid and collodion gives great relief, especially when accompanied by the use of Donovan's solution.

c. Radical treatment by removal is not indicated in ordinary cases: if the patch be excised the affection will almost certainly recur, and with extensive tracts excision is impracticable. It is, however, quite otherwise in those cases where malignant infiltration appears to be commencing, or where the warty outgrowths giving rise to "ichthyosis" have formed. We have now to do no longer with an inflammation, but with a tumor, and early and complete removal is at once required. Should recurrence now occur it will be necessary to remove the tongue. The question will suggest itself: Would it not be well to remove the whole or part of the tongue in all cases of leucoma, without waiting for cancer, which will in so great probability develop? The answer depends mainly on the proportion of cases in which epithelioma does arise, a proportion which we cannot as yet definitely ascertain. It would, however, appear that in a very obstinate case of

leucoma, especially where there are fissures, and much induration, and where the patient is over forty, the tongue should be removed, if the patient will submit to the operation; and the rapid increase in the death rate from cancer may cause such early operations to become generally adopted.

Urticaria of the tongue is rare, but may, by the rapid swelling to which it gives rise, cause much alarm, and it is liable to lead to mistakes in diagnosis. It causes great swelling and some pain, which, however, shortly subside, often to recur again and again.

Annulus migrans consists in the formation of slightly raised red patches with a yellowish border, which spread rapidly in eccentric circles over the upper and under surface of the tongue, subsiding in the center as they grow at the periphery. These circles may intersect, subside, and grow again in various ways, but do not quite disappear for a very long time. It is found mainly in children. The pathology of the disease is not known. In spite of its resemblance to *tinea circinata*, there is no reason to suppose that it is parasitic. Barker relates one case in which *trichophyton tonsurans* was found in scrapings, but others in which it has been sought for gave negative results. The prevailing theory is that it is an inflammatory process of neurotic origin. No treatment appears to have any effect.

Syphilitic affections of the tongue are numerous and important. In the first place we may here meet with chancre, which presents its usual characters, but which is less common on the tongue than on the lips and tonsil. In secondary syphilis are found mucous plaques. These form about the tip, borders, and back of the tongue, and are very prone to ulcerate where rubbed by the teeth. The relationship of syphilis to leucoma is not yet clear. In the treatment of secondary syphilitic affections the internal administration of mercury is indicated with local washes of solution of corrosive sublimate, or use may be made of chromic acid or mercuric cyanide, or the ethereal solution of salicylic acid.

The tongue suffers in tertiary syphilis from infiltration of its structure, just as do many other organs, and here, as elsewhere, the infiltration may be general and extensive, or localized in one or more

points, the latter form constituting a gumma. Of the general infiltration Fournier describes two well-marked forms, viz., superficial glossitis and deep glossitis. I cannot regard these as inflammations in the ordinary sense of the word, but rather as of the nature of new growths, and I would therefore prefer some other term to that of "glossitis;" but as its use is general it is retained for the present. Would not cirrhosis be the best term to use, as implying no pathological theory, while indicating the analogy of this disease to syphilitic cirrhosis of the liver and other organs?

1. **Superficial glossitis** is an infiltration of the deeper layers of the mucous membrane of the tongue by round cells, which eventually become spindle-shaped or fibrous. The result is the formation of one or more smooth, stiff patches on the surface of the tongue, where the papillæ have disappeared and the surface is of a deep red color. These patches often run together over a large area. They are little or not at all painful. They have a great tendency to become cracked, and superficial fissures are thus formed, which are very troublesome to heal, and which may cause considerable deformity of the tongue. The affection is very chronic, even when treated as usual syphilitic affections, and the patches leave pale, contracted cicatrices.

2. **Deep glossitis** is a similar infiltration, affecting, however, the entire parenchyma of the tongue. In the early stage there is general hypertrophy of the organ, and very frequently this causes considerable superficial irritation by rubbing against the teeth. As a rule the hypertrophy is limited to the region of the dorsum, but sometimes affects the entire tongue. Succeeding this stage is that of cicatricial contraction, when the infiltrating tissue forms fibrous bands of varying thickness running through the entire organ and dividing it into lobules, exactly as the liver is cut up by fibrous bands in cirrhosis. The entire tongue then becomes smaller, its surface is rendered puckered and uneven, and as some superficial infiltration is usually combined, often red and smooth. These two forms of "glossitis," occurring as they frequently do in conjunction, cause great and very characteristic deformity of the tongue.

Gummata of the tongue consist, like the two affections last described, in a

small-celled infiltration, but differ in that they do not cicatrize, but either break down or undergo absorption, and in that they are much more localized. A gumma may be superficial or deep; the superficial, which are situated in the submucous region, or corium, being, as a rule, not larger than a large pea; while the deep, situated in the muscular tissue, may be as large as a hazel nut. They may be single, but there are often several. The gumma forms a hard mass, easily felt in the substance of the tongue when sought for, but often not noticed owing to its painlessness. The usual seat is the center and back of the dorsum.

From other tumors of the tongue they differ in the frequent multiplicity, the painlessness, the presence of other signs of syphilis in the tongue or elsewhere, and in their ready curability by iodide of potassium. If the gumma fail to yield to the administration of iodide of potassium, it will sooner or later ulcerate, its substance breaking down into a semifluid mass which is expelled by an opening, at first small but rapidly enlarging. The resulting ulcer forms a more or less regular circle or oval, with clean-cut edges of firm, but not very hard, consistence; the base is irregular, but devoid of granulations, and often has the peculiar wash-leather appearance of syphilitic ulcers. The edges may be somewhat undermined. There is frequently more than one such ulcer, and the tongue may present evidence elsewhere of syphilitic disease. These points will enable us to diagnose the affection; but we may note also that it differs from tubercular ulceration in the absence of a surrounding deposit of fine tubercles, in its more regular shape, in its greater depth as compared with its area, and in the absence of signs of pulmonary phthisis.

From chancre of the tongue it differs in that the cervical glands are rarely enlarged in the case of a gumma, whereas they always become so in chancre. Chancre will be followed by the appearance of secondary syphilitic symptoms: chancre is not benefited by the use of iodide of potash, and the general history of the patient will usually be a sufficient guide.

Here, as elsewhere, gummata usually yield well to iodide of potassium, which may be given in large doses with ferrum tart. Locally we may use an antiseptic

mouth wash if ulceration has occurred. Should the sores not yield to this treatment there is some risk of the supervention of epithelioma, and it will probably be necessary to amputate the tongue, the less severe measures having had a fair trial.

Tumors of the tongue.—**Angioma** (nævus) has been found here not infrequently, and may be treated by ligature, puncturing with hot needles, cautery, or excision. If very large and spreading, it may necessitate removal of the tongue. **Fibroma** forms a firm, very slowly growing isolated mass, which is quite painless and insensitive to pressure; it may be excised and there is no danger of recurrence. **Lipoma** is very rare; it forms a softish polypoid excrescence, often with a slightly yellow tint, and is readily removed. Chondroma, osteoma, and keloid are pathological curiosities.

Papillomata are common, forming small warty growths at the border or in the middle of the dorsum of the tongue. They are much exposed to irritation, and hence often become ulcerated, or in older people may develop into epithelioma. They should be removed early and freely, so as to take also some of the apparently healthy tissue. Should they return, as is often the case, they must be again removed, but any trace of deep infiltration of the tissue must be the signal for a more extensive operation.

The above tumors are all benign; but far more important are the malignant growths of the tongue. **Sarcoma** has been met with, but is exceedingly rare, and its characters cannot as yet be generalized. **Scirrhus** is equally uncommon.

Epithelioma of the tongue is one of the most common and terrible manifestations of malignant disease, constituting about eight per cent. of the total mortality from cancer. It is almost invariably met with in advanced life, and far more frequently in the male than in the female. This difference in the susceptibility of the two sexes is perhaps partially accounted for by the tendency of the "cancerous diathesis" to manifest itself in the generative organs of the female, but a far more important factor is the prevalence in the male sex of other predisposing conditions. Practically these predisposing conditions are same the as those of leucoma, which so often result in epithelioma. Smoking, abuse of condiments, and

spirits, and syphilis, may therefore all be regarded as tending to produce epithelioma. Further, any constant irritation of the tongue may lead to a development of cancer, and hence we must add to the category, chronic inflammation from whatever cause, the presence of jagged and decayed teeth, syphilitic lesions, and benign tumors of the tongue. The medicinal use of caustics in any of these affections will increase the irritation and the danger. Statistics show that cancer is more prevalent in low-lying and swampy districts than elsewhere ; but there are no data to prove whether this peculiarity applies to epithelioma of the tongue.

Epithelioma may arise upon any part of the tongue, but far more frequently on one side, and in the middle or posterior third, than elsewhere. It may commence as a small nodule, as a crack which soon develops into an ulcer, or as a hard infiltration arising in connection with some pre-existing ulcer or growth. In any case there is shortly developed a superficial ulcer with hard indurated base and edges, consisting of cancerous tissue.

At first there is but slight pain, but this soon increases, and, as a rule, becomes very severe, being greatly increased by the slightest movement of the tongue, as in speaking or eating. The infiltration spreads rapidly, and soon extends to the floor of the mouth and to the fauces of jaw. At an early stage the glands below the angle of the jaw also become affected

and grow large, hard, and painful. Later cancerous deposit in internal organs may arise, especially in the lungs, but dissemination is comparatively rare. The pain, salivation, the difficulty of eating, and the mental distress which ensue, are very severe, and soon greatly reduce the patient, producing a well-marked example of the "cancerous cachexia." Hemorrhage may occur, and is either slight and continuous, or perforation of the lingual artery may cause a sudden gush and possibly close the scene. The ulcer becomes very foul, and the breath has a disgusting odor, which adds to the patient's misery, while the inhalation of the decomposing materials is apt to lead to fatal pneumonia. If not relieved by operation the result is certain, early, and very painful death.

Owing to the necessity for prompt treatment, the *diagnosis* of epithelioma in an early stage is of the greatest importance. The description here given, compared with those of other affections of the tongue, for which it might possibly be mistaken, will probably suffice for guidance in most instances ; but in all cases of doubt it is not well to wait very long but to treat as epithelioma, especially in male patients advanced in life. The affection with which it is most liable to be confused is an ulcerating gumma ; but the points of distinction are numerous, as will be seen from the following table :

DIFFERENTIAL DIAGNOSIS OF EPITHELIOMA AND DEEP SYPHILITIC ULCER.

	EPITHELIOMA.	SYPHILITIC ULCER.
Cause.....	Often due to some local irritation, <i>e. g.</i> , rough or carious teeth ; smoking a clay pipe.	Due to the breaking down of a gummatous deposit, not to any local irritation.
Age.....	Generally over forty years.....	Generally under forty years.
Situation.....	More commonly at one side, toward middle or posterior third.	Often in median line toward median or posterior surface of dorsum.
Shape.	Irregular	Oval or round.
Base	Foul and sloughy ; rough and irregular, with well-marked and widespread induration.	Deeply excavated ; much less induration, often covered with a "wash-leather slough."
Edges.....	Raised, averted, thickened and indurated.	Ragged and irregular ; often sharply cut.
Course.....	Ulceration primary, the induration about base being secondary to the ulceration.	Ulceration secondary, <i>i. e.</i> , the induration (<i>viz.</i> , the gumma) breaks down and ulcerates.
Floor of mouth...	Becomes involved, so that tongue after a time is tied down, fixed, immovable, and incapable of being protruded from the mouth.	Not involved, so that tongue is freely movable, and capable of being protruded from the mouth.
Speech.....	Soon interfered with owing to fixation of tongue.	Not much affected, as tongue remains free.

DIFFERENTIAL DIAGNOSIS OF EPITHELIOMA AND DEEP SYPHILITIC
ULCER.—*Continued.*

	EPITHELIOMA.	SYPHILITIC ULCER.
Pain.....	Usually acute ; often a prominent symptom.	Generally slight.
Glands.....	Those beneath the jaw (submaxillary) soon affected with secondary deposits.	As a part of a general glandular implication those in the neck (especially posterior, cervical and occipital) may be slightly enlarged and indurated ; at the same time the submaxillary may be affected, as the result of simple irritation propagated from the ulcer.
Number.....	Generally single.....	May be multiple, though usually single.
Progress.....	Generally rapid ; floor of mouth, and in many cases the pillars of fauces becoming involved.	Slow and stationary.
Result of treatment.	No effect.....	The ulcer heals, often leaving a deep fissured cicatrix. At the same time glandular enlargement, if due to simple irritation, also subsides.
Concomitant symptoms.	After a time, evidences of the cancerous cachexia.	A history or other evidences of syphilis.

Further, epithelioma may be distinguished by the microscopical examination of scrapings from the edge of the ulcer. The following appearances will probably be found, and are quite characteristic, viz., flattened and irregular cells, which are often coarsely granular, and frequently contain large nuclei and nucleoli ; mother cells with enclosed daughter cells ; cell nests.

Treatment.—If the growth be entirely limited to the tongue, it should be at once removed. If there be a fairly limited growth with slight glandular affection, remove the tongue and the glands either at the same time or by successive operations. If the floor of the mouth be affected, it is a grave question whether an operation will be of any service ; but if there appear to be a fair chance of removing all the diseased tissue, the attempt should be made, although no strong hopes of prolonged relief can be held out. When the growth is extensive, the glands largely implicated, or where there is evidence of metastatic deposit in internal organs, resort to palliative treatment only. In the case, then, of a localized growth, we may adopt one of two courses, either removal of the part affected only, *i. e.*, of one side of the tongue, or removal of the entire tongue. Of these two, the latter certainly commends itself ; increasing the probability of removing the entire growth, the operation is but little more serious, and the result is no worse, inasmuch as half the tongue seems to be of very little use, becoming, as it does, bound down

by cicatricial adhesions, and losing its mobility. Hence I unhesitatingly give the preference to removal of the entire tongue. In cases where the glands beneath the jaw are also enlarged, they must be removed by the usual methods. No definite rules can be laid down for clearing the floor of the mouth, the procedure being adapted to the nature of the individual case ; but great care must be taken to remove the whole of the infiltrated tissue.

In those cases where removal is not advisable, something can be done to relieve the patient. The use of caustics, especially bromine, which was formerly resorted to, is now abandoned as mere cruelty. The internal remedies for cancer which have from time to time been advocated are valueless. More hopeful appears to be ligature of the lingual artery, thus arresting to some extent the flow of blood to the tongue, and thereby slowing the growth. Occasionally the same procedure is required to check hemorrhage. Another valuable suggestion is to divide the lingual (gustatory) nerve. From within the mouth this nerve can be readily felt immediately beneath the mucous membrane, lying on the angle of the lower jaw, and vertically below the second lower molar tooth. It may here be cut down upon, drawn from its bed and divided ; or better still, a portion may be excised. The procedure greatly relieves pain, diminishes salivation, and allows of movement of the tongue without the intense agony otherwise resulting.

Its temporary value is great, but we doubt the statement that the nerve does not reunite.

Pain may also be diminished by applying to the ulcer some powder, as bismuth subnit., containing a little morphia; or, still better, by painting the diseased surface every four hours with a ten per cent. solution of cocaine. Applications of iodoform will control decomposition and diminish fetor. Food must be fluid, and of the blandest possible nature, and if the pain is very great, nutrient enemata may be required. Hemorrhage is to be controlled by styptic applications, or, if necessary, by ligature of the lingual artery.

Omitting the earlier operations, the first valuable procedure was that of Chassaignac, who introduced an *écraseur* through the floor of the mouth above the hyoid bone, and thus removed the organ as far back as possible. The *écraseur* is also used through the mouth, the *frænum* and inferior muscular attachments of the tongue being first divided to allow of free protrusion. The special advantage claimed for this method is the absence of hemorrhage; but this is not invariable, and it is open to the objections that considerable sloughing of the bruised tissues often results, and that we cannot thoroughly control the direction of the incision, or ascertain the existence of infiltration behind it. The same objections apply with even greater force to the use of the galvanic *écraseur*.

A more complicated procedure, of which there are several modifications, consisted in division of the lower jaw and removal of the tongue through the opening thus made. Syme divided the jaw in the line of the symphysis and removed the tongue by the scalpel. Sédillot's procedure was similar, but he made the cut in the jaw dovetailed, to render easier subsequent replacement. Billroth divided the jaw on either side and turned it down as a flap. Langenbeck divided it on one side. These methods may be of occasional service when there is infiltration of the floor of the mouth and an extensive removal is contemplated; but in ordinary cases they are needless complications, greatly increasing the danger.

Regnoli's method consisted in carrying a vertical cut from the symphysis menti to the hyoid, with a curved incision on either side running along the lower

border of the lower jaw so as to form a somewhat T-shaped incision; through the large opening thus made in the floor of the mouth he removed the tongue. Billroth dispensed with the vertical incision, and made the curved one longer. These operations also may occasionally be useful for clearing the floor of the mouth.

Kocher suggested a preliminary tracheotomy, in order that the patient should not inhale the fetid discharge resulting from healing of the stump. There can be no doubt of the importance of this precaution, but possibly the local application of iodoform will enable us to dispense with it. Kocher's operation is one of the most complicated, and is designed to remove both tongue and glands, while preventing hemorrhage by ligature of the lingual artery, protecting the lungs from fetid inhalations by a preliminary tracheotomy, and allowing of antiseptic dressing of the wound. The method of Baker consists in splitting the tongue longitudinally along the middle line, then freeing with scissors the mucous and muscular attachments of the diseased half, drawing it well forward, and passing an *écraseur* round its base. The opposite half is then removed, "in the event of both sides of the tongue requiring removal." For reasons above stated, I prefer in all cases entire excision; but there can be no doubt that, if we are to use the *écraseur*, a great advantage is gained by first splitting the tongue, so as to allow of more complete control over our line of division. This method is now largely employed, and has yielded excellent results.

Some few years since I advocated excision of the tongue by means of scissors only. The head being placed in a good light, and a gag introduced, the organ is drawn well forward by a ligature through its tip. With a pair of sharp scissors the *frænum* is then divided, and, strong traction being made on the tongue, its attachments are gradually freed by a series of short snips carried as far back as possible. The lingual arteries will probably require securing as they are cut, and may be twisted or ligatured. The base is kept under control by a strong silk ligature passed through it, which is retained for one day. I have never seen any trouble from hemorrhage, the *bête noir* of operators upon the tongue.

The *after-treatment* of a case of ex-

cision of the tongue is of more importance than the precise method adopted for its removal. The patient is generally in a low state of health, and the difficulty of feeding him, the inhalation of fetid products of decomposition, with the mental distress resulting from the loss of the power of speech, render this period exceptionally dangerous. We have mainly to keep up the strength by suitable food, and to counteract the tendency to septic pneumonia. Other dangers are common to this and to all serious operations. Nourishment may be administered partly per rectum. By the stomach food may be given by means of a soft tube passed well over the stump and down the esophagus, or a similar tube may be introduced into the gullet through the nose. As an antiseptic I have for some time used iodoform, either as powder or in ethereal solution, which may be painted on the well-dried stump. The recent introduction of "iodoform gauze" has, however, proved an equally convenient and efficient means. The stump is well dried, and then every crevice packed, and the floor of the mouth covered with fine gauze impregnated with iodoform; this remains *in situ* for several days until the wound is practically healed. It keeps down all offensive smell, and allows of the use of fluid food without the necessity for an esophageal tube. Finally, the patient should not be allowed to make any attempt at speech for at least a week after the operation.

The proportion of apparent recoveries (when there was no return of the growth for twelve months or more) after excision of the tongue is estimated at from 10 to 15 per cent.; but these figures must be accepted with reserve, inasmuch as the diagnosis is not in all cases confirmed by a microscopical examination, and some of these cases may possibly not have been epithelioma. The death rate of the operation is about 12 per cent., being somewhat higher in case of removal by scissors; but this is partly to be explained by the fact that only the less severe cases can be operated upon by the *écraseur*. The average increment of life after operation is probably about six months; and, slight as the gain may thus seem to be, it is really a great one, as the death from recurrence is usually much less painful than that from the primary disease.

The main cause of the mortality is

some form of septic pneumonia; but erysipelas, pyæmia, gangrene, and exhaustion also play their part.

VI. Affections of the Fauces and Tonsils.—**Elongation of the uvula** may result from acute or chronic catarrh. In the acute form the uvula is elongated, thickened, and œdematous. It forms a soft, semi-translucent mass, hanging down from the soft palate, and causing tickling of the fauces and great irritation. If the ordinary treatment of catarrh is not followed by its recession, scarification may be adopted, and will give rise to an exudation of watery blood, after which it will probably shrink up.

In chronic cases elongated uvula frequently accompanies hypertrophy of the tonsils, being due to the same general conditions, and aiding in keeping up the irritation which leads to that hypertrophy. The uvula may even hang down into the larynx, and by irritating the glottis may cause serious spasm, while in all cases it causes unpleasant tickling and perhaps nausea. In such cases it may be removed. In amputating the uvula, the only point of importance is to ensure that the part removed shall not drop into or upon the glottis. This may be simply effected by seizing its tip in a pair of forceps and cutting it through above with scissors. Or scissors may be used with hooks placed on the under side of both blades so as to seize and retain the tip while they cut through the base of the organ. The cut surface heals readily, but the operation is usually followed by a somewhat acute catarrh, lasting for a day or two, of which the patient should be forewarned.

Hypertrophy of the tonsils often necessitates operative interference. It results from a chronic process, probably of inflammatory nature, and is found mainly in young persons at or before the age of puberty, and more often in boys than in girls. In nearly all cases the patients are strumous, and have been subject to recurring attacks of tonsillitis. The hypertrophied nodules approach one another and may almost fill up the fauces, seizing the uvula between them, so as to compress and elongate it; or even by mutual pressure causing ulceration. They seriously obstruct respiration and deglutition, and as each inflammatory attack recurs, cause much pain and increase the difficulty of breathing, and may even, if not relieved,

cause suffocation. Attempts may be made to promote their absorption by general hygienic and anti-strumous treatment, by local application of perchloride of iron or other astringent, or by painting the throat externally with iodine. But if these measures do not cause diminution in size, the growth must be removed. This may be done by aid of a knife made like a hernia bistoury, with a rather longer cutting edge, or by an ordinary probe-pointed bistoury, the upper part of the blade being guarded by enclosing it in strapping. The tonsil is seized in a tenaculum forceps, and pulled inward slightly, the knife introduced below and a cut carried upward and slightly inward. It is not necessary to remove the entire mass, as what is left will cicatrize and shrink up, while too deep a cut might endanger the internal carotid artery lying to the outside of the tonsil. To expedite this little operation have been invented various forms of tonsil guillotine, which at once seize and remove the growth. For children and very nervous persons the guillotine is perhaps an advantage, as only one instrument need be introduced into the mouth; but in most cases the knife will be equally convenient, while if chloroform be given there can be no possible objection to its use. Some hemorrhage may follow excision of the tonsil, but is usually easily checked by sucking ice or tannin lozenges; if this fail, paint the surface of the wound with a little tinct. ferri perchlor. The inflammation which follows the operation is treated as an ordinary acute catarrh, and the wound soon heals.

Syphilitic affections of the tonsil and fauces resemble those of other parts of the mouth (*q. v.*). Chancre of the tonsil is rare. It is important to diagnose it from epithelioma. Mucous plaques are less frequent here than in some other parts of the mouth. Gummata are not rare either in the tonsil or velum palati.

Epithelioma may be primary in the tonsil, and resembles, in its character, epithelioma of the tongue. It usually spreads rapidly to surrounding parts, and causes glandular and general infection. In an early stage it may be removed, but if advanced, palliative treatment is alone possible.

Sarcoma is more common than cancer. Of twelve cases collected by Butlin, of malignant disease of the tonsil, which

had been microscopically examined, nine were sarcomata. This form of tumor grows rapidly as a soft mass, but has less tendency to ulcerate than has epithelioma. It also affects the glands and viscera.

Abscess of the tonsil may result from tonsillitis, and should be opened early with a sharp-pointed knife (a tenotomy knife will do well); pus and blood escape, at once relieving pain and swelling, and a cure will probably soon follow. In the case of small follicular abscesses it is generally possible to evacuate the pus by introducing a probe through the opening of the follicle.

Calcareous **concretions** sometimes occur in the crypts of the tonsil, and if not removed they irritate and keep up the chronic inflammation which is at once their cause and their effect. If superficial they may be scraped off or picked out with forceps; or if deeper a slight cut will suffice to liberate them.

WALTER WHITEHEAD.

MUMPS (Idiopathic Parotitis).—An acute infectious disease, characterized by swelling of the parotid and salivary glands, running a definite course and terminating in recovery.

Symptoms.—The period of invasion is short, usually less than twenty-four hours, and is marked by some discomfort in the region of the parotid gland, especially on moving the jaw, also by a rise of temperature, lassitude, headache, and anorexia.

Sometimes there are no premonitory symptoms, and at others the disease is heralded in an alarming manner by vomiting, diarrhea, and convulsions.

The first symptom is a stitch-like and increasing pain in the region of the parotid (generally the left) spreading to the jaw, and aggravated by any movement, as in talking, etc. Soon a swelling appears, at first in a hollow between the mastoid process and the jaw, but rapidly spreading onto the face in the masseter region; the swelling is wedge-shaped, the apex being downward. Then the neighboring tissues, if not from the first involved, become infiltrated, causing a rapid extension of the swelling in the neck, both downward and toward the spine, to which, in severe cases, it may reach. The overlying skin is tense and shiny; it is occasionally reddened, and sometimes pits on pressure. The swelling continues to increase for about three days; it remains stationary for

about two days, and then rapidly subsides, completely disappearing in the course of about five days. The submaxillary gland, and the tissues in its immediate neighborhood, may be affected in an exactly similar manner.

In rare instances, the disease is confined to one side, but much more frequently the other parotid becomes affected within two days, and in very rare instances both sides are attacked at once. So long as one side only is involved the head is inclined to that side, afterward it is held stiffly erect. The movements of the face are in abeyance, owing to the pain in the jaws, and it is consequently expressionless, while the swelling in the parotid and submaxillary region gives the patient a grotesque and most unnatural aspect. The mouth is either closed or permits of such very slight opening that the patient is reduced to liquid food, and even this causes much pain. Other symptoms usually present are thirst, anorexia, and constipation. The temperature seldom rises above 104° F. The pulse is frequent, and the tongue furred. The saliva is not, as a rule, altered either in quantity or character, but owing to the difficulty in swallowing, it accumulates in the mouth and dribbles away, giving rise to the mistaken belief that the secretion is excessive. The general symptoms abate in severity as the swelling subsides.

The most common complication is the so-called metastasis, to the testes in the male, or to the ovaries (?) or mammæ in the female. This is most common in those who are attacked about the period of puberty, and is more often observed in males than females. Some six or eight days after the commencement of the illness, swelling of the body of one testis appears, and fluid collects in the tunica vaginalis. In the course of a day or so the other testicle is similarly affected, but it is rare for both to be simultaneously attacked. The swelling is accompanied by great pain and tenderness, and some œdema of the scrotum is often present. The course of this affection is precisely similar to that of the parotid, and there is a separate recurrence of fever and febrile symptoms. Atrophy of the testicle has been known to follow, but such an event is rare.

Rheumatic symptoms with heart lesions have been observed, and in very rare cases meningitis has supervened, as also disease

of the spinal cord. Deafness is a complication to be feared, though when it is due to the inflammatory process from the pharynx (for in a few cases the pharynx and tonsils are affected), along the Eustachian tube, it passes off in a few days, but when it begins suddenly, without any such cause, it is generally permanent; in a few cases it has been due to suppuration taking place in the parotid, and the subsequent bursting of the abscess into the auditory passages. Facial paralysis has been occasionally observed.

As a rule recovery is complete, though a good deal of general debility may be left, and in scrofulous children enlargement of the lymphatic glands is often set up; The *diagnosis* can only be doubtful when the second side is not yet affected, and the swelling does not obviously extend on to the jaw.

Pathology.—The first change is hyperæmia of the gland, with an exudation of serous fluid; the parotid is swollen, reddened, and on section is of a uniform fleshy aspect. There is a good deal of serous infiltration of the surrounding tissues, and it is believed that sometimes the gland itself may be unaffected. It is probably not the result of the extension of a specified catarrh along the duct of the parotid, otherwise, in affections of the mouth, inflammation of the parotid would be more common.

Ætiology.—The disease is hardly known in infants, and is decidedly rare in early childhood, being most common between the ages of five and fifteen, but it is seen in adults, though not in old people. A second attack is almost unknown. It is more common in males than in females, and it is said to be most prevalent in the spring. Epidemics are apt to occur either directly before, or during, or directly after, outbreaks of measles, and to a less extent of scarlet fever and diphtheria. The children of the poor do not seem to be so susceptible to it as those of the well-to-do. The period of incubation is from two to three weeks or even longer, during which time there are no symptoms. The disease is probably most contagious at first, but it is believed that a person is not free from infection for a month from the onset. Of the nature of the contagium nothing is known; it is supposed to be conveyed by the breath.

Treatment.—In many cases it will not be necessary to do more than keep the

patient in a warm, even temperature, on such light diet as can be swallowed, with an occasional saline purgative. When the swelling is great, warm fomentations with or without opium, water dressings or light poultices may be used. Iced drinks and drop doses of tincture of aconite every hour are useful. Sleeplessness may be overcome by bromide of potassium. The orchitis should be treated by supporting the testicles and applying warm anodyne lotions. During convalescence tonics and cod-liver oil may be given with great benefit.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Aconite* is useful in the onset when febrile symptoms present, followed by *mercurius*, until swelling abates. *Pulsatilla* may be required in case of metastasis to the testicles or mammaræ, or *belladonna* when there are cerebral symptoms.

MUSHROOMS, POISONING BY.—

Various species of these fungi possess poisonous properties, but the one which in this country most commonly gives rise to urgent symptoms is *Amanita muscaria* or fly-fungus, the active principle of which is *muscarine*.

Symptoms.—The effect of the poison is exerted chiefly upon the gastro-intestinal and nervous systems. Colic, nausea, vomiting, and diarrhea follow, a few hours after the ingestion of the poisonous fungi. Excitement and delirium, ending in a condition of stupor and coma, are the prominent nerve symptoms.

In severe cases the symptoms somewhat resemble the algide stage of cholera, collapse, cyanosis, and muscular contractions preceding a fatal termination.

Morbid anatomy.—The chief signs are those of a very acute gastro-enteric catarrh. Portions of the fungi may be found adhering to the mucous membrane of the stomach and intestine.

Prognosis.—Severe diarrhea, with rice-watery stools and violent delirium, are very unfavorable symptoms.

Treatment.—The stomach should be washed out immediately with a syphon tube, or an emetic of sulphate of zinc (grs. xx in water), or mustard ($\frac{3}{4}$ ss. in water) may be administered. Atropine, the physiological antagonist of muscarine, should be given at once, either in the form of the tincture of belladonna (m. xx in water), or two drops of an injectio atropinæ hypo-

dermica (gr. $\frac{1}{60}$, to be repeated in half-an-hour if necessary. The best purgative is castor oil, of which an ounce should be given as soon as possible.

If there be much depression, stimulants will be needed, brandy, ether, and ammonia being the most suitable. The patient should be kept warm, and should remain in bed for some days after the urgent symptoms have disappeared, owing to the liability to cardiac paralysis.

MUSCLES, DISEASES OF.—The chief are: 1, Atrophy and degeneration; 2, contraction; 3, inflammation; 4, paralysis; 5, parasites (trichiniasis); 6, syphilitic affections; 7, tumors.

Muscles, Inflammation of.—Chiefly occurs as an extension from inflammation of neighboring parts, or as a result of injury, or of syphilis. Liable to end in abscess, which may be very troublesome, especially in certain parts, *e.g.*, abdominal wall. Considerable pain and constitutional disturbance.

Treatment.—Local rest, poultices, etc.

Muscles, Atrophy and Degeneration of.—Four chief forms, viz.: 1, simple atrophy; 3, granular degeneration; 5, fatty degeneration; 4, "waxy," *e.g.*, in chronic joint disease. Microscopically there are abnormally few striated muscle fibers, and the appearance becomes more that of fibrous tissue. Waxy degeneration occurs as a sequel of continued fevers. All the forms of degeneration are found in progressive muscular atrophy. The microscope shows in the case of fatty degeneration numbers of fat cells in the place of the muscle fibers, and in the case of waxy degeneration, a "homogeneous, colorless, glistening mass."

Progressive Muscular Atrophy.—(*q.v.*)

Muscles, Contractions of.—*Causes.*—1, Inflammation of, or abscess in the muscle; 2, disease of nerves or nerve-centers; 3, reflex irritation, *e.g.*, from worms (intestinal irritation), phimosis (sexual irritation); 4, "antagonism," *i.e.*, contraction of one set of muscles because its opponents are paralysed; continued relaxation of a muscle, *e.g.*, the state of the flexors of a limb which has long been kept on an angular splint. Muscles in such a state tend to become permanently shortened. Most cases of paralytic talipes are probably caused by the limb permanently assuming a certain position under the influence, not, as was formerly

supposed, of true "antagonistic" contractions, but of mere gravity; 6, mal-development: but a muscle which has never been developed to its proper length cannot be properly termed "contracted." The diagnosis of the affection is manifest; that of its cause depends chiefly on the history.

Treatment.—In a few cases it is sufficient to remove the cause, *e. g.*, to circumcise for phimosis, or to give santonin and scammony for worms. In mild cases, regular manipulation by stretching or continuous mechanical extension may suffice. But usually tenotomy is indicated. (*See CLUB-FOOT.*) Tenotomy should be followed by mechanical extension, either gradual or immediate and total.

Muscles, Paralysis of.—Almost all cases which the surgeon has to treat may be classified as: 1, those arising from injury to nerves (*see NERVES, INJURIES OF*); 2, those arising from direct blows on a muscle; 3, infantile paralysis; 4, Duchenne's disease; 5, paralysis from disuse; 6, neuromimetic or hysterical paralysis. Paralysis from direct injury requires rest till tenderness has disappeared: afterward, manipulation, rubbing, kneading and passive exercise.

Infantile paralysis.—(*q. v.*)

Duchenne's disease, or pseudo-hypertrophic paralysis.—Cause unknown. Age, childhood. Three stages: (1) of weakness of muscles of lower limbs; (2) of gradual hypertrophy of, successively, gastrocnemii, glutei, and lumbar muscles, weakness still persisting; (3) of wasting and increased paralysis. The muscular enlargement is due to growth of connective tissue and fat. Idiocy often co-existed.

Prognosis.—Bad. Quite hopeless in third stage.

Treatment.—Electricity; manipulation; "shampooing."

Paralysis from disuse is practically identical with atrophy, and requires shampooing, passive or active exercise, and perhaps stimulus, electricity.

Muscles, Tumors of.—Almost any variety may occur. Sarcomata probably most common. Ossification of muscles themselves presents appearance of hard tumors. Such ossification sometimes affects the adductors of cavalry soldiers ("rider's bones"). Cysts. Cancer. The *Trichina spiralis*, a nematoid worm, is a parasite which lies encysted in the mus-

cles of patients affected with "trichiniasis," as the affection is termed.

Muscles and Tendons, Rupture of.—Tendo Achilles and quadriceps extensor of thigh most often affected. Occurs chiefly in middle age.

Treatment.—Fix in a relaxed position for a fortnight. Then resume use cautiously and gradually

C. B. KEETLEY.

MUSCULAR ATROPHY, PROGRESSIVE.—*See* PROGRESSIVE MUSCULAR ATROPHY.

MUSCLES, WOUNDS OF.—Wounds of muscles, like those of other soft tissues, may be incised, lacerated, punctured, or contused, and call for but few remarks. When a muscle is divided transversely to its fibers, the cut ends contract, causing the wound to gape. They should, therefore, be approximated as much as possible, by placing the part in such a position as to relax the muscle, and sutured with animal ligature, as cat-gut or kangaroo-tail tendon, the wound closed, and the parts placed at absolute rest. When the wound is deep, or longitudinal to the fibers, a drainage tube had better be inserted, as the discharge is likely to be pent up by the bulging of the fleshy belly of the muscle. Should the muscle have lost its contractility, and appear so lacerated and contused that it must obviously die, the injured portion may be cut away. Wounded muscle generally unites by fibrous tissue, but the formation of new muscle fiber has been observed in a few instances.

MYELITIS, ACUTE.—Any inflammatory affection of the spinal cord of rapid onset, which may be primary or secondary.

Symptoms.—Vary according to the amount of the cord affected and the position of the lesion. In primary or idiopathic acute transverse myelitis there is rapid paraplegia, motion and sensation becoming profoundly affected in a few hours, or sometimes in a few days. The initial spinal symptoms are often accompanied, and sometimes preceded for a short period, by fever and general malaise. Pain in the back and limbs, unlike what occurs in spinal meningitis, is frequently absent, and if present, slight and transitory. Spasms and twitchings of the

muscles, moreover, are of comparative rarity in the early stage of myelitis.

Numbness, tingling, and such-like sensory disorders commonly attack the limbs, and then ensue, after a varying interval, loss of motor power and sensibility in the extremities.

The paraplegic symptoms in acute myelitis do not supervene so suddenly as in spinal hemorrhage. In the former the onset may extend over a period varying from a few hours to several days, whereas in the latter the onset is quite sudden.

In exceptional cases the commencement of acute myelitis is comparatively abrupt, and it occasionally happens during the course of the disease, and when the symptoms have attained a high degree of intensity, that a sudden exacerbation takes place. In such cases it is highly probable that spinal hemorrhage has occurred secondarily. When the symptoms of acute myelitis have reached their height, there is more or less complete paralysis with anæsthesia of the affected limbs.

Control over the sphincters is usually lost from the first. The urine frequently becomes ammoniacal at an early period, and cystitis is common. Bed sores over the sacrum and other parts subjected to pressure often occur with great rapidity and in spite of all precautions. The temperature of the paralyzed muscles is usually slightly raised in the early stage, but subsequently it falls a degree or two below the normal.

Since the lower part of the spinal cord is the most frequent seat of myelitis, it follows that the lower limbs only are affected in the majority of cases.

If the cervical region be involved, the arms suffer as well as the legs, and, if the disease be above the origin of the phrenic, paralysis of the diaphragm will occur.

When the disease is above the lumbar enlargement, the muscles of the lower limbs are at first flabby, but later they recover tone, and still later may become the seat of spasm from descending degeneration of the pyramidal tracts.

When the lumbar and the sacral regions are involved, the muscles of the legs remain flabby, waste, and exhibit the reaction of degeneration.

Sensation is sometimes lessened, sometimes absolutely lost. Just above the upper limit of the anæsthesia there is frequently a zone of hyperæsthesia, or a feeling of constriction—the so-called “girdle

pain.” A hot sponge passed down the spine will usually detect the hyperæsthetic point by the feeling of pain caused. The hyperæsthetic line is often situated about the level of the epigastrium, but, whatever its position, it indicates the upper limit of the lesion in the cord.

The condition of the reflexes depends on the vertical extent of the spinal lesion. When the mischief is in the dorsal region, the reflexes of the lower limbs may be temporarily abolished by shock. Later, reflex action returns, and exaggeration occurs if descending changes take place. When the lumbar and sacral regions are implicated, the superficial and deep reflexes are permanently annihilated. The condition of the cremasteric, abdominal, and the various trunk cutaneous reflexes give valuable aid in determining the vertical extent and the upper limit of the spinal lesion.

The pupils are occasionally affected when the cervical region is involved. In a few instances optic neuritis has been described, and in most of such cases the myelitis has been of the disseminated form.

The *course* of acute myelitis is variable. In the severe cases death frequently ensues from respiratory disorders, or from pyæmia following on bed sores, or from the extension upward of inflammation from the bladder to the kidneys. In other cases sensation returns almost in its entirety, the motor power being regained later, though often imperfectly.

Muscular spasm may occur when the mischief is above the lumbar enlargement. Under such circumstances a state of spastic paraplegia may slowly supervene, the lower limbs being sometimes in extension, sometimes in flexion. The latter condition unfortunately renders the upright posture and walking impossible, and hence the patient is permanently bedridden.

Sometimes very great improvement, occasionally amounting to a practical recovery, takes place in acute myelitis, and a favorable change may occur, even when paralysis has been present to a marked degree for many months.

Myelitis of traumatic origin, that due to slow compression by growth, caries, or other agents, and that which results secondarily in spinal meningitis (*see* SPINAL CORD, SLOW COMPRESSION OF).

Varieties.—In some instances the dis-

ease may consist of a single limited patch of inflammation (*focal myelitis*) or the foci may be multiple and scattered (*disseminated myelitis*). Under such conditions the symptoms may be of limited extent, or, on the other hand, irregular in distribution. Many cases of infantile paralysis are, doubtless, instances of focal myelitis involving the anterior gray matter (acute anterior polio-myelitis).

Diagnosis.—The points which serve to distinguish most cases of myelitis from spinal hemorrhage have already received attention. Granted the diagnosis of acute myelitis, it is then necessary to decide whether it is primary or secondary. Caries and malignant growths of the vertebræ will sooner or later make themselves manifest by their characteristic signs, although not uncommonly all indications of their existence are absent at the onset of the spinal mischief.

Pain of any severity and persistency suggests myelitis by compression, meningitis or meningeal hemorrhage (*see SPINAL CORD, HEMORRHAGE INTO*).

Acute ascending paralysis (Landry's paralysis) resembles closely an acute ascending myelitis. In the former, however, sensation is unimpaired and the muscles preserve their electrical excitability.

Prognosis.—A guarded opinion should always be given in the early stage, in as much as extension of the lesion upward may take place. When this occurs, danger to life from paralysis of the intercostal muscles or of the diaphragm is possible. The acute formation of bed sores, or the rapid onset of cystitis, which occur mainly when the diseases affect the lumbar and sacral regions, are grave indications, though not necessarily leading to a fatal result.

When the lesion is limited to the dorsal part of the cord, the patient often becomes the subject of spastic paraplegia, and if the lower limbs be in extension, the power of walking may be regained. An early return of sensation is a favorable symptom, fair motor power often being acquired in such cases.

Morbid Anatomy.—In the acute stage, the pia mater is injected and the affected part of the cord swollen and softened. On section, the distinction between gray and white matter is lost or ill-defined, and the tissue is often diffuent and of a red or reddish-brown color. This is

sometimes termed the stage of "red softening," and when the extravasation of blood is considerable the affection has received the name of "hemorrhagic myelitis." The changes which the effused blood undergoes, and the fatty degeneration which attacks the damaged nerve-elements, lead, in the course of time, to alterations in color of the affected part of the cord (yellow and white softening). Still later, the cord assumes a grayish tint, becomes atrophied, and finally cicatrices may form and occasionally cavities. In chronic cases, moreover, sclerosis of the various spinal tracts supervenes.

On microscopical examination the capillaries and small arteries and veins are distended with blood. The walls of the vessels are thickened by cells, and the peri-vascular sheaths filled with leucocytes. In the gray matter the ganglion cells are first swollen, granular, and cloudy, the nucleus and nucleolus being in process of division or sometimes vacuolated. The cell-processes, at first swollen and irregular, finally shrivel and disappear. In the terminal stage the cells are represented by small, irregular, structureless masses, or may disappear altogether.

In the white matter the nerve-fibers become irregular, the medullary sheath showing granular and fatty degeneration. The axis cylinders are commonly granular and enlarged, exhibiting in their course irregular swellings. The fibers frequently undergo atrophy, the axis cylinders, however, persisting for a long period.

In transverse sections of the cord clear spaces may often be seen, formed by the removal of degenerated nerve-fibers. The neuroglia becomes swollen and amorphous in aspect, except for scattered nuclei. The cells of Deiters and their processes undergo marked enlargement. After the lapse of time the affected area may become fibrous, but numerous nuclei and the cells of Deiters, together with dilated and thickened vessels, are visible for a considerable time. The spinal nerve-roots and the peripheral nerves show degenerative changes.

Ætiology.—Males are most frequently affected, and the disease is most common between the ages of ten and forty. Prolonged exposure to wet and cold, especially to both combined, and overexertion, are

frequent exciting causes. Myelitis is often dependent on injury to the cord, such as concussion or fracture-dislocation of the vertebræ. The disease sometimes follows variola, measles, typhus, and other acute specific fevers. Syphilis and alcohol have a possible share in the production of myelitis. Compression of the cord by growths involving either the membranes or substance of the cord, spinal caries, malignant affections of the vertebræ, and spinal meningitis frequently give rise to secondary inflammation of the spinal cord. Lastly, it may be mentioned that in many cases of acute myelitis no cause can be determined. It has been suggested that occasionally an infective agency may be at work, and this idea is borne out by the appearance of thrombi and micrococci in the small vessels, described by some observers.

Treatment.—In the early stage absolute rest should be enforced, the prone position being strongly advised by some authorities. Dry or wet cupping, the choice to be determined by the general condition of the patient, and stimulating applications to the spine, may be employed. Strong counter-irritants, such as blisters and the actual cautery, should be employed with extreme caution. The danger of the formation of obstinate sores from such remedies must be remembered. An icebag to the spine is sometimes of service. It is of the utmost importance to guard against the formation of bed sores, and with this object in view the most scrupulous cleanliness should be enforced. Parts exposed to pressure should be sponged with spirit and then carefully dried and dusted. The effects of pressure may be considerably obviated by the use of cotton-wool. When there is incontinence of urine the tendency to bed sores is increased. Absorbent cotton-wool, frequently renewed, may be used. If there be retention the regular use of the catheter is required. The instrument should be absolutely clean, and just before use should be cleansed with carbolic solution and then lubricated with carbolic oil. If cystitis occur, the bladder must be washed out with an antiseptic solution.

Bed sores demand constant attention, and the slightest appearance of redness must be anxiously watched. The application of fine oakum over the dressing is often of great use in obviating the fetor of bed sores.

The influence of drugs in myelitis is doubtful. Ergot and belladonna are recommended in the early stages. Mercury and iodide of potassium seem to be of little avail, even in cases in which there is a probable syphilitic origin. In the later stages of myelitis, preparations of iron, quinine, arsenic, and strychnia may be employed. Rubbing and the use of electricity are of service when the acute period is over.

W. B. HADDEN.

Symptomatic Indications.—The most generally useful remedy in this condition is *belladonna*, especially when the myelitis has resulted from external violence; also in chronic cases, from retrocession of an eruption. *Ergot* is useful in myelo-meningitis; muscular twitchings begin in the face, and extend over the whole body. *Gelsemium* may be useful in myelitis of the anterior cornea.

MYXŒDEMA (Adult Sporadic Cretinism, Cachexia Pachydermique of Charcot).

Definition.—Clinically, myxœdema is characterized by a peculiar physiognomy, by an increase in the bulk of the body, by nutritive changes in the skin and elsewhere, and by slowness and imperfection of both bodily and mental processes. The only constant pathological condition is destructive change of the thyroid body.

Symptoms.—The physiognomy is characteristic, and has been variously described as cretinoid, mask-like, placid, heavy. The features are broad, puffy, and coarse, the nostrils swollen, the lower lip thickened, everted, and livid, the mouth widened transversely. Over the cheeks and nostrils there is a well-defined red patch, contrasting in a marked degree with a pale, wax-like orbital area. The body is bulky and unwieldy, and the skin everywhere dry, scaly, and thickened. Moles and warty growths are very frequent. There is almost invariably an absence of perspiration and of sebaceous secretion. Localized tumefactions, dependent probably on the accumulation of fat, are often present, the usual site being the supraclavicular regions. The hands are broad, swollen, and clumsy-looking, and the nails not uncommonly stunted and brittle. The feet are affected like the hands. The hair of the scalp is dry, ragged, and broken. Sometimes

there is marked baldness. The eyebrows, eyelashes, and the hair on the pubes and in the armpits suffer in the same manner. The teeth often become brittle or undergo caries, the gums being spongy and swollen. The tongue is usually enlarged, and the uvula and soft palate swollen. The thyroid gland, as shown after death, is almost always diminished in size; sometimes this can be ascertained during life, though very often this point cannot be satisfactorily determined in consequence of the fullness of the neck so common in myxœdema. Changes in the character of the speech are well-nigh constant, the utterance being slow, monotonous, thick and guttural, as though the tongue were too large for the mouth. In almost all cases there is marked intellectual torpor, the patient being sluggish, placid, and indifferent. A tendency to undue persistence in thought and action has been described. Occasional attacks of irritability or fretfulness may occur; and in nearly one-half the cases absolute insanity has been noted, chiefly in the advanced stages of the disease. Memory is usually impaired from an early period, especially for recent events.

Somnolence during the day is frequent, and sleep at night is often disturbed by unpleasant dreams. The only disorder of sensation, which occurs with any marked frequency, is retardation. With respect to this point, it must be remembered that these patients are dull of perception, and hence this form of sensory disorder must probably be looked upon as part of the general intellectual hebetude. The special senses often suffer. Deafness, to a varying degree, occurs in about one-half the cases. As regards sight, the most common defect is general diminution of acuteness of vision. Excessive watering of the eyes has been sometimes observed. Exophthalmos has occurred in the early stages in a few instances, and as an equally rare condition cataract may be mentioned. Subjective sensations, referable to both common and special sensation, are common. Among the less frequent symptoms may be noted occipital headache, convulsions, and agoraphobia. The bodily movements are performed slowly, though usually without imperfection. Falls leading to injuries, such as fracture of the patella, sometimes occur, and there is not unfrequently some degree of inco-ordina-

tion. The ordinary duties of life, such as dressing, are not only performed with great deliberation, but entail an amount of lassitude quite out of proportion to the muscular effort put forth.

The muscles of the neck are often enfeebled, so that the head falls forward, the chin resting on the sternum, as in cretins. The gait is slow, ponderous, and elephantine. The reflexes, superficial and deep, are usually normal; sometimes they are diminished or delayed, in exceptional instances absent. Occasionally they have been described as brisk or exaggerated. Sensations of cold are practically constant, and this is not merely subjective. The temperature, especially when the average is taken over a long period, is almost invariably subnormal. A temperature four or five degrees below the normal standard, persisting for weeks, is frequent. As regards the urine, it may be noted that the specific gravity is often subnormal, that albuminuria in the later stages may be present as an accidental condition, and that the amount of urea is probably always diminished, sometimes the excretion falling to a half or even less of the average quantity. Glycosuria occurs as a rare condition. No characteristic changes are present in the blood, though rarely there is diminution in the red corpuscles or the hemoglobin. The heart is usually normal; accentuation and reduplication of the sounds have been occasionally noted. The pulse is weak, soft, and slow; in only exceptional cases is excessive tension present. Respiratory troubles sometimes occur, in some instances being the immediate cause of death. The appetite is generally much impaired. As a rule the bowels are constipated, but occasionally there is watery purging. True dropsy sometimes supervenes, though usually it is slight and limited to the feet and ankles; in rare cases ascites, to a marked degree, has occurred. The onset of œdema or effusion has been observed to coincide with an amelioration in the general condition. Irregularities of menstruation are frequent, sometimes the flow being scanty, sometimes profuse. An early disappearance of the catamenia has been recorded in some cases. Uterine hemorrhage, either subsequent to parturition or more often occurring independently, is not uncommon. It may be observed here that myxœdema is no bar to pregnancy.

Even in the advanced stages gestation may take place and go on to the full period. Hemorrhages from the nose, gums, teeth, and bowels, as well as from the uterus, have been frequently recorded.

Death usually results from intercurrent maladies, such as bronchitis, phthisis, or pneumonia. In a certain number it is the direct result of the disease; mental disorder supervening, with subsequent coma.

Diagnosis.—The facies is so characteristic that, once seen, no difficulty in diagnosis will henceforth present itself when the disease is in the fully developed stage. The peculiar physiognomy of myxœdema was in the past mistaken for that of chronic renal disease, and even now the two conditions are occasionally confounded. The points of divergence are so numerous and striking that it would be superfluous to enumerate them. In the initial period of the disease it is a matter of considerable difficulty to pronounce a positive diagnosis. Indeed, it is often impossible to do so. It may be mentioned, however, that fugitive œdema, especially when affecting the face, ought to excite the suspicion of early myxœdema. In a doubtful case it is only by a comprehensive survey of all the symptoms that an opinion of any kind can be formed.

Occasionally the embarrassment of speech is so obtrusive that the possibility of bulbar paralysis has been entertained. The affection known as "acromegaly" (*q. v.*), has many important features in common with myxœdema. It will be sufficient, however, to mention that in the former there is great enlargement of the hands and feet, without any increase in the general bulk of the body, that the skin presents none of the alterations seen in myxœdema, that the hair is normal, and that bodily and mental torpor is not present, except perhaps in the terminal stage. In acromegaly the cartilages of the nose, eyelids, and ears become hypertrophied, but the characteristic cretinlike aspect is wanting. Lastly, certain of the bones become enlarged in acromegaly, and this is especially striking in the lower jaw.

Prognosis.—The disease is chronic, and the tendency is from bad to worse. Periods of temporary improvement occur, sometimes unconnected with treatment; in a few instances marked amelioration

has taken place during or after pregnancy. There is little doubt that judicious treatment is of the greatest service. The duration of life is doubtful, but it is certain that existence may be prolonged for twenty years or more after the disease has attained its fully developed state.

Morbid anatomy.—The disease is essentially an affection of the thyroid gland, which, to the naked eye, after death is small, pale or yellowish white, firm and fibrous-looking. Microscopical examination shows in the early stage a small-celled infiltration of the walls of the vesicles, with epithelial proliferation in the vesicles themselves. Later the gland becomes converted into delicate fibrous tissue, in which are seen clumps of small round cells, clearly the remnants of vesicles. Finally, the gland structure is replaced by fibrous tissue, in which small islets of round cells are sparsely placed. Death occasionally ensues before the anatomical change reaches the advanced stage, and sometimes before the entire gland becomes invaded. Alterations in other organs and tissues occur, but they appear to have no causal relation with the disease. In the skin there is very frequently nuclear hyperplasia and the development of connective tissue, mainly in the neighborhood of the sudoriparous and sebaceous glands and around the hair follicles; anatomical changes which explain some of the conditions already described in the clinical account. Occasionally there is to be seen an unusual interval between the bundles of fibrous tissue in the corium, and this open-textured appearance has been found in the lower eyelid. Dr. Ord is of opinion that the spaces described probably contained mucin. Interstitial change does not occur in the organs as a generalized condition, though occasionally it is present to a varying extent in the sympathetic, kidneys, liver, heart, and submaxillary gland. As regards microscopic appearances, it may be mentioned that the subcutaneous fat, as well as the fat elsewhere, is abundant; that at the time of death anasarca and serous effusions are frequent; that the kidneys often exhibit more or less interstitial change; that the left ventricle of the heart is hypertrophied in those cases in which the kidneys are markedly affected, and that some degree of degeneration of the larger arteries is common. In exceptional cases tuber-

cular disease of organs and cirrhosis of the liver have been found.

Pathology.—It is well-nigh certain that myxœdema is identical in essential points with cretinism, both endemic and sporadic, as well as with cachexia strumipriva. All these conditions are dependent on loss of function of the thyroid body, whether that loss be due to destructive change occurring sporadically in adult life from causes yet unknown, to congenital absence, or to early developmental arrest, or to total extirpation of the gland by the surgeon. Certain clinical differences exist between myxœdema and cretinism, but such points of divergence are related to the period of life at which the disease begins. The arrest of growth and general development found in cretins does not occur in adult sporadic cretinism or myxœdema, because in the latter the disease supervenes at a time when the organism has already attained full development; in short, it is a question of decay, not of arrest. Mr. Horsley's experiments on animals, particularly on monkeys, have shown that symptoms of cretinism follow complete removal of the thyroid gland. Furthermore, it has often happened that extirpation of the goitrous thyroid gland in man has given rise to symptoms identical with those of myxœdema. It may be mentioned that in some instances no indications of cretinism have followed supposed complete removal in man, and that in others the symptoms of cachexia strumipriva have occurred after partial removal. The immunity in the first case is probably due to the presence of accessory thyroid glands and their subsequent compensatory hypertrophy, or to the fact that the removal has really been incomplete, or, lastly, to insufficiently long observation after the operation. As regards the second apparent fallacy, it is probable that the part of the gland left behind was functionally inactive in consequence of structural change. An increase in mucin is not constant at all stages of the disease. The term myxœdema has now passed into common parlance; nevertheless, it is imperative to bear in mind the intimate relations which this disease has to cretinism and cachexia strumipriva.

The cause of the destructive change in the thyroid gland in myxœdema is quite unknown. The exact physiological function of the gland, moreover, has not yet

been determined. That it regulates nutrition in some manner is undoubted. It would appear that in myxœdema the normal destruction of the tissues and their consequent removal, which is essential for the maintenance of health, is much diminished. The lowered temperature and the diminished excretion of urea point to this, and it is instructive to note in this respect that many of the most salient features, such as the bodily and mental torpor, may be explained on the assumption that the normal metabolic processes are partially arrested.

Ætiology.—It is curious that those districts in which goiter is endemic, and others in which cretinism is known to occur, do not supply cases of myxœdema in a disproportionate amount. Nothing of a decisive character has been ascertained with respect to causation. The disease is commoner in women than in men, the proportion being as six to one. The onset may occur at any period between early adolescence and extreme old age, but the majority of cases arise between thirty and sixty-five. Syphilis, alcoholic excess, and social condition have no influence. The disease has, in a few instances, attacked members of the same family, and, rarely, it has been transmitted to the offspring. Among possible predisposing causes may be mentioned tubercle, neuroses of various kinds, mental disturbance, acute rheumatism, prolonged lactation, pregnancy, catamenial irregularities, and hemorrhages.

Treatment.—In many instances periods of marked improvement have been noted, and one actual recovery is reported. The natural conditions under which these favorable remissions occur are but little understood. The influence of warmth is particularly striking. The bodily heat should be promoted by suitable clothing, by friction of the body, and by massage. Turkish or hot air baths may be employed. If possible, the patient should be removed during the winter to a warm climate. Of drugs, jaborandi is the most useful; it may be given in doses of 30 minims of the tincture, increased gradually to a dram, three times in a day. Pilocarpine has a similar beneficial action, and may be used subcutaneously. Nitro-glycerine has been employed in a limited number of cases with good result. Iron, quinine, strychnine, nux vomica, arsenic, iodide of potassium, mercury, cod-liver oil, and

many other remedies have been employed, the majority with doubtful effect.

W. B. HADDEN.

MYALGIA.—See RHEUMATISM, MUSCULAR.

MYDRIASIS.—See IRIS, DISEASES OF.

MYODYNIA.—See RHEUMATISM, MUSCULAR.

MYOMA.—See TUMORS.

MYOPIA.—See REFRACTION.

MYO-RHEUMATISM.—See RHEUMATISM, MUSCULAR.

MYOSIS.—See IRIS, DISEASES OF.

MYSOPHOBIA.—See FEAR, MORBIA.

NÆVI.—See TUMORS, VASCULAR.

NAILS.—Chief Affections. — In-growth, onychia, hypertrophy, and psoriasis.

Ingrown toe nail is really the over-growth of the flesh at the side of the nail, caused by pressure of boot and by not cutting the nail square.

Treatment.—Bad cases require perfect rest. With the point of a penknife insinuate a little cotton-wool beneath the side of the nail, and between the edge of the nail and the overlapping flesh. Avoid cutting the nail. Poultice and rest thoroughly, if there is much inflammation. In a few cases avulsion of the whole nail (of course, under either local or general anæsthesia) may be necessary.

Onychia.—An ulceration of the matrix of a nail. Varies much in severity. The worst cases are termed “onychia maligna.”

Causes.—Bad constitution; weakly children especially liable; local injury, neglect, syphilis.

Signs.—Ulceration, sometimes confined to one angle of the matrix, sometimes extending along both sides and base of matrix. Nail blackens, loosens, and peels off, perhaps in strips. Sanious, foul discharge. Often, great pain.

Treatment.—Remove nail. Carry hand in a sling beneath chin; poultice a day or two, then dress with ung. hyd. oxid. rubri, or carbolic oil. Nitrate of lead. Ung. iodoformi would be worth trying when inflammation is reduced, ℞ liq. arsenicalis ʒ iij, aquæ ad ʒ ij, m. ft. lotio. Black wash. Internally, give tonics and cod-liver oil.

Hypertrophied nails should be re-

moved, and measures be taken to protect against local irritation.

Psoriasis of the nails.—“The central part of the nail becomes thickened, rough and scabrous, and unnaturally convex; the free edge is often split; the cuticular fringe at the bottom of the nail is ragged and retracted, leaving a deep fissure between the nail and the skin of the finger. The whole nail, in an extreme case, resembles the outside of the concave shell of an oyster” (T. Smith).

Treatment.—Smooth down with sand-paper. Dress at the margin with equal parts of ung. picis liq. and ung. hydrarg. ammon. Constitutionally, give arsenic or antisyphilitics, as may be indicated. Remember that parasitic disease of the nails, “ringworm,” occurs, but with extreme rarity. May be detected by the microscope.

C. B. KEETLEY.

NASAL BONES, FRACTURE OF.—See FRACTURES.

NASAL POLYPI.—Tumors, usually of a soft, jelly-like character, growing in the nasal passages.

Symptoms.—These may be divided into local and general. A sense of fullness and stuffiness in the nostrils, with difficulty in breathing through the nose, in some cases passing on to complete obstruction, a constant secretion from the nostrils, partial or complete loss of the sense of smell, and frequently more or less deafness, are the chief local symptoms. Among the general or remote symptoms must first of all be enumerated asthma, which may owe its origin to the existence of nasal polypi. Even when not directly due to polypi, asthma is always aggravated by their presence. Cough, hay-fever, epilepsy, giddiness, nightmare, etc., have been met with in patients suffering from polypi, and have disappeared after the removal of these growths.

Polypi may frequently be recognized without instrumental aid, as they sometimes even protrude from the nostrils. The most convenient method of examining the nostril is by means of a nasal bivalve speculum. Polypi almost invariably take their origin from the middle or superior turbinated bodies, or from the outer wall in the middle meatus, occasionally from the inferior turbinated

body, but hardly ever from the septum. They are usually of a pinkish or pearly-gray color, round or pear-shaped, unless distorted by pressure, and of a gelatinous consistence. They are almost always multiple and frequently occur on both sides.

Diagnosis.—Hypertrophy of the inferior turbinated body is sometimes mistaken for a polypus; the situation, firm consistence, and red color should suffice to prevent the mistake. Erectile swelling of the anterior end of this body may also be confounded with a polypus. The effect of cocaine in causing a disappearance of this swelling will suffice for the diagnosis. A deviated septum might also give occasion to error. Malignant growths in the nose are generally more firmly attached than polypi, are harder, more painful, and bleed freely.

Prognosis.—Polypi, though not dangerous to life, are exceedingly troublesome to eradicate. In one case history shows the condition to have been present for thirty years. The mucous membrane is now of a myxomatous character throughout, so that it is only possible to prevent the formation of fresh polypi by using the galvano-caustic loop every four or five months.

Morbid Anatomy.—Mucous polypi belong to the myxomata, consisting of a loose form of connective tissue, the meshes of which are filled with stellate cells and with a mucin-yielding substance.

The papillomata are another form of nasal polypi; these almost invariably spring from the inferior turbinated body.

Nasal polypi generally occur at the middle period of life, and are very rarely met with before the age of sixteen.

Treatment.—The question at present is as to the employment of the galvano-caustic loop, as opposed to the loop of cold wire. To a large extent this is determined by individual custom; the cold snare requires less apparatus, but then the tug requisite to remove the polyp is a somewhat painful procedure. The writer has from the first employed the galvano-caustic loop, and he has been so satisfied with it that he has not been tempted to try other methods. The application of a 20 per cent. solution of cocaine by spray or brush much facilitates the operation, by causing contraction of the mucous membrane and by rendering it anæsthetic. But when the

polypi has been removed, whatever process be employed, there still remains the difficult task of preventing their recurrence. The most convenient plan is to burn down the pedicle by means of the galvano-cautery, cocaine having been previously employed to render the part anæsthetic, or caustics, such as chromic acid in the form of crystals, or the 90 per cent. solution of carbolic acid, may be applied to the base of the polyp, but in the case of multiple sessile growths the tendency to recurrence is so great that the utmost patience and perseverance are required in order to attain the desired end.

F. DE HAVILLAND HALL.

The injection of a solution of tannin is said to bring about a speedy withering of the growth with a final separation.

Symptomatic Indications.—*Sanguinaria* has been successfully employed for the removal of polypus narium. *Calcare carb.* has also been successfully used for the same purpose.

NECROPSY.—See POST-MORTEM EXAMINATION.

NEPHRITIS.—See BRIGHT'S DISEASE.

NEPHRITIS, CALCULOUS.—See SURGICAL KIDNEY.

NERVOUS DEBILITY.—See NEURASTHENIA.

NETTLE RASH.—See URTICARIA.

NECK, INJURIES OF.—**Contusions.**—A blow directly on the neck will in all cases cause a certain amount of ecchymosis, *i. e.*, extravasation of blood. So long as this is superficial to the deep fascia it is of no importance, provided the skin is unbroken. It frequently extends in the loose subcutaneous tissue almost to the middle line posteriorly, and in front may reach below the clavicles on to the chest. If, on the other hand, the extravasation is beneath the deep fascia in the loose connective tissue surrounding the large vessels and nerves, then it will, by pressing on the same, cause symptoms sometimes of an alarming character.

As for direct injury to the deep cervical structures from a blow, we may note an accident which is not an organic lesion, but a disturbance of function which may end fatally, namely, spasm of the glottis.

As a result of contusion the larynx may be fractured or the esophagus ruptured,

The arteries may be damaged so as to produce a traumatic aneurism, and injury of a vein may lead to the formation of a blood cyst. Injury of the sympathetic nerve, if sufficient only to irritate it, will cause dilation of the pupil and protrusion of the eyeball; while, if it is paralyzed, the pupil will be dilated, the eyeball retracted, and the secretion of sweat on that side of the head and neck interfered with.

NECK, WOUNDS OF.—Simple uncomplicated wounds of the neck must be treated on general principles, and may be expected to heal by the first intention if the parts are kept perfectly at rest. For this purpose the patient's head and neck should be fixed by being placed between sandbags covered with a thin pillow, or a light splint of gutta-percha may be fitted to the shoulders and nape of the neck, so that the head cannot turn. After ligation of large vessels, this precaution should always be taken.

I. Wounds of Special Parts.—Punctured wounds, stabs, etc., in the *posterior triangle* may reach the subclavian vessels, the brachial and cervical plexuses, the spine and spinal cord.

If the large vessels are wounded, and the hemorrhage temporarily arrested by plugging, pressure is to be made on the proximal side of the wound, which must then be laid freely open and the vessel tied with chromic catgut, and the wound dressed antiseptically. If one of the cervical nerves entering the brachial plexus, or one of the cords of the plexus, is divided by a cut, and no restoration of motor power has been attained at the end of five or six weeks, the wound must be reopened and the nerve sutured. If the spinal cord is reached by a knife, bayonet, etc., then the special symptoms of paralysis, etc., will denote the amount of injury, and treatment must be mainly directed to providing very free drainage of the wound, coupled with the liberal use of antiseptics. Wounds in the front of the neck and of the anterior triangle may be considered together, although in some points, especially in their after effects, the regions differ.

Wounds of the *front of the neck* and of the *anterior triangle* may injure (1) the air passage; (2) the food passage; (3) the large vessels; (4) the large nerves. The ordinary cut throat of the suicide or homicide has received notice but presents nothing peculiar in itself, unless it be

endless variations in the extent of the lesion. However, it cannot be too often insisted upon as a general fact, applicable to all cases, that the main importance of a wound in the neck does not lie in the immediate symptoms it presents, however urgent, but in the possibility of complications arising in the after-treatment; for since the former can be met by the ordinary rules of action in surgical emergency, the sequelæ (cellulitis, pneumonia, etc.) really determine the result of the case, and therefore the prognosis too.

1. Wounds of the air passage.—The pharynx may be opened by a horizontal cut passing above the hyoid bone through the base of the tongue, or below the hyoid bone in the thyro-hyoid space. Here, if the pharynx be extensively opened, the cut divides the epiglottis more or less completely according to the position it was in at the time. The divided epiglottis has sometimes caused asphyxia by dropping into the glottis, plugging it up, and exciting spasm. In either of these kinds of severe cut throat about the hyoid bone, air and food will escape through the wound, and the tongue, when thus cut free from the hyoid bone, frequently presses backward, and produces more or less suffocation; it must in such a case be drawn forward by a silk loop passed through it. After thorough washing out of the part with carbolic solution, the wound in the mucous membrane of the pharynx, where feasible, may be closed by sutures placed entirely in the submucous tissue, the angles of the skin wound apposed by a few horsehair sutures, and free drainage with a large tube arranged in the middle third of the space. The wound heals always by granulation, as the movement of the parts prevents adequate rest for primary union, and it usually heals quickly if kept very clean by frequent irrigation. It must be wiped out, not syringed, if the glottis is exposed.

The larynx is usually opened by one or several transverse cuts about the lower part of the thyroid cartilage. While no special symptoms, beyond the usual escape of air, etc., directly accompany this condition, it is especially liable to be followed by the very dangerous sequel of acute inflammatory œdema of the glottis. The glottis being cut into, usually above the vocal cords, it is exposed to the air, to irritation by blood, etc., and so acute œdema (in which the mucous membrane

becomes extremely swollen by exudation into the loose submucous tissue) being excited, the lumen of the larynx is choked, and the patient rapidly becomes asphyxiated unless a tube is passed into the trachea. For this reason it is advisable to perform tracheotomy whenever the glottis is the seat of the wound, for the rapidity with which œdema glottidis sets in is so extreme as to sometimes kill the patient before the operation can be performed. At the moment when the wound is inflicted there is danger of asphyxia from blood running down between the vocal cords and filling the air passages; and a relatively small quantity of blood can thus produce fatal asphyxia, unless, of course, the patient is able to cough it up. In addition to œdema glottidis, the complication of emphysema may arise, in which condition the subcutaneous tissues of the neck become infiltrated with air and enormously swollen.

Finally, when the vocal cords are injured, or the cricoid cartilage is cut through, the voice is either completely abolished or very much weakened and hoarse.

If the trachea is only opened for a small distance, it will heal readily, as most tracheotomy wounds do. If, however, as rarely happens, it is very severely wounded (it has been seen completely cut across), it should be united with fine catgut sutures, the wound being kept freely open and frequently cleansed.

2. Wounds of the food passage.—Note may here be taken of the risk of septic infection with this complication. Where possible the mucous membrane of the alimentary canal should be closed by sutures.

3. There is no mystery about the symptoms of **wound of one of the large vessels**. If seen in time the bleeding point should be caught between the thumb and forefinger of the left hand, one digit (preferably the thumb) being thrust to the bottom of the wound, the other being outside, pressing on the sterno-mastoid muscles. The bleeding being thus absolutely arrested for the moment, the wound should be enlarged up and down for a short distance, the fresh incision dividing the deep fascia. A finger of the right hand can now be brought to exert firm pressure directly on the trunk of the bleeding vessel, the wound in which can then be exposed by removing the left hand.

It can then be completely closed by catch forceps. If the original wound gape very widely there will be no necessity to enlarge it, but no time is to be wasted in trying to compress the vessels through the intact structures of the neck. The wound in the vessel, now under perfect control, is to be permanently closed by ligature of the trunk above and below it. The wound is then to be disinfected and dressed.

4. Injury of the large nerves has already been alluded to.

In concluding the subject of wounds of the neck, attention is again drawn to the fact that the majority of cases end fatally because, the wound decomposing, the foul discharge either sets up cellulitis, which spreads down into the mediastinum, or it enters the trachea and sets up septic pneumonia. Every care, therefore, is to be exerted toward thorough cleansing and disinfection of the wound.

II. Cellulitis of the Neck.—Cellulitis may be started in any one of the regions of the neck occupied by connective tissue, by several causes, the commonest of which is inflammation of a gland, almost invariably a lymph gland, and more rarely the salivary glands. The lymph glands are liable, of course, to become inflamed by absorption of septic matter from a sore inside the mouth and pharynx, or elsewhere, especially in some acute specific fevers, *e.g.*, scarlet fever, diphtheria, when the swelling of the neck receives the title of scarlatinal angina, cynanche maligna, etc., the name simply signifying that the connective tissue around the glands is in a state of acute phlegmonous inflammation.

Next to acute inflammation of the glands as a cause of cervical cellulitis, comes chronic adenitis, which is usually of tubercular origin, then wounds and injuries of the soft parts of the neck, alveolar abscess from carious teeth, and, finally, specific poisons, which produce the particular form of cervical cellulitis known as angina Ludovici (or Ludovigii), and the rare parasitic disease known as actinomycosis.

Cervical cellulitis presents itself in various degrees of severity, as cellulitis does everywhere. Thus we may have a simple but acutely developed œdema (acute inflammation) of the connective tissue spaces, as occurs sometimes in diphtheria. Or this may be phlegmo-

nous, as in many cases of septic poisoning and scarlet fever, the center of the plegmonous mass softening down into an acute abscess. Further than this, the inflammation may be of so virulent a type that the result is gangrenous destruction of the tissues, producing sloughs bathed in a horribly fetid, ichorous fluid.

As the best example of this latter condition may be detailed the affection known as angina Ludovici, or submaxillary cellulitis or angina. The general causes which excite cervical cellulitis have just been mentioned, but it will easily be understood that the condition of submaxillary cellulitis is most usually started by a local spreading inflammation from an abscess round a carious tooth, or from septic inflammation of the submaxillary gland.

Angina Ludovici begins like an acute specific fever, and when not treated runs a very rapid course, ending fatally, sometimes in from five to nine days. It begins with pyrexia, the temperature rising rapidly to 103° and 104° , ushered in by a rigor, accompanied by headache, depression, and loss of appetite. When these symptoms are well declared, there then begins a swelling under the jaw, which is simply due to œdema of the connective tissue. The swelling forces the tongue upward and backward so as to form a large unwieldy mass in the mouth. This causes some pain in swallowing, and interferes with the free movement of the jaw and with speech. Frequently there is comparatively little pain in this affection; but sometimes, if the swelling is developed very rapidly, the pain is severe, until the limiting fascia gives way and allows the pus to infiltrate the surrounding tissues, when the patient experiences considerable relief. If the swelling is incised at this time it will be found to be composed of sloughy, but solid, connective tissue, infiltrated with foul grayish-brown sero-pus. The muscles become infiltrated secondarily, and the cellulitis may spread into the anterior mediastinum and reach the pericardium, the patient dying of exhaustion and septicæmia, if not relieved.

Treatment.—In all cases an incision, from 1 inch to $1\frac{1}{2}$ inches long, is to be made through the skin and superficial fat, any vein divided being picked up with catch forceps. If the cellulitis is clearly defined and localized to one or the other

spaces of loose cellular tissue in the neck, then it clearly must be under the deep fascia, which is, therefore, to be divided to the same extent as the skin. A certain amount of serous œdema fluid will ooze into the wound from the cut tissues. A steel director is now to be thrust carefully toward the center of the swelling, and if foul ichorous matter flow along the groove of the director, a pair of dressing forceps is to be thrust (closed) along the groove to the center of the abscess, and then withdrawn, with the blades moderately separated, so as to dilate the opening. Finally, a large drainage-tube should be inserted, and the whole syringed out with warm carbolic acid solution. The neck should then be wrapped in hot fomentations of boracic lint.

The line of incision varies according to the space to be opened. Thus, in the posterior triangle, the cuts should be made parallel to the main vessels and nerves, taking care at the forepart not to wound the external jugular vein.

To open the spaces in front of the neck in angina Ludovici, the incision must always be made in the middle line, and, if necessary, a further one may be carried through the center of the swelling, but this is rarely necessary. The connective tissue space around the carotid, etc., is to be opened as in the operation for ligature of that vessel, namely, parallel to the sterno-mastoid.

III. Tumors of the Neck.—Include among their varieties several kinds which are peculiar to the region involved, these mostly being congenital in origin. Viewed as a whole, they may be divided into two main classes, viz., cystic and solid tumors. Cysts are usually arranged according to their contents, but for clinical purposes are best grouped in the anatomical order of the parts they arise from, and the same method will be employed in treating of the solid tumors.

I. Cystic tumors arising from persistence of embryonic structures.—The fissures in the neck, known as visceral clefts in the embryo, sometimes do not close, or only partially; *i. e.*, at both ends and not in the middle, or at one end only. If the first imperfection exists, there may be found a prolongation of the angle of the mouth almost to the ear, while at three points between the lower border of the jaw and the thorax it may present itself as a sinus-like cavity, running upward

and backward from the front of the neck, sometimes only just admitting a probe, and always secreting a little thin mucous fluid. If the ends of such a "*congenital fistula*" are closed and the center patent, then there develops a congenital cystic tumor, which may reach a large size and extend deeply (sometimes to the spine), so as to form important connections with the large vessels and nerves. These cysts form rounded, painless swellings, with exceedingly thin walls, and the skin over them non-adherent. They usually contain a serous fluid, and therefore come under the general appellation of "*hydrocele colli*," but in some rare instances they are lined by one or more layers of epithelial cells, and contain a fatty material. If it should prove impossible to extirpate these cysts (after repeated aspiration has been tried), they should be injected with iodine or carbolic acid.

The other common class of congenital cystic tumors are often called *dermoid*, but it must not be supposed that they always contain examples of all dermal appendages. These dermoid cysts usually are found in the middle line, where the somatic plates fuse together, and they arise, no doubt, from small masses of included epiblast. They are also found in the sites of the visceral clefts, but this position is rarer. The commonest seat is between the genio-hyoid muscles, where the tumor presents itself as a rounded swelling in the middle line, just above the hyoid bone. It pushes up the floor of the mouth and the tongue so as to project considerably beneath the buccal mucous membrane. These cysts, when they occur on the side of the neck, often form dangerous adhesions to the large vessels. Like the "*hydrocele*" cysts, these have very thin walls, but, unlike them, the dermoid contents always contain a large quantity of yellowish-white fatty *débris* (cholesterine, etc.), with epithelial cells. More rarely hair, sebaceous matter, and teeth have been found in them. They must be extirpated with special attention to surrounding structures.

2. Cystic tumors arising from the air and food passages.

(a) Cysts containing air may arise in the neck from either the apices of the lungs projecting up under the sternomastoid, or from the side (usually) of the trachea (*tracheocele*). In the first case the cyst is an example of hernia of the

lung. In the second case, as the result of mal-development, the parts are not united in the middle line, so that a tracheal fistula is left; or one or more rings are wanting so as to render a hernia of the mucous membrane of the trachea possible when powerful expiratory efforts are made, especially if the glottis be closed.

(b) The bursa between the hyoid bone and the thyroid cartilage may enlarge and become distended with fluid. It should, if acutely inflamed, be treated with leeches and hot fomentations. It may require aspiration, but I have seen the fluid absorbed in about a month in the case of a young man who refused all treatment. Aspiration is always of service.

(c) Cystic tumors may originate in the mucous glands of both trachea and esophagus, the secretion being bent up so as to form retention cysts.

3. Cysts arising from the blood vessels.

(a) The commonest blood cystic tumor in the neck is an aneurism.

(b) The next commonest, perhaps, is a simple cyst containing blood; the cyst being developed in connection with a vein or in an enlarged venous plexus. Another variety of cyst containing blood, more or less altered, however, is the so-called hemorrhagic cyst, which condition results from rupture of some small vein or veins leading to the formation of a cystic cavity. Aspiration of this kind of cysts sometimes draws off blood so altered as to present a chocolate-like appearance.

(c) The third kind of blood cystic tumor is venous angioma, which develops in the neighborhood of the vessels, usually in the posterior triangle. Beyond being extremely rare, it does not differ from ordinary venous angioma.

The treatment of blood cysts, omitting aneurism, depends on the nature of the cyst. If the latter is in connection with a large vein and is of moderate size, it is to be exposed, and the pedicle or the feeding vessel ligatured. If this is impossible it must be treated like an aneurism, viz., by electrolysis, etc. A hemorrhagic cyst requires dissecting out where possible; if not, it must be scraped and drained. Venous angioma in the neck is always best treated by frequent puncture with the actual cautery at a dull red heat.

4. Cysts arising from lymph vessels.—

Lymph cysts containing a thin serous

fluid are probably more common than is generally believed. From their watery contents and the deformity produced they have been named "hygroma colli." They are divisible into two classes, congenital and acquired.

Congenital hygroma is a very grave affection, the exact origin of which is not very clear. A child is born with a sero-cystic tumor usually over the carotid, the growth steadily increasing and causing death by pressure on the esophagus, trachea, and blood vessels. If punctured, it is found that the cyst is composed of loculi communicating with one another, and the walls of each firmly adherent to the large vessels and nerves. The treatment should consist in incision and anti-septic drainage.

In the adult a lymphatic cyst (acquired hygroma) in the neck is usually a single cavity formed by a fairly thick-walled sac, which is lined by lymphatic endothelium, so that there is little doubt of the nature of the tumor. It should be excised.

5. Simple sebaceous (atheromatous) cysts of the neck are common.

6. Hydatid cysts of the neck.—Very rarely, *i. e.*, has the echinococcus been found in cysts of the neck. Treatment should be by incision and drainage.

Little has been said of the differential diagnosis between the various cysts described above, because the diagnosis between the different kinds is rendered sufficiently obvious by the description of each; but it is important to point out that they may be confounded with soft solid tumors, *e. g.*, lipoma, and with abscesses (especially if chronic). In most cases aspiration with an exploratory syringe is harmless, if performed antiseptically, and with due caution, while it frequently definitely decides the diagnosis.

IV. Solid Tumors in the Neck.—**1. Tumors growing from the skin and connective tissues.**—The skin itself is occasionally the seat of nævi, warts, and epithelioma, the latter occurring especially in old cicatrices. The subcutaneous tissue is very frequently the seat of one of the simple growths, *e. g.*, fibroma and lipoma, which are most common in the posterior triangle. More rarely enchondroma and osteoma have been found springing from the remnants of the visceral arches or so-called cervical ribs. Primary sarcoma has been described growing in the connective tissue, espe-

cially in the anterior triangle. Special difficulties in diagnosis can only arise when these tumors are soft and growing deeply in fat subjects.

2. Tumors of the muscles.—These are very rare. There is, however, a definite tumor peculiar to the cervical muscles, especially to the sterno-mastoid, and occurring in new-born children, which requires notice. In breech presentations, and in children the subjects of congenital syphilis, there is often noticed after birth a steadily increasing swelling about the middle of the sterno-mastoid muscle, which at the end of a month may interfere with swallowing, etc. It is clearly a syphilitic formation at a point damaged by rupture at birth, and is best treated with mercury and external anti-inflammatory remedies.

3. Tumors of the lymph glands.—These glands give rise to by far the largest number of tumors in the neck. Lymph glands may give rise to tumors under the following conditions:

Simple hypertrophy, sometimes wrongly described as lymphadenoma. The glands simply increase in size and density, the skin is freely movable over them and not reddened; the swelling is painless, as a rule, and non-adherent to surrounding structures. In true lymphadenoma the cervical glands partake of the general numerical enlargement, sometimes forming enormous collar-like masses on the sides of the neck. In these cases the glands are often so adherent to one another as to form, practically, a confluent mass. Simple enlargement occurs in young individuals placed under bad hygienic conditions, or overworked, etc. The treatment consists in local counter-irritation by iodine, interstitial injection of the same, and general constitutional treatment. And if all these means fail, excision of the mass should be performed.

Strumous disease.—Chronic inflammatory changes, in which caseation occurs early, is found in the cervical glands both in children and adults.

Chronic inflammatory and syphilitic enlargement.—These require only to be mentioned as causes of tumor in this region.

Primary new growths.—The commonest new growth commencing in the lymph glands is sarcoma. It may be spindle-celled, or round-celled, usually the latter, which is consequently termed lympho-sar-

coma. This is excessively malignant, grows with great rapidity, and involves surrounding structures. Scattered glands may be attacked simultaneously. Early excision is the only, but not a promising, treatment.

Secondary new growths.—Cancer and round-celled sarcoma usually involve the lymph glands secondarily. Cancer, especially epithelioma, invades the glands nearest the original tumor. The enlargement of the gland is usually irregular, painful, and hard. It soon becomes very adherent on the outside to surrounding structures, while it degenerates in the center so as to form a cavity filled with pultaceous *débris*. Early excision is the only treatment.

V. Affections of the Salivary Glands.

—A. Simple inflammation of the parotid.

—The parotid gland inflames rarely from direct primary causes, but very frequently as a symptom of some acute specific disease. It is so common a feature of mumps as to almost render the terms parotitis and mumps synonymous. It also occurs frequently in pyæmia, and more rarely in scarlet fever, typhus, and smallpox. Acute adenitis of the submaxillary gland is as rare as that of the parotid is common.

Suppurative parotitis only occurs in very debilitated subjects, and in pyæmia. In the latter affection it is heralded by a severe rigor, and is usually found to form a localized swelling, although the phlegmonous infiltration around spreads through the whole gland. Early antiseptic incision is the only treatment, coupled with the general treatment of pyæmia.

Gangrenous parotitis is a very rare affection, in which the inflammation terminates in sloughing of the superjacent skin, with subsequent destruction of the proper gland tissue. Treatment consists in free incision and the application of strong disinfectant solutions.

B. Cystic tumors of the parotid.—Occasionally the main duct of the gland becomes plugged by a calculus, so that the part behind the obstruction and the gland itself are distended to form a retention cyst. This condition is, however, rare in the parotid. In the sublingual region, salivary retention cysts are more common. Very rarely true cysts (probably arising from the blocking of a secondary duct) have been met with.

C. Solid tumors; adenoma.—Simple

tumors in the salivary gland, composed of one tissue only, are very exceptional; in almost every case the growth is compound. Growths are common in the parotid, but rare in the submaxillary and sublingual glands. The ordinary non-malignant "parotid tumor" of the older writers is now known to be fibro-adenoma. The adenomatous tissue is simply a copy of the original gland tissue, the lumen of the acini, however, being filled up with cells. Owing to changes in the fibrous stroma of the tumor, it is frequently more correctly termed myxo-adenoma, and from the not infrequent development of cartilage therein, is termed a myxochondro-fibro adenoma.

These simple parotid tumors grow very slowly, distending and usually rupturing the original capsule of the gland, but forming a new capsule out of the surrounding connective tissue. While growing in the gland they can often be shelled out of this false capsule without wounding the healthy gland tissue. The skin, too, is usually freely movable over the mass. Occasionally the socia parotidis is affected alone.

The most important points to be borne in mind in connection with parotid tumors are: (a) The facial nerve running through the lower end of the parotid is liable to the paralyzing effects of the pressure from a new growth of the kind indicated. But it is more liable to be injured in removing the tumor, and the possibility of this accident (sometimes *a necessity*) should be explained beforehand to the patient. (b) As regards the blood supply, it is also to be remembered that the external carotid artery passes through the deep portion of the gland, but no notice need be taken of hemorrhage when it is a question of thoroughly removing a growth, all vessels being secured with forceps as they bleed. The internal maxillary artery will be found to bleed from both ends, so as to require a double ligature.

D. Adeno-sarcoma is a growth which affects the submaxillary gland nearly as often as the parotid; it forms a steadily growing tumor (the rate of growth increasing with each recurrence) which becomes adherent to neighboring structures, and invades muscles and fasciæ. The pressure on the branches of the fifth nerve gives rise to excruciating pain, and penetrates deeply between the jaw and the base of the skull. It sometimes af-

fects the glands secondarily. Free excision must be performed.

E. Carcinoma of the salivary glands is very rare; scirrhus has been described as most common. An attempt to remove the whole mass may be made, if the disease be not too far advanced.

NECROSIS.—See BONES.

NEPHRITIS, SUPPURATIVE.—See KIDNEYS.

NERVES, ATROPHY OF.—May be either local or general. The latter is found only in cases of extreme and protracted emaciation, from defect of general nutrition. Local atrophy may be the result of several different causes, viz., chronic inflammation, stretching, compression, and even severe contusions. Of these the most common is compression caused by tumors, aneurisms, enlarged glands, etc. Nerves of special sense often waste after loss or wasting of the central organs to which they belong, as the optic nerve after wasting of the globe of the eye. In some instances the nerve fibers only are implicated, and nothing may be left but the neurilemma. In others the neurilemma itself is involved in a greater or less degree. During the process of atrophy, the nerve-fibers become uneven, their white substance is broken at intervals and stripped from their axis cylinders in masses, which again break up into smaller fragments that are mingled with fatty particles.

J. L. CLARKE.

NERVES, CONCUSSION OF.—This term was applied by Willard Parker to a condition of the nerves analogous to that known as concussion of the nervous centers, *e. g.*, concussion of the brain. The condition is the result of an injury, the supposition being that the nerve receives a shock, its function being for a time suspended. Whether this is due to an actual lesion of the nerve, or to a derangement of its molecular structure, is a matter of conjecture.

Symptoms.—In the early stage, there is usually severe pain in the affected part, with more or less paralysis, weariness, and inability to use the limb. The symptoms subside more or less completely after rest, but speedily recur upon exertion, the most striking and important symptoms being the intolerance of overexertion, continued use of the part causing a de-

cided and progressive impairment of power, the limb becoming emaciated, the muscles atrophied, and the usefulness of the limb permanently impaired.

Diagnosis.—The marked symptom is the intolerance of severe exertion, over-exercise giving rise to nervous exhaustion, characterized by dull aching or tired pain, which is relieved only by rest, often long continued.

Prognosis.—Depends much upon the early treatment. If recognized in the early stage and properly treated, the prognosis is favorable. If not understood, and active, exhausting measures are employed, it is decidedly unfavorable. Aggravation of the symptoms occurs, partial paralysis, and a gradual wasting of the limb follows, and its usefulness is permanently impaired. The weak and irritable condition of a part extends to the nervous centers, causing a general nervous irritability, and this in turn aggravates the local affection. In no instance has the disease resulted fatally to life.

Treatment.—Rest, until the equilibrium of the circulation is restored, and such lesion as may exist is repaired, is most positive and essential. It is, in fact, the *sine qua non*. The proper treatment of concussion of the nerves, immediately after the accident, is of the utmost consequence for future success. Perfect recovery depends entirely upon this treatment, early pursued. Electricity has been used in addition to powerful local applications and exercise, but always with positive injury. Local depletion has been practiced, under the impression that the pain was due to local inflammation, and the result has been no less unsatisfactory.

By rest should be understood a certain degree of rest, alternating with such an amount of passive exercise as never causes the return of the "dull, tired pain," of which patients invariably complain, when the nerves approach the state of exhaustion. Passive exercise, as riding in an easy carriage, or on the water, not carried beyond this limit, proves decidedly beneficial, and should be commended,

Dry friction of the limb also gives much relief. Friction may be made with the hand or a coarse cloth, and should be continued according to the feelings of the patient.

The condition of the general system should be carefully attended to, for on its

integrity depends the tone of the nervous system. While all fatiguing exercise of the body, within the limits specified, should be scrupulously avoided, it is not less important that the mind be not overtasked by exertion or anxiety,

Symptomatic Indications.—*Rhus, arnica.*

NERVES, CONGESTION OF.—The early stage of neuritis. The causes of this condition are not known, though it may result from cold. It has been produced artificially by congelation of a nerve trunk by intense cold.

Symptoms.—When artificially produced there is intense aching pain along the course and distribution of the nerve, followed by numbness, loss of sensibility, gradual loss of mobility, and rise of temperature. It is probable that neuralgic pains may be frequently due to this condition.

Symptomatic Indications.—*Aconite, belladonna. Arnica*, when from injury.

NERVES, INFLAMMATION OF.—See NEURITIS.

NERVES, TUMORS OF.—See TUMORS, NEUROMA.

NERVES, INJURIES OF.—**Contusion, rupture, and wound of nerves.**—The peripheral nerves are liable to the same sort of accidents (contusions, ruptures, and wounds) as other tissues of the body, but owing to their mobility and usually protected position in their course along the limbs, they enjoy a remarkable immunity from injury. Injuries of nerves are, therefore, among the least common in surgery; but are, nevertheless, among the most important, for they may give rise to consequences which are not only immediate, but also to those which may be remote both in time and situation. Contusions, compressions, ruptures, and wounds of nerves are alike in this, that they may cause more or less impairment of motion and sensation in the parts to which the nerve goes. And by the presence of such symptoms, and by the history of the accident, a diagnosis can usually be made immediately or soon after the injury; immediately, when the nerve has been divided or severely contused; soon, when it has been only compressed or partially divided, and inflammatory exudation

interferes with its function as a conductor of impressions.

Effects.—I. *Wallerian degeneration.*—The section of a compound nerve, or any lesion which destroys its conductivity, leads to degeneration throughout its whole course beyond the seat of injury. This effect is due, it is believed, to the fibers being disconnected from their "trophic" centers; the large cells of the anterior cornua in the case of efferent or motor fibers, and the ganglia of the posterior roots in the case of afferent or sensory fibers. This degeneration, generally called Wallerian, occurs along the line of conductivity of the fibers, efferent or afferent as the case may be. When a posterior root, therefore, has been divided between the ganglion and the cord, degeneration spreads centripetally to the cord, and the posterior root wastes on the cord side of the lesion. Such a section can rarely, if ever, happen accidentally.

Division of a mixed nerve, at any part of its course, must separate its motor fibers beyond the point of lesion from their connection with the trophical cells in the cord, and Wallerian degeneration is the result.

Experimental observation has shown that the primary and essential changes of this degeneration "consist in the progressive destruction of the special elements of the nerve fibers, the medullary sheath and the axis cylinders," and that they begin as early as the first day. The myelin breaks up into fragments and may ultimately disappear, and the sheaths of Schwann may in the end be filled with fine granules of fat and disintegrated globules of myelin. According to Ranvier, the axis cylinder disappears about the sixth day; by about the twentieth the sheaths of Schwann are more or less empty, and the trunk looks atrophied and shrunk, in varying degrees at different parts. The neurilemma also takes part in the process; it proliferates, and leads to a cirrhotic condition of the nerve. Similar changes, though less in degree, arise also at the cut end, but only at the end, of the proximal part of the trunk.

If the nerve lesion is soon repaired, regeneration takes place in the degenerate fibers in the reverse order to that of the previous degeneration. The possibility and degree of ultimate restoration of function depend, to a large extent, on the length of time during which the nerve

has been divided, for, in addition to degeneration in the nerve itself, changes are taking place in the muscles supplied by it. "The fibrillæ lose their distinct striation, and apparently undergo an alteration in their chemical composition. There is proliferation of nuclei, and of the connective tissue, leading also to a cirrhotic condition of the muscle."

The consequence of these changes, which arise whenever the "trophic" influence of the cornual cells has been interfered with, whether by disease in themselves or in the motor cords which connect them with distant parts, is shown in marked alterations in the electro-excitability of the muscles, and what is known as the "*reaction of degeneration*" is established. The phenomena consists essentially in diminished, and soon annihilated, faradic excitability, with increase of the galvanic excitability, the response of the muscles to slow interruptions of the galvanic current showing various modifications according to the length of time that the degeneration has lasted. At first diminished, it gradually becomes increased as the excitability to the faradic current is disappearing, so that a smaller number of cells is sufficient to excite contraction than in a healthy muscle, and the contraction, moreover, is slow, lazy, and deliberate. Then, as degeneration advances, and becomes complete, and no muscular fibers remain, there is no longer response to either current, and the muscles may be looked upon as atrophied beyond all possibility of repair. Reaction of degeneration, it should be borne in mind, is essentially due to degenerative atrophy of muscle, which depends on a particular cause, and bears no relation whatever to paralysis. The muscles of a limb may be completely paralyzed, for example, by cerebral lesion, but they need not on that account show any abnormality in electrical reaction.

2. *Loss of motion and sensation.*—While the common early result of nerve division is loss of motion and sensation, the loss of sensation is often by no means as well marked as that of motion, even in cases where a nerve has been completely divided. Thus, after division of the median in the forearm, the anæsthesia in the hand may not occupy the precise area of its known anatomical distribution. Variations of this kind are not at all un-

common, and are probably due to free communications between separate nerves at some parts of their course. This fact, which has been attested by numerous observations, must be remembered in forming a diagnosis, and in considering the advisability of any operation to rejoin a divided nerve.

3. *Trophic changes.*—Yet other consequences than those already named may follow severe nerve injuries or division, namely, disturbances of nutrition, often called "trophic," in the tissues at the periphery of the affected nerve. These "trophic" changes are most likely to arise when the nerve is being subjected to continuous irritation at the seat of lesion, as when its ends, perhaps only partially divided, are bound down in cicatricial tissue, or have been involved in inflammation at the time of healing of the flesh-wound. In such cases there is often the most exquisite tenderness at the cicatrix; tenderness, so great, it may be, as to make the whole limb useless, and seriously affect the patient's general health; and at the periphery of the nerve, say, in and about the fingers, there are grave nutritive disturbances. The part may be colder than natural, and may long remain so, be red or reddish-purple in color, have on it blisters like pemphigus, or sores which have been started by some trifling injury and show little or no tendency to heal, and the nail may become crumbled and deformed, or be shed spontaneously. The fingers may be œdematous, glossy, eczematous, or erythematous in appearance; constantly moist with sweat, and perhaps extremely hyperæsthetic, and, as time goes on, they may become withered, parchment-like, and stiff. Whatever may be the immediate cause of these changes, whether they arise from vasomotor disturbance, or be the direct result of some special "trophic" derangement, they are rarely met with unless the nerve at the seat of lesion is being subjected to continuous irritation, and they are commonly looked upon as signs of an "irritative" lesion.

4. *Changes in the central nervous system.*—Not only, however, may changes arise in the periphery of a nerve, but, in consequence of injury to a nerve trunk, it sometimes happens that certain changes or effects are produced in central parts of the nervous system. These are of two kinds: some arise immediately or soon

after the injury, and are shown by palsy or spasmodic affections of parts not directly in relation with the nerve injured. They are probably reflex, purely functional in origin, and frequently pass away when the nerve lesion has been repaired. Whatever is their precise nature, they show at any rate how close an intimacy there is between the peripheral nerves and central parts of the nervous system. Nor is it strange that if functional disturbances should be thus generated, we should occasionally meet with cases where actual central lesion has been thus set up in parts removed from the seat of peripheral injury. These form the second of the two forms of change. The explanation of such consequences may be difficult or impossible, but there is no question as to the fact; and in one of the most marked cases of the kind recorded by Dr. Ferrier, a morbid condition of the whole of the gray column of one side of the spinal cord was developed in connection with long-standing peripheral irritation of nerve trunks in the stump of an amputated arm. All such cases, and all the manifold results of nerve lesion hitherto named, whether early or remote, teach the importance of placing an injured nerve in such a position that recovery and restoration of its function shall take place as soon as possible, and of preserving it from inflammation and irritation in the process of repair.

Nerve suturing.—By *nerve suture* the ends of a divided nerve can be put in such apposition that union will soon take place, and nerve degeneration and atrophy be reduced to a minimum. Nerve suture is either *immediate* or *secondary*. Immediate suture should be the invariable practice in all cases where a nerve has been divided in a wound, and the surgeon should no more neglect to look for and bring together the ends of a divided nerve, than he should to secure and tie the bleeding arteries.

The procedure is simple: bring the ends into apposition, and fix them together as accurately as possible by catgut or fine carbolized silk sutures passed either through the sheath alone, which is the best plan, or through sheath and trunk, when the former is insufficient. The wound must be kept aseptic and suppuration prevented, and union of the nerve will soon take place, and the lost function will be gradually, and it may be

perfectly restored. Sensation usually returns before motion.

Supposing, however, that primary suture has been neglected, that the nerve injury was unrecognized, or that suppuration and inflammation have led to the early bond of union being dissolved, and the nerve ends have become bound in irritative cicatricial tissue, that there is tenderness at the scar, and that "trophic" changes have been developed, then it may be desirable to perform secondary suture. This operation consists in cutting down upon the nerve at the seat of lesion, finding the ends, dissecting them free from the cicatricial tissue in which they are imbedded, removing the bulbous nodules of fibrous tissue which usually involve them, and then uniting the clean-cut freshened ends as in primary suture. The size of the bulbous ends may be such that considerable shortening of the nerve is unavoidable after their removal. It may then be necessary to dissect the nerve free for some distance, so as to allow of its ends being brought more readily together, and the limb must be kept in such a position afterward, at perfect rest, as shall minimize the traction upon them. The all-important thing is to avoid suppuration in the after-treatment, so that the nerve may not again be involved in a dense irregular cicatrix. Given, however, the avoidance of these things, there is every hope of considerable restoration of function even in cases where the condition has lasted for many months, and it is tolerably certain that the seat of lesion will cease to be painful and that the trophic disturbances will disappear. The prognosis will largely depend on the state of the muscles, as learned by the character of the reaction of degeneration. Help in restoring muscular power and muscular nutrition may be gained by perseverance in electrical treatment.

Compression of nerves.—The same sorts of effects as those hitherto described may be due to pressure on a nerve trunk, by its involvement in inflammatory thickening, or by being itself inflamed. A man goes to sleep with his arm in such a position that his musculo-spiral nerve is subjected to pressure or exposure, or the same nerve may be injured in fracture of the humerus, either at the time by displacement of the bone, or later by the pressure of callus. Owing to its proximity to the humerus, this nerve is perhaps

more often subjected to local injury than any other nerve in the body, and operative interference may be desirable when the resultant palsy of the extensors is slow in passing away, or is uninfluenced by other treatment. The precise seat of the lesion is often indicated by marked local tenderness of the nerve trunk, and this having been carefully noted, the surgeon must expose the trunk and release it from its abnormal surroundings. It may possibly be buried in callus or bone, out of which it must be carefully dissected. Even when no such serious causes of mischief are discoverable, the nerve trunk may yet be found a little swollen, red, and adherent, and its simple release may be the means of allowing restoration of function to be begun, or to be hastened when it had come to a standstill. Avoidance of suppuration by antiseptic precautions is here again essential to success.

HERBERT W. PAGE.

NEURALGIA.—Derivatively meaning nerve-pain, the term neuralgia has been applied to all disorders in which pain referred to the peripheral nerves has been a prominent symptom. Thus it used to include migraine, which, in many of its characters, bears a strong likeness to neuralgia, but differs so much in others that it is generally regarded as a substantive affection. Sciatica is still regarded by some as essentially neuralgic in character, but it is probable that most instances of that disease are really due to a perineuritis, and should be so considered. The application of the term neuralgia would in this way be restricted to cases of functional nerve-pain, which, however, may originate in irritation of the sensory nerve terminations, and would exclude all cases of peripheral neuritis, whether idiopathic or depending upon injury to the nerve by wounds, or the presence of a tumor, etc., but, on the other hand, would include those instances in which nerve pain is reflected to a nerve-tract from peripheral irritation.

Symptoms.—The onset may be sudden, but more generally the patient becomes aware of certain anomalous sensations in the course of some nerve—*e. g.*, tingling, numbness, and pins and needles, the meaning of which he soon learns to appreciate. Actual pain is soon experienced, and this is paroxysmal and spontaneous or excited by movement, so that

the mere act of eating may cause the greatest discomfort. It is variously described as lightning-like, stabbing, boring, darting, or burning, and is generally confined to the distribution of one nerve, but in severe cases radiates into other surrounding nerve regions.

The pain is nearly always unilateral, and even when symmetrical it is usually much more intense on one side than on the other. Symmetry has been supposed to be the characteristic of diabetic neuralgia, but it is certainly present in other cases. In some subjects the pain is invariably referred to one nerve, which seems particularly vulnerable, but in others it is migratory, attacking first one nerve-tract and then another. The skin in the affected region is often hyperalgesic, so that very slight influences excite pain or exaggerate the neuralgic paroxysms. Tender points, the *points douloureux* of Valleix, are in about half the number of cases to be found in the course of the nerve. They are circumscribed, and correspond, as a rule, to the place where the nerve pierces a fascia to become superficial or emerges from a bony canal. Certain definite tender points are therefore to be found in the course of most superficial nerves. Trousseau has described a tenderness over the spinous process corresponding to the origin of the painful nerve, but it is not constant and may occur under other conditions.

Vasomotor disturbances are common, and usually lead at first to constriction of vessels, causing pallor, and subsequently to their dilatation and blushing, which may be accompanied with an increased secretion of sweat. If long continued, the congestion of the tissues leads to tumefaction and hypertrophy, changes which are sometimes associated with an erythematous condition simulating erysipelas.

When the pain is very severe, reflex spasm may be induced in the related muscles, and is especially liable to occur in those of the upper lip and nose.

The pain in an ordinary neuralgic attack is not constant, but subject to remissions and exacerbations of indefinite duration. The symptoms gradually decline, leaving a feeling of bruising and soreness, and may not recur for months or years until revived by some debilitating influence. Again, the attacks may be extremely frequent, and become more aggravated as they increase in number.

Distinct periodicity is sometimes observed in cases other than those of malarial origin.

According to the situation of the neuralgia, two classes are formed, superficial and visceral.

I. Superficial Neuralgias.—These are further subdivided into two groups, depending upon the area affected.

Neuralgia of the fifth nerve (Tic douloureux : prosopalgia).—This is the most frequent situation for neuralgia, which usually affects one or possibly two of the main divisions of the nerve, but very rarely all three at the same time. In severe cases the pain may radiate from one division to another, and even into other nerve tracts.

The *symptoms* are those of neuralgia generally, but vary to a certain extent according to the branch affected. The vasomotor and trophic disturbances are here most common, and spasmodic movements of the face are frequent in a variety of neuralgia which has been called “epileptiform tic.” This occurs in the degenerative period of life, and especially in those who have a very decided family history of insanity. It is characterized by the suddenness and intensity of the pain and its resistance to all forms of treatment, so that it generally persists for the remainder of the patient’s life, which it renders almost unbearable.

Neuralgia of the ophthalmic division is generally referred to the supra-orbital branch and has been called “brow ague,” on account of its once frequent dependence upon malaria. Tender points may be found in some of the following situations: A little above the supra-orbital notch, in the upper eyelid, at the junction of the nasal bone with the cartilage (long nasal branch), at some indefinite point within the orbit, and at the inner angle of the orbit (trochlear branch). The spontaneous pain is frequently very severe and exaggerated by the least muscular exertion of the neighboring parts, so that the act of chewing, sneezing, coughing, or blowing the nose is attended with the greatest distress. The skin is often hyperalgæsic, and the patient becomes unable to bear the simple pressure of his hat. Congestion of the conjunctiva, photophobia, and lachrymation not infrequently occur, and much more rarely blepharo-spasm and transient paralysis of the third nerve. Intense pain in the eye

or at the back of the eyeball may be experienced alone, or in conjunction with neuralgia of the parts around. When alone, it is usually binocular and dependent to a certain extent upon some error of refraction, and especially hypermetropia. When forming part of a wide-spread neuralgia, it is, as a rule, monocular, and is sometimes associated with amblyopia and constriction of the field of vision. The paroxysms of migraine are often accompanied with a neuralgic condition of this division of the trigeminal nerve.

Neuralgia of the superior maxillary division.—This nerve is much less frequently the seat of pain, which tends to be more concentrated and fixed in one of its branches than in the case of the ophthalmic division. The foci may be found where the infra-orbital nerve emerges from its canal, on the malar bone, at some indefinite point in the gum of the upper jaw, and rarely in the palate or upper lip. The paroxysms of pain are sometimes accompanied with an increased secretion from the mucous membrane of the nose and from the parotid gland.

Neuralgia of the inferior maxillary division generally extends over a considerable area, and painful points may be found in the course of the auriculo-temporal nerve, a little in front of the ear, at the site of emergence of the inferior dental nerve, and rarely at the side of the tongue or lower lip. Another tender point may be present a little above the parietal eminence, where an inosculation of various branches takes place; this and the supra-orbital are by far the most frequent foci in trigeminal neuralgia. Auditory hyperæsthesia may occur when the ear is involved in the pain.

Cervico-occipital neuralgia occurs in the area supplied by the posterior branches of the first four spinal nerves, and of these the great occipital (arising from the second) is most frequently affected. Foci may be found on any of the branches of the cervical plexus, but are most commonly situated a little above the parietal eminence and midway between the mastoid process and the spine. The pain is often bilateral, and may radiate over the back of the neck and scalp, which it renders extremely sensitive to pressure, into the territory of the fifth nerve. It is often due to exposure to cold.

Cervico-brachial neuralgia.—The nerves here implicated are the posterior

branches of the four lower cervical nerves and those of the brachial plexus. Tender points may be looked for in the axilla, at the inferior angle of the scapula, at the posterior border of the deltoid, in the bend of the elbow, on the outer side of the upper arm about three inches above the elbow, at the "funny bone," where the ulnar nerve passes in front of the wrist, or where the radial nerve becomes superficial on the lower and outer part of the forearm. The most common situations are the axilla, shoulder, and in the course of the ulnar nerve. In these cases the pain is usually paroxysmal and spontaneous, but is greatly intensified by muscular movements.

The most frequent causes are rheumatism and nerve injuries, which are capable of producing a true neuralgia, independently of setting up a neuritis. Dental caries has been supposed the cause in some instances.

Dorso-intercostal neuralgia affects the intercostal nerves from the third to the ninth, and especially the seventh, eighth, and ninth. Painful points are generally to be found at the intervertebral foramen near the middle line anteriorly, and midway between these two situations. The pain is generally constant, but liable to exacerbations, which may be induced by respiratory and other movements. It is frequently associated with herpes zoster. Infra-mammary pain, particularly on the left side, is of common occurrence in anæmic women, and in those who have become exhausted by over-lactation or menorrhagia.

Dorso-lumbar neuralgia is less common and the symptoms are more vague, although they bear a certain general resemblance to those of the intercostal variety. The principal foci are at the intervertebral foramina, near the middle of the crista ilii, in the hypogastric region, in the groin near the emergence of the spermatic cord, and in the scrotum or labium majus. This form of neuralgia is sometimes secondary to pelvic disease. Crural and obturator neuralgias, in which pain is referred to the front and inner side of the thigh respectively, are very rarely met with.

Neuralgia of the sciatic nerve is probably rather rare compared with perineuritis of that nerve; both conditions are included under the common term, sciatica (*q. v.*). The points of greatest tender-

ness are found a little above the sacrum near the spine, where the sciatic nerve emerges from the pelvis, at various points along the posterior aspect of the thigh, behind the head of the fibula, and on the outer and inner sides of the ankle. The neuralgic pains in these cases are referred rather to the distribution of the nerve than to its main trunk, and there is often a history of neuralgia in other situations.

Coccydynia.—This is a term which is used to designate pain in the region of the coccyx. It occurs especially in women, and in some instances probably depends upon neuralgia of the coccygeal plexus. Pain is most commonly excited by a long continued sitting posture and by defecation. It frequently proves very intractable.

II. Visceral Neuralgia.—This is of much less frequent occurrence than the superficial variety, but is generally of greater importance on account of the difficulty frequently experienced in diagnosing it from grave organic affections.

Cardiac neuralgia.—Pain referred to the region of the heart is often of neuralgic origin. It is sometimes the result of abuse of tobacco, and the infra-mammary pain complained of by chlorotic girls has already been noticed. Paroxysms of deep-seated neuralgic pain are sometimes accompanied by symptoms closely simulating those of angina pectoris. The diagnosis then becomes one of extreme difficulty, and is complicated by the differences of opinion which exist in regard to the nature of angina and the cases which should properly be included under that head. Some regard it as essentially a neuralgia, but this is probably erroneous, though it is extremely likely that some cases of so-called angina are really examples of neuralgia (*see* ANGINA PECTORIS; HEART, NEUROSES OF).

Gastralgia is one of the most definite examples of visceral neuralgia. The pain may be dull, long-continued, and liable to exacerbations, or acute and lancinating. It is referred to the region of the stomach, generally darts through to the back, and may be relieved or accentuated by the taking of food. The appetite may be lost or rendered capricious during the attacks; vomiting sometimes occurs, and constipation is the rule. Such cases are occasionally closely simulated by neuralgia of one of the intercostal nerves.

Other organs are sometimes the seat of neuralgic pains, *e. g.*, the intestines, liver, kidneys, ureters, ovaries, uterus, and testicles. The all-important symptom in these cases is deep-seated pain, which is dull, heavy, and constant, or acute and paroxysmal. It is unaccompanied with any evidence of organic change, but is sometimes associated with functional disorders. There is very often a history of superficial neuralgia, and the same causes contribute toward the development of both. Among women, who are the most liable to visceral neuralgias, the most important predisposing factors are hysteria and anæmia.

Diagnosis.—Many cases present no difficulty whatever. The pain is unilateral, restricted to a certain nerve-tract, paroxysmal or constant, and subject to exacerbations; there is a history of preceding attacks, and no evidence of neuritis. Such symptoms occurring in the region of the fifth nerve are almost certainly due to neuralgia; but it should not be forgotten that pain in the same region is sometimes the result of organic intra-cranial disease, which, however, usually gives rise to other symptoms, such as headache, vomiting, optic neuritis, and convulsions.

Difficulty may be experienced in diagnosing neuralgia of the extremities from peripheral neuritis in an early stage, especially if the affected nerve, or nerves, be deeply seated and out of reach. The occurrence at a later period of patches of anæsthesia, wasting of muscles with the reaction of degeneration, and of swelling and tenderness of the nerve trunk, when accessible, leaves no doubt that the case is one of peripheral neuritis.

The lightning pains of tabes dorsalis may possibly be mistaken for neuralgia. They are, however, more fugitive and migratory, and although one of the earliest symptoms, are generally associated with some other evidence of the disease, *e. g.*, the loss of the pupillary reflex, and the absence of the knee-jerks.

The pain of myalgia may be distinguished by its occurring only on movement.

When the nerves of the extremities are invaded by a growth, persistent and severe pain is experienced, combined with other symptoms, sensory and motor, pointing to structural changes in their trunks. In this case, the diagnosis from

neuralgia is not therefore generally difficult; but when the same condition is present in the thorax or abdomen, the diagnosis is often one of extreme uncertainty. Thus aneurism of the descending part of the aorta may give rise to no other symptom but pain, which is generally unilateral and persistent; but in most cases some other evidence of the nature of the disease is forthcoming. Tumors of the cord, pachymeningitis, and cancer of the bodies of the vertebræ may cause pain in the course of nerve-trunks; but other symptoms of these affections are generally present, pointing to the presence of organic disease.

The diagnosis of visceral neuralgia is not one to be lightly arrived at, and can only be positively made after a most careful examination has precluded the possibility of an organic lesion.

Prognosis.—This is favorable when the patient is comparatively young, has no marked neurotic predisposition, suffers from some constitutional condition which can be remedied or removed, and when the neuralgia has resulted from some over-fatigue or exhaustion, which can be prevented in the future. The slighter forms of the disease are the most amenable to treatment. When revived, or occurring for the first time during the degenerative period of life, neuralgia is apt to prove very intractable, and may resist every form of treatment. It does not tend to shorten the duration of life.

Pathology.—This has been the subject of much debate and difference of opinion. Where is the seat of the neuralgic pains? Is it in the peripheral nerve terminations, the conducting fibers, or in the ganglionic cells of the posterior roots, or in those of the central nervous system? Many considerations point strongly to its central origin, and this view is now held by many eminent authorities.

The immediate cause of the affection is probably an instability of the central ganglionic representation of certain sensory nerve-tracts, and this may depend upon an abnormal degree of irritability of the affected centers or upon a deficiency of their inhibition. It is possible that these centers discharge spontaneously; but it seems likely that they are also excited to action by afferent stimuli from the periphery, many of

which are so slight as in no way to affect consciousness.

Ætiology.—Neuralgia is often hereditary, and very frequently there is a general neurotic predisposition, a family history of insanity, epilepsy, chorea, or some other neurosis. The affection is rare up to the time of puberty, but afterward the tendency to it rapidly increases, and it becomes common during early adult and middle life. It is frequently developed or revived at the time of the menopause, and occurs with great intensity in the early period of degeneration, when the arteries are commencing to be atheromatous. After sixty its frequency diminishes. As a rule women are more frequently attacked than men. Among predisposed subjects no cause is so powerful in producing an attack as a debilitated condition, whether it result from anæmia, overlactation, menorrhagia, sexual excess, mental or physical overwork, worry, or from any other cause. In many such patients the slightest deviation from their normal standard of health is marked by the occurrence of neuralgia. It may also arise from alcoholism, lithæmia, and lead poisoning, but in all these cases it is necessary to exclude the presence of peripheral neuritis before making a positive diagnosis. Malaria is a potent cause of neuralgia. Tobacco smoking sometimes excites an attack in people who are very susceptible to its influence. The disease is often reflex in origin and dependent upon an irritation of the sensory terminations, frequently of some other nerve; the most common illustration of this is neuralgia of some branch of the fifth nerve excited by dental caries, but the same result may ensue from such a remote cause as injury to the ulnar nerve. Herpes zoster is, except in the young, usually accompanied by neuralgia in the immediate neighborhood of the eruption, and this may anticipate the development of the rash by a few days. The pain is often very severe, and in the old may prove intractable and persistent. Among other occasional causes may be mentioned rheumatism, rheumatoid arthritis, hysteria, nerve traumatism, and probably secondary syphilis. Of the direct exciting causes, none are so powerful as exposure to cold.

Treatment.—The indications for treat-

ment are (1) the removal of the cause and (2) the relief of the pain.

The diet should generally be liberal, containing a fair proportion of fat, and a small amount of alcohol at meal-times is often distinctly beneficial. Complete mental rest is necessary, especially in those whose neuralgia depends upon overwork or worry. Fresh air and moderate exercise should also be indulged in. Carious teeth should be looked for and extracted, particularly in cases of neuralgia of the fifth nerve. Rheumatism, gout, malaria, and syphilis must each be treated with appropriate drugs. Iron, to which cod-liver oil may be added, is valuable not only in anæmic states, but even when there is no evidence of a deficiency of hemoglobin. Arsenic is useful when the neuralgia is due to malaria or a cachectic condition, and also in cases of pain referred to the heart. The liquor sodæ arseniatis, in doses of m. iij-m. viij, is often better tolerated than Fowler's solution. Quinine is most efficacious in malarial neuralgia, and should be given, in a full dose of gr. v-xx, a little before the time of the expected attack. In smaller doses of grs. ij-ijj it is sometimes beneficial in other cases, particularly when the pain is in the region of the ophthalmic division of the fifth nerve. Nux vomica or liquor strychninæ is a valuable adjunct in many cases of neuralgia. Phosphorus has been highly recommended, and its administration is sometimes attended with marked success. It is best prescribed in capsules, or combined with cod-liver oil in the proportion of gr. j to $\frac{3}{4}$ jss, of which $\frac{3}{4}$ j is taken every four hours. Stimulants are often serviceable in relieving the pain, and of these the chief is alcohol. It is a dangerous remedy to prescribe, and should only be recommended when the patient seems possessed of sufficient self-control to resist taking it to excess. It must be given medicinally, in fixed quantities, to be taken only at meal-times. Other stimulants recommended are sulphuric ether and valerian.

For the relief of the pain, no drug is so potent as opium or morphine. Great care must be exercised in their administration, lest the opium habit be developed. Morphine is best given hypodermically, but in no case should the patient be trusted with the performance of the operation. Very small doses (gr. $\frac{1}{10}$ - $\frac{1}{8}$) have frequently the

desired effect, and should be raised very gradually when necessary. Given in this way, morphine sometimes not only relieves the pain, but ultimately cures the neuralgia. Belladonna is of most value in the treatment of pelvic neuralgia, and may be given by the mouth in doses of gr. $\frac{1}{8}$ – $\frac{1}{2}$ of the extract. The hypodermic injection of atropine (gr. $\frac{1}{120}$ – $\frac{1}{60}$) is more powerful, and is advantageously combined with morphine in some cases. Cannabis indica, in doses of gr. $\frac{1}{4}$ –1 of the extract, is often beneficial in the lighter forms of the disease, and sometimes also relieves the pain of severe cases. The injection of gr. $\frac{1}{2}$ –1 of cocaine is often attended with good results.

Among other drugs recommended are gelsemium (m. xv of the tincture, frequently repeated), butyl chloral (in doses of grs. vx or even grs. xx), and aconite (m. vx of the tincture) in cases of trigeminal neuralgia; muriate of ammonia (grs. x–xx) in intercostal and hepatic neuralgias; bromide of potassium, in 3 ss doses, when there is great restlessness and irritability, and antipyrine.

Local applications are often of service in relieving neuralgic pain. One of the most successful of these is counter-irritation, which is generally applied by means of fly blisters, about the size of a fifty cent piece over the painful points or by the side of the spine.

Electricity proves beneficial in the treatment of some cases, and the continuous current is most generally useful. It is intended only to act as a sedative, and the current should only be strong enough to cause a tingling and burning sensation. Sponges moistened with warm salt water should be used as electrodes, and placed in such a manner as to bring the affected nerve within the circuit. The direction of the current may be neglected. One of the sponges should be applied successively to the different painful points, but should not be raised from the skin until the strength of the current has been lowered to zero. Each application should last about ten minutes, and may be frequently repeated when relief is afforded. A strong current of faradism or voltaism is sometimes employed as a counter-irritant.

Other local applications are the liniments of aconite, belladonna, and chloroform, singly or combined; menthol, which may be used alone or mixed with equal parts of chloral hydrate and camphor; the

oleates of morphine and atropine, and the ointments of aconitine and veratrine. All these are at times of value in relieving the pain, but often prove quite useless. In a number of cases medicinal measures entirely fail, and the propriety of surgical interference has to be considered.

The operations of nerve-stretching and excision of a portion of the affected nerve are sometimes attended with relief, which, however, occasionally proves but temporary. Meckel's ganglion has been removed with good result in some cases of neuralgia of the second division of the fifth nerve.

WM. GAY.

Symptomatic Indications.—*Aconite* is often effective in neuralgias of a congestive or a rheumatic character, particularly when from cold, anxiety, or night watching; severe paroxysmal pains. *Belladonna* is useful after aconite, in congestive type, flushed face, hot cheeks, sensitiveness to light, noise, and movement, particularly in tic douloureux, sciatica, spinal irritation, uterine and dysmenorrheal neuralgias; pains appear and disappear suddenly. *Veratrum viride* is useful in one-sided neuralgias of the face or neck, with icy coldness of the affected part. *Arsenicum* is valuable in neuralgia of malarial origin or from debility, burning periodic pains, aggravated by cold, relieved by warmth, worse at night; restlessness, anguish, debility. *Phosphorus* is frequently effective in neuralgia from nervous debility, especially when due to mental overwork. *Cimicifuga* in neuralgia from cold, especially when through the eyeballs, renders excellent service. It is also useful in intercostal and ovarian neuralgia. *Sumbul*, in severe facial, sciatic, or ovarian neuralgia will frequently relieve when other remedies have failed. *Neuralgia* of malarial or catarrhal type will sometimes yield to *gelsemium*; the pains are cramp-like, drawing, tearing; worse from any exertion or mental effort. *Spigelia*, in facial neuralgia of rheumatic variety, does excellent service; great restlessness, jerking pains, worse from stooping. *Chamomilla* is valuable in sciatica, with shooting, tearing, throbbing pain, torpor of affected part, anger, impatience. *Ignatia* in hysterical and intercostal neuralgia with nervous erithism; sciatica.

NEURASTHENIA.—Literally, a loss of strength in the nervous system.

This term is now very generally employed to designate a morbid condition of the nervous system, which may manifest itself by a great variety of symptoms.

Perhaps the best equivalent in our language for "neurasthenia" is "nervous breakdown."

The various symptoms which constitute this morbid condition have been long known and accurately described, but attention has of late been specially drawn to the subject by the marked success which has attended the adoption of the method of treatment first advocated by Dr. Weir Mitchell of Philadelphia, and generally known by his name.

Those who have had most practical experience in dealing with these cases are disposed to restrict the terms "neurasthenia" and "neurasthenic" to a condition which is for the most part characterized by a clinical history somewhat of the following character:

The patient is usually a woman, but the condition has been met with in men. The family history is generally "neurotic," and the history of the patient, previous to the onset of the symptoms, is not uncommonly marked by the occurrence of various neurotic manifestations. Then an event commonly happens—it may be an illness of a definite kind (not infrequently it is some uterine affection), or a disappointment, a fright, dyspeptic troubles, or some cause of pain—which forms the starting-point for a prolonged period of ill-health, during which the original affection is quite overshadowed by the appearance of a great variety of pure neuroses. The patient becomes, as time goes on, more and more a chronic invalid, passing most of her time in bed or on a sofa, and either remaining indoors for years or perhaps going out occasionally in a bath chair. Dyspeptic troubles often predominate, and there may be complete loss of appetite and a professed inability to take more than a ridiculously small quantity of food, attended, as such a condition must necessarily be, by extreme emaciation and anæmia. Pain or sleeplessness usually leads sooner or later to a resort to chloral or morphine, to which drugs many of these patients become absolute slaves. There is generally a marked craving for sympathy and desire to attract attention, while emotional and hysterical manifestations are very common.

In another class of cases there is, instead of emaciation, an excessive formation of subcutaneous fat combined with anæmia, the mental condition being similar to that described.

Treatment.—The only mode of treatment of these cases which has been attended by success is that devised by Dr. Weir Mitchell, which will be found described in detail under the heading of **MASSAGE**.

In the cases marked by anæmia and an excessive formation of fat, a preliminary period of semi-starvation is recommended before the usual treatment by excessive feeding is begun.

J. K. FOWLER.

Symptomatic Indications.—*Calcis hypophos*, is useful in nervous prostration with depression of spirits, profuse night sweats, pale and emaciated countenance, habitual coldness and nervous congestion from debility. *Phosphorus* is valuable when the disease is the result of mental overwork or loss of animal fluids, much emaciation. *Phosphoric acid*, when there is general debility, with feeling of extreme weakness and prostration, great chilliness followed by cold, clammy sweats, great fatigue on least exertion, with cold sweats. *Zinc phosphide*, prostration from brain fag in business men, sleeplessness, depression of spirits, causeless worry. *Ignatia* is useful for sleeplessness, melancholy, disposition to weep from trifling causes, especially when caused by grief or worry. Page's Tonic Tablets are very useful in this affection.

NEURASTHENIA SPINALIS.—Weakness or exhaustion of the spinal nervous system. A functional neurosis of the spinal nervous system.

The condition is most common in youths and between the ages of twenty and thirty years, and is chiefly characterized by sensations of numbness and formication, with muscular fatigue and weakness. The subjects of the affection usually believe themselves to be suffering from some organic disease of the spinal cord. Sensations of stiffness, weariness, and pain are commonly complained of, and the condition is not unfrequently associated with hypochondriasis and insomnia.

Various causes of the affection have been assigned, including all those commonly credited with producing the vari-

ous neuroses, such as overstrain and sexual excesses. Erb considers that the spinal centers are in a state of exhaustion. The condition may last for a considerable period—as long as two years; but it is doubtful whether it ever passes on to organic disease.

Treatment.—Every endeavor should be made to discover the underlying cause of the affection. Massage and electrical treatment are likely to afford relief.

NEURINE.—See PTOMAINES.

NEURITIS (Peripheral Neuritis Multiple Peripheral Neuritis).—An inflammation of a nerve.

Neuritis, to which the word peripheral is generally though somewhat unnecessarily prefixed, may result from poisoning by alcohol, lead, arsenic, and bisulphide of carbon. It may occur as a sequel to typhoid and typhus fevers, variola, dengue, and intermittent fever, and perhaps plays a part in the causation of diphtheritic paralysis. It is sometimes due to syphilis, diabetes, and tabes dorsalis, and is probably an essential factor in anæsthetic leprosy and beri-beri. Now and then cases are met with which seem to be due to over-fatigue, exposure to damp and cold, or no cause may be discoverable; all such cases are termed idiopathic.

Symptoms.—Sometimes a single nerve is picked out, but more commonly the affection is widespread, and several nerves of both upper and lower extremities are symmetrically attacked.

The onset of multiple peripheral neuritis is generally rather rapid, sometimes apparently sudden, though, on inquiry, one can generally elicit a history of pins and needles, shooting pains, numbness or tingling of the legs and arms, dating from some weeks or months previously. In the commencement, the temperature may be raised to 103° or 105.5° F., but it soon declines to normal. The pulse is usually accelerated and rarely under 120, though in one case described it was only 48. The complaint is usually of paralysis, which is, as a rule, symmetrical, spreading from the periphery toward the trunk and falling with much greater severity upon the extensors than the flexors. Hence it is that one of the earliest, and at the same time one of the most characteristic, of the symptoms is dropping of the hands

and feet. The latter gives to the gait a high-stepping character, because the patient has great trouble in clearing the ground with his toes, which he endeavors to overcome by increasing the flexion of the thigh on the abdomen and of the leg on the thigh.

At a later stage the dorsum of the foot lies almost in a straight line with the front of the leg; the toes are flexed, and the great toe is curved downward and tucked under the second toe. Adaptive shortening of the flexor muscles and formation of adhesions between the tendons and their sheaths may now give rise to deformities—*e.g.*, talipes equinus or equino-varus, contractures of the wrists, fingers, and toes.

But meanwhile the paralysis, again attacking the extensors the more severely, has spread and affected the muscles of the thigh and upper arm, so that the patient lies in bed with his thigh flexed on his abdomen, the leg on the thigh, and the forearm on the upper arm. If, further, the muscles of the trunk and diaphragm be attacked, a fatal result generally ensues. The facial muscles are very rarely paralyzed, but the ocular not infrequently, especially the external recti.

There is rapid wasting of the muscles, and their faradic excitability is either lost or diminished. The galvanic formula may be retained, but diminished and with slow contractions; or more usually the reaction of degeneration is obtained. The mechanical excitability of the muscles is sometimes normal or even exaggerated, but in the later stages is probably always lost.

Muscular spasms and tremors are extremely rare, but have been described. Occasionally there is loss of muscular sense, and in such cases the gait becomes ataxic, and much unsteadiness results from closing the eyes and putting the feet together.

The knee-jerks are absent as a rule, but in some few cases have been retained, and in fewer still exaggerated. The plantar reflex is generally diminished, delayed, or gone; the cremasteric and abdominal, normal or diminished. The organic reflexes of the bladder and rectum are rarely affected, except as the result of great mental hebetude.

Various paræsthesiæ are complained of, and lancinating pains may give rise to much suffering. Hyperæsthesia of the

skin is not uncommon, but gives place ultimately to anæsthesia. A hyperæsthetic condition of the muscles, so that a slight pinch causes intense pain, is a very important and extremely common symptom of alcoholic paralysis. The transmission of pain, temperature, and tactile sensation is diminished. Very often the nerve-trunks are found to be considerably thickened and tender to the touch, and, when the arms are affected, a painful spot may be sometimes found a little internal to the upper angle of the scapula.

Vasomotor and trophic disorders are common, and include redness and œdema of the hands and feet, local or general perspirations, glossy skin, papulous, herpetic and bullous eruptions, perforating ulcers of the feet, affections of nails, and sometimes local asphyxia and even gangrene. Most important of all in this respect is the fact that bed sores are extremely rare. Many affections of the eye have been described, but only two, inequality of pupils and weakness of the external recti, are at all common. The rest, nystagmus, dilatation of pupils, amblyopia, central scotoma, contraction of the field of vision, optic neuritis, and atrophy, are more or less rare.

Some mental symptoms are present in most cases of alcoholic paralysis. They include insomnia, loss of memory (especially for recent events), want of power of attention and concentration, and emotional disturbances. Sometimes there is active delirium, with illusions and hallucinations, and occasionally delusions, which are narrated with much circumstantial detail and appearance of truth,

Such are the general symptoms of multiple peripheral neuritis, but considerable variety of grouping obtains according to their causation. In alcoholic paralysis the chief features are the mental symptoms, the muscular hyperæsthesia and the coincidence of the paralysis upon the lower extremities. In lead paralysis the forearms are first and chiefly affected, the supinator longus escapes, and sensory symptoms are conspicuous by their absence. In some cases of alcoholic and arsenical origin, ataxic symptoms predominate over the paralytic, and tabes dorsalis is closely simulated.

Diagnosis.—Multiple peripheral neuritis may be diagnosed from polio-myelitis by the presence of marked sensory phenomena, the proneness of the extensors

to be first and chiefly affected, and by the grouping of the muscular lesions, which correspond roughly with the distribution of certain nerves, and not with the arrangement of the functionally related centers in the spinal cord,

Multiple peripheral neuritis differs from tabes dorsalis in that there is no Argyll Robertson pupil phenomenon and no affection of the bladder, but, there is generally a paralysis with the reaction of degeneration, and the lightning pains play an altogether insignificant part as compared with the analgesia, anæsthesia, and muscular hyperæsthesia.

From Landry's paralysis (acute ascending paralysis) peripheral neuritis is sufficiently marked off by the presence of wasting and degenerative electrical reactions, the marked sensory disturbances, and by the progress of the paralysis, which does not attack first the legs, then the trunk, and lastly the arms.

Prognosis.—In alcoholic paralysis much depends upon how far the patient can be induced to give up the exciting cause. But under any circumstances the prognosis should be guarded, as a fatal result is not infrequent. It is sometimes due to complications—*e. g.*, chronic Bright's disease and pneumonia—but generally to respiratory paralysis.

In peripheral neuritis due to most other causes a favorable opinion can generally be expressed, and a complete cure anticipated. Sometimes, however, although the paralysis ceases to spread, the nerves fail to regenerate, and permanent contractures result.

Pathological anatomy.—Frequently nothing abnormal is discovered until the nerves are subjected to microscopical examination, when the changes are found to be entirely parenchymatous. The medullary sheath, at first slightly swollen, is broken up into fragments, between which finely granular protoplasm and new nuclei are seen. The axis cylinder may be similarly broken up or normal. At a later stage the sheath of Schwann contains nothing but a mass of globules—the remains of the medullary sheath—protoplasm, and nuclei. The axis cylinder has disappeared, or is represented only by a fine thread. Later still, variations are found in the size of the fibers, owing to the *débris* contained in the sheath of Schwann having been absorbed in parts. Finally, all that remains of the medullary

sheath and axis cylinder is absorbed, and nothing persists but the shrunken sheath of Schwann, with perhaps a little granular matter and nuclei less numerous than before.

In other cases the nerves are plainly enlarged and inflamed. Microscopically, the vessels are found engorged, the connective-tissue fibers and cells increased, and the nerve strands in a similar condition to that described, except that there is a large amount of fatty deposit, probably due to the distended vessels being unable to carry away the degenerated medullary sheath.

In extremely rare cases a segmentary neuritis exists, in which an alternation of normal and degenerated zones occurs. Such has been described in lead poisoning and diphtheritic paralysis, atrophy and fatty degeneration of muscles accompanying these changes in the nerve fibers. Usually, but at a varying time, regeneration of the nerve commences. Whether this is effected by a process of growth from the unaffected part of the nerve, or by the evolution of a new axis cylinder and medullary sheath from the degenerated mass contained within the sheath of Schwann, is still an open question, and keenly contested.

Treatment.—The general lines of treatment are indicated by a recognition of the cause. In the severer cases a water-bed is desirable, on account of the more equal support it affords and the comfort it gives the patient.

Salicylate of soda may be given during the initial pyrexia, and also in those cases which seem to be a rheumatic origin. Morphine is often urgently called for to allay the exquisite pains and hyperæsthesia; while, locally, hot or cold douches may be used, or lint steeped in chloroform may be pressed for a minute or two over the most painful points, or the limbs may be swathed in cotton-wool. The food must be light and easily assimilated, and in those cases in which there is much gastric disturbance nutrient enemata may be necessary. In cases due to the abuse of ardent spirits it may not be advisable at once to cut off the alcohol entirely, but it should be gradually diminished, and stopped as soon as possible. When the acute stage of the disease has passed, strychnine or arsenic often proves useful. The patient should be encouraged to cautiously use

the muscles of the affected limbs, and a properly conducted course of massage is of the greatest value at this time. Electricity also finds here one of its most beneficial applications; by its use the muscles are exercised, and their function and nutrition maintained until the nerves have had time to regenerate. One pole is put over the trunk of the nerve, and the other over the muscle, and the current is slowly interrupted. Contractions which will not respond to a long-continued massage must be treated by tenotomy, and adhesions of joints and tendons forcibly broken down.

WM. GAY.

Symptomatic Indications.—*Aconite, belladonna; arnica* when from injury.

NEUROSIS.—A convenient term, under which are grouped a variety of widely differing affections having this only in common—viz., that they are all referable to some derangement of the nervous system. The nature of the derangement is unknown. There must be no organic lesion of any part recognizable after death, either by the naked eye or by the aid of the microscope. Hysteria, neurasthenia, epilepsy, chorea, Graves's disease, neuralgia, spasmodic tic are a few of the more common neuroses. Improved methods of investigation have already done much to reduce the number, and will doubtless continue to further reduce it in the future. (See HEART, NEUROSES OF; HYSTERIA; LARYNX, NEUROSES OF; NEURASTHENIA.)

NODULAR RHEUMATISM.—See RHEUMATIC ARTHRITIS.

NOMA.—See CANCRUM ORIS.

NOSE, POLYPUS OF.—See NASAL POLYPI.

NERVES, TUMORS OF.—Rare, and do not often come under the notice of the surgeon. Nerve trunks are, nevertheless, liable to be the seat of tumors, called *neuromata*, although it would be more correct to apply this term to those only which are composed of nerve elements. These are very rare, by far the commonest kind of nerve tumors being those composed of fibrous tissue, the fibromata or fibrous neuromata. They start from some part of the connective tissue of the nerve, may

attain considerable size, and involve in great numbers the trunks of many nerves.

Sarcomata are not nearly as common as fibromata; they also spring from connective tissue. From connective tissue spring also the *myxomata*, which are commoner than sarcomata, and appear as transparent lobulated nodules.

The position which the nerve-trunk occupies in its relation to these various tumors depends largely on the precise point of origin of the growth, whether, for instance, it be at one side, and the trunk is therefore stretched over it, or actually within the center of the nerve, and the nerve fibers be spread out around it, or around the nerve, which therefore passes right through it. Tumors may be started by injury. Thus, and by the subsequent irritation, arise some of those bulbous swellings at the ends of nerves which have been divided accidentally or in amputation of a limb. These belong to the true neuromata, in which are *medullated* nerve fibers, although the greater part of them are formed of fibrous tissue. They may attain a large size.

The *non-medullated neuroma* rarely involves a nerve trunk.

Tumors of nerves, of whatever kind, are liable to cause pain or muscular spasm, either from direct pressure, or because the nerve is stretched over them, but it is difficult to say in any case what is the precise relation of parts without actual inspection. The tumor may be near, not of, a nerve; but in cases of multiple tumors, the fact that they follow the course of a particular nerve or nerves makes the diagnosis of nerve tumors more certain.

When the general circumstances indicate it, and the position permits, it is well to remove a nerve tumor. Whether this can be done without excising a part of the nerve also must entirely depend on their relations to each other; but when a portion of nerve has been unavoidably taken away, the surgeon should endeavor to suture the divided ends, so as to insure early union and the speedy re-establishment of conductivity.

NOSTALGIA (Homesickness).—A variety of melancholia chiefly met with in the young, and characterized by an intense longing to return home. It is chiefly seen in those coming from mountainous districts of moist climates.

Great exaltation of the imaginative faculty is the first warning, accompanied, it may be, by constipation and a sense of oppression and weariness. Febrile symptoms are sometimes observed, and a gradual decline of mental and bodily power may be followed by death from exhaustion. The subjects of this disorder sometimes commit suicide. See **MELANCHOLIA**.

NOSE, WOUNDS OF THE.—

Wounds of the nose may be inflicted from without, or from within through the nostrils. They may merely involve the superficial structures, or they may be complicated by division of the cartilages, or fracture of the bones.

The parts should be thoroughly cleansed, and brought as accurately together as possible with horsehair sutures and the wound sealed with collodion. Even where considerable portions of tissue have been detached, immediate union may be hoped for, as the blood supply of the nose, like that of the face generally, is very free, a fact which also explains the liability of wounds of these parts to be followed by swelling or erysipelas; but if much tissue has been lost, a plastic operation may be required. When a sharp instrument has been thrust up the nostril, care should be taken that no portion of it is allowed to remain in the wound; and as in such cases the cranium may have been penetrated and the brain injured, rest should be enjoined and the patient watched for any signs of intracranial inflammation.

Foreign bodies, such as peas, beads, etc., are often pushed up the nostrils by children, and, more rarely, hard substances, such as cherry stones and the like, have, during vomiting, entered into the nasal cavities from behind the palate. They may remain in the nasal passages for some time without being discovered, but the fetid discharge to which they almost inevitably sooner or later give rise should lead to a suspicion of their presence. They can generally be extracted by the forceps, or some of the ingenious screws or curettes invented for the purpose; or they may be freed by the nasal douche sent up one nostril and returned by the other; but Rouge's operation has sometimes been necessary for their removal.

Rhinoliths, or nose stones, are formed

from the deposition of phosphate of lime and mucus upon either a foreign body or hardened secretion. They give rise to much swelling, nasal obstruction, and a fetid discharge. They have been mistaken for osteomata, polypi, or even malignant growths. Removal with the forceps, previously crushing, if necessary, is the proper treatment.

NOSE, ACNE ROSACEA OF.—See ACNE.

NOSE, LIPOMA OF.—Integumentary and subcutaneous hypertrophy of alæ and tip of nose. Variable in extent and size. Attacks old men. Fibro-cellular and not fatty in structure.

Treatment.—Removable by suitable incisions. There is slight danger of erysipelas.

NOSE, LUPUS OF.—See LUPUS.

NOSE, EPITHELIOMA OF.—See CANCER.

NASAL CATARRH, CHRONIC.—

Causes.—Residence in damp, cold localities, repeated acute catarrhs, constitutional predisposition, struma, exposure to draughts, irritating dust, irritation of nasal polypi and specific causes. (See OZÆNA).

Signs.—Mucous membrane swollen, red, covered with secretion, mucous or muco-purulent, moist, or crusted. Sometimes a nasal tone of voice. Nose may be occluded by swelling of mucous membrane. Pharynx usually also affected.

Treatment.—Treat the cause. Use a nasal douche with solutions of chlorate of potash, common salt, phosphate of soda, and carbonate of soda, in hot water (hot water is preferable to lukewarm). Use this douche twice a day. Solutions should be just strong enough to taste saline. Later, astringents should be added in small quantities to the saline washes. Nose not to be blown for a short time after douching. The same fluids may be applied with an atomizer instead of the douche. Inhalation of vapor of chloride of ammonium. Insufflation of powdered alum, bismuth, and starch, etc. Iodoform powder sniffed up. Iodoform in vaseline (grs. xx- $\frac{2}{3}$ j), applied with a small brush far up each nostril. With regard to the douche, it should be noted that Professor Roosa of

New York strongly condemns it as too dangerous to the ears; and even Professor Cassels, who stoutly defends it, never trusts patient to use it himself. Sleep with a high pillow. Diet should be moderate. Fish and milk are admissible. Avoid all stimulants. Cod-liver oil at night is sometimes beneficial. Change of air and scene should be sought, if possible; preference being given to a dry, elevated region. Internally large doses of chlorate of potash may be administered.

Symptomatic Indications.—*Pulsatilla* is useful when the disease is of a simple character, without constitutional taint; greenish, yellow discharge; *hydrastis*, when the discharge is tenacious and stringy, mucous dropping from posterior nares; *kali bichrom.*; when the discharge is tough and stringy, with digestive derangement; *sanguinaria*, stinging, tickling sensation, irritative swelling, with or without free discharge; *arsenicum iodatum*, acrid, burning discharge, excoriating nose and throat; valuable in cases of long standing, with bloody and fetid discharge, scabs, and pus: *aurum*, offensive discharge, with soreness of bones of the nose; depression of spirits.

NOSE, TUMORS OF.—See NASAL POLYPUS.

NYCTALOPIA.—Faculty of seeing during the night, with privation of the faculty during the day. Affects both eyes at once, when idiopathic. Its duration is uncertain, and treatment very obscure. It is, however, a disease of nervous irritability, and one of excitement of the visual nerve in particular. The indications of cure will consequently be—to allay direct irritation in every way; to excite counter-irritation by blisters; and to gradually accustom the eye to the impression of light.—DUNGLISON.

NYMPHOMANIA.—Increased sexual excitement in the female, corresponding to satyriasis in males.

The *symptoms* may vary from mere extravagancy in dress, and a prurient tendency in conversation, to solicitation, suggestive attitudes, exposure of person, and masturbation. Nymphomania must be distinguished from erotomania—a disorder in which amatory conceptions predominate, but which finds neither the object nor the gratification of the desire in

sexual congress. It is a disorder of the imaginative faculty, and the affection is frequently fixed upon a person of the same sex. Pure nymphomania is a rare condition, and is allied to hysteria and hypochondriasis, but similar symptoms are not uncommon in both acute and chronic mania. The cause may be local, such as ascarides, hemorrhoids, or pruritus ani et pudendi, or uterine disease. Foreign bodies may be found in the vagina.

Symptomatic Indications.—*Platina* is useful when the disease is due to ovarian irritation; *stramonium*, when attended with nervous erethism, desire for light and company; *hyoscyamus*, when with desire to uncover and remain naked.

NYSTAGMUS is a name given to certain rhythmical involuntary movements of the eyeballs. It is usually present in both eyes and to the same degree. In the most common form the movements are purely horizontal, *i. e.*, from side to side, but sometimes they are rotatory. Usually, but not always, the movements are rapid. It is met with in certain local affections of the eyes, also in coal-miners who work in stooping or lying positions with dim lights, and in certain diseases of the nerve centers, *e. g.*, disseminated sclerosis and hereditary locomotor ataxy, in which affections it differs from the ordinary form in appearing only when the patient attempts to fix his eyes upon some object. It also occurs in meningitis, thrombosis of cerebral sinuses, tumor cerebri, and in cases of hemorrhage and softening, but is often seen apart from any other disease as a result of ophthalmia neonatorum, and in some cases it is believed to be congenital. It is common also in albinism.

OZÆNA.—An habitual and offensive odor from the nose, often amounting to a horrid stench, and almost always of a certain characteristic nature.

Causes.—(1) Strumous ulceration, (2) syphilitic ulceration, (3) necrosis from non-specific causes, (4) long-continued chronic catarrh, (5) foreign bodies impacted, (6) merely a peculiar tendency to decomposition of the nasal secretion.

Seat of Disease.—Any part of nasal walls, or of sinuses opening into nose. Amount of discharge very variable. Often all passes backward into pharynx.

Prognosis.—Unless cause can be detected and easily removed, ozæna is very

difficult to cure. May last for years. When complicated with bone-disease, deformity a frequent result.

Treatment.—Antisyphilitics for syphilis. Cod-liver oil, iron, arsenic, etc, for struma. Explore nasal cavity carefully with a strong light, a mirror, and speculum. Remove dead bone. Nasal douche with hot alkaline or salino-astringent solutions. Solutions of Condyl's fluid. Insufflation of mercurial powders—white or red precipitate, 2 grains to 1 dram of sugar. Iodoform (*see* NASAL CATARRH). Pugin Thornton strongly recommends spray of solution of borate and carbonate of soda. \mathcal{R} Sodæ carbo., sodæ biborat., aa \mathfrak{z} ij; liq. sodæ chlorinata, \mathfrak{z} ss- \mathfrak{z} ij; glycerini, \mathfrak{z} j; aq. ad \mathfrak{z} viij. In syphilitic ozæna of infants, syringe out nostrils, with hot saline solutions, and afterward insert melted ung. hyd. nitrat. dil. or iodoform ointment. Of course remove foreign bodies. Treatment of ozæna must be persevering, and used twice or even three times a day.

Symptomatic Indications.—*Aurum* is the most generally useful remedy, especially when of scrofulous or syphilitic origin; *mercurius iod.*, when with whitish, yellow, or bloody discharge, posterior nares affected, with raw sensation, nasal bones diseased; *iodium*, for ulceration with great fetor; *arsenicum*, for ichorous discharge, malignant cases, debilitated condition; *pulsatilla*, fetid, green discharge.

OBESITY (Corpulence; **Poly-sarcia**).—An excessive development of fat throughout the body.

The exact degree of fatness which constitutes obesity cannot be rigidly defined. The condition is most common in those who are past their prime, and especially among woman at and after the climacteric; but may be met with at all ages and in both sexes. Sometimes it is congenital, or appears soon after birth, but in the latter case it does not generally persist for more than a year or two. Heredity certainly plays a part in its production, and the influence of the nervous system in its causation is undoubted. Corpulence is common among the gouty and diabetic.

The main exciting cause of obesity is the ingestion of more food than is required for the due maintenance of nutrition, though it is undeniable that a great many large eaters never become corpulent, and

some stout people are remarkable for the smallness of their appetites. Alcoholic drinks, especially champagne, port, burgundy, and malt liquors have a marked effect in the production of adipose tissue. With excess of food should also be mentioned the lack of active exercise, as there is no doubt that the latter has a powerful effect in warding off the consequences of overfeeding. The taking of insufficient exercise may, in the first instance, be the result of mere laziness, but is afterward due to physical inability consequent on the corpulent state.

Of the part played by the different articles of diet in the production of the fat it is now generally accepted that no fat is produced directly from the carbo-hydrates, but that, when these are associated with an abundant supply of albumin, they cause fat to be separated and deposited from the albumin. The explanation of this is that the carbo-hydrates are very rapidly converted by combustion in the body into carbonic acid and water, and protect a portion of the albumin from total decomposition, and thus what survives is the fat. Ebstein has shown that when fats are given as food they are not nearly so liable to produce fat as are the carbo-hydrates, for, being less readily converted into carbonic acid and water, they do not interfere nearly so much with the decomposition of the albumin, and hence there is less probability of a residue of fat.

It must be understood that obesity has nothing to do with fatty degeneration, and that, as a rule, the viscera remain more or less free from disease, although often disturbed in their functions by mechanical causes; thus, the heart is often hampered by the layer of fat that accumulates on its surface. In children the fat is mostly subcutaneous, and in older persons tends to be deposited in the deeper structures.

Treatment.—In the first place, effect a considerable reduction in the total quantity of food taken, without, however, starving the patient, and then select a diet which the patient will be able to adhere to for the rest of his life. The carbo-hydrates are absolutely forbidden, sugar, sweets, and potatoes being the most important of this class; bread limit to the smallest possible quantity, while by no means forbid fat; it has often been found that even those who formerly disliked fat

could take it with relish and with relief to their dyspeptic symptoms. Allow all kinds of meat and vegetables, especially the leguminous kinds, with tea, coffee, and light wines. The following is a diet table:

Breakfast.—One large cup of black tea, about $\frac{1}{2}$ pint, without milk or sugar; 2 ounces of white or brown bread toasted, with plenty of butter.

Dinner (at midday).—Soup, often with marrow; from 4 to $6\frac{1}{2}$ ounces of roast or boiled meat, vegetables (leguminous) and cabbage; for second course a salad or some stewed fruit without sugar; two or three glasses of light white wine; immediately after dinner a large cup of black tea without milk or sugar, and a little fresh fruit is also allowed.

Supper.—In winter almost invariably, and in summer occasionally, a large cup of black tea without sugar or milk; an egg or a little fat roast meat, or both, or some ham with its fat, Bologna sausage, smoked or fresh fish; about 1 ounce of white bread well buttered; occasionally a small quantity of cheese and some fresh fruit.

The method which was successful in the case of the late Mr. Banting, and which now bears his name, excluded almost all fats, but gave a much larger allowance of albuminous food, and all other diets have been based on the same idea, viz., as far as possible to exclude the carbo-hydrates and fats.

Exercise and cold bathing are important elements of the treatment, and should be encouraged by every means. The medicinal treatment is of much less value; iron is useful, especially in cases where there is much anæmia, and iodine and the alkalies have been supposed to have a beneficial effect; the fucus vesiculosus, which has been much lauded, perhaps owes any virtues which it may possess to iodine. A purgative treatment, except on a very mild scale, cannot be recommended.

JOHN ABERCROMBIE.

ŒDEMA GLOTTIDIS.—See LARYNX, DISEASES OF.

ŒDEMA.—See ANASARCA.

ŒSOPHAGUS, DISEASES OF THE.—*Cancer.*—Cancer, as a rule, affects the upper or the lower end of the esophagus, rarely the middle. Epithelioma is the most common form at the upper end, scirrhus at the lower. The enceph-

aloid form also occurs. The growth may infiltrate the walls of the tube or form a distinct tumor, in either case causing difficulty in swallowing solid food. Ulceration is frequent, and in some cases goes on to complete perforation.

Symptoms.—The leading symptom is a gradually increasing obstruction to the passage of food, the localization of which is obvious to the patient himself. At the outset, solid and lumpy food only is obstructed; later, even pulpy substances cannot be passed; and, finally, the channel may become impervious to liquids. In the earlier stages, the obstructed food may pass after a while; if the passage be wholly impeded, it is regurgitated into the mouth. Regurgitation, from obstruction high up in the tube, is almost immediate; if the growth be low down, the impeded matters may accumulate, distending the tube, their return may be delayed for many hours, and the process may closely simulate gastric vomiting. The alkaline reaction of the returned matters, and the maceration and decomposition, instead of digestion, of the food, furnish a means of distinction. Pain is usually felt in greater or less degree at the seat of the growth, if it be in the neck; in the interscapular region, if it be in the thoracic portion of the tube. In either case it will probably be aggravated by attempts to swallow, especially solid food. It sometimes shoots into the shoulders or the sides of the chest. A sense of fullness or oppression in the chest, or actual dyspnœa, may occur from pressure of the growth on surrounding parts. As the disease progresses, the ejected matters contain much mucus, and sometimes blood.

Rapid loss of flesh and strength occurs, and the usual signs of the cancerous cachexia are manifest. Thirst is often a troublesome symptom.

Diagnosis.—See the end of the article.

The *course* of the disease is fairly rapid, life being seldom prolonged more than eighteen months from the first appearance of the symptoms. The posterior wall of the trachea may be infiltrated and perforated, such cases sometimes proving fatal by the supervention of gangrenous pneumonia. Perforation into the pleura may set up acute pleurisy.

Treatment.—In the early stages consists in excluding hard and lumpy articles from the dietary, and enjoining slow eating

and careful mastication. As obstruction advances, the diet will need to be gradually reduced to liquid food. At this point rectal alimentation had better be commenced. Tonics are often of service; also cod-liver oil if it can be taken; small doses of morphine may be needed to relieve pain. If the growth have ulcerated, cocaine, in the form of a lozenge or tablet, may be of use in relieving pain and spasm. Thirst, if present, is best assuaged by acid lozenges.

When obstruction becomes total, or threatens shortly to become so, the choice must be taken between maintaining life by means of rectal alimentation or resorting to an operative procedure.

The operative procedure which offers the greatest advantages is Mr. Symond's method of passing through the midst of the growth, by means of a bougie, a short tube, to the upper end of which is attached a small funnel. The tube, further retained in position by a silk thread passing out through the mouth, is allowed to remain *in situ* for several days, or even for a fortnight at a time, and affords a sufficient channel for the passage of fluid food taken in the ordinary way.

Benefit is in many cases obtained by the passage of a small bougie through the growth, creating a temporary channel, or by the similar use of a gum catheter, through which fluids can be poured past the stricture; but it must be remembered that every passage of an instrument through a malignant growth is attended with a risk of perforation.

The operations of esophagostomy in the case of a growth high up, or of gastrostomy in the case of one low down, offer other alternatives in surgical procedure, if the risk of perforation or other causes be held to prohibit any kind of intubation.

Fibrous Stricture is usually the result of syphilitic disease; more rarely, it occurs from cicatrization of wounds or simple ulcers. It may exist at any level of the tube.

The *symptoms* are the same as those of cancerous stricture, except that acute pain and ejection of blood are rarely present unless ulceration has taken place above the stricture; wasting is less rapid, and the special marks of the cancerous cachexia are wanting.

The esophagus becomes dilated and pouched above the stricture, and some-

times ulcerated from the irritation of the obstructed contents.

The *prognosis* is more favorable than in the case of malignant stricture. The progress of the affection is toward complete obstruction, but the result may be averted, or its consequences avoided, by operative measures, the success of which enables life to be prolonged.

Treatment.—The dietetic regulations described under CANCER being enjoined, the systematic passage of bougies must be commenced, with the object of maintaining the existing degree of patency of the tube and, if possible, of increasing it. A bougie should be passed weekly at least, and attempts cautiously made to increase the size of the instrument from time to time. If pain follow the passage, its frequency must be lessened, and attempts at dilatation suspended; and if there be reason to suspect ulceration about the seat of stricture, the esophagus must be left quiet for a while, and rectal alimentation resorted to, in order to allow the ulcer to heal. A powder of 10 grains of subnitrate of bismuth, placed on the tongue daily and slowly swallowed, may assist the healing of the ulcer, and a small quantity (from $\frac{1}{8}$ grain) of a morphine salt may be added if there be much pain or irritation. When the symptoms of ulceration have subsided, the use of the bougie may be carefully resumed.

Should the use of the bougie fail of its object, esophagostomy or gastrostomy, according to the seat of the stricture, will afford a chance of prolonging life.

Ulceration.—Except as a consequence of malignant disease or fibroid stricture, ulceration is rarely met with. Severe localized pain, greatly increased by attempts to swallow, and the ejection of mucus and blood, are its special symptoms. Perforation is the chief danger to be apprehended.

Treatment.—Rest may be given to the part by suspending deglutition and feeding per rectum. Powders of bismuth, with morphine if necessary, may be given as described above. The use of a bougie is attended with some risk of perforation.

Spasm (*Esophagismus*).—More or less spasm attends all organic diseases, and especially ulceration of the esophagus; but it may exist as a result of temporary irritation from hot or cold drinks, from irritating articles of food, or from the habitual use of spirits; it may be caused

by pressure on the esophageal nerves, or reflexly by affections of neighboring organs, or may occur as the result of a purely nervous condition, especially in hysterical women and hypochondriacal men. The spasm may be so slight as to produce only a trifling inconvenience and delay in swallowing, or so severe as to amount to complete obstruction. It is unattended with pain, and the patient is only conscious of its existence during attempts to swallow. It sometimes yields to repeated acts of deglutition. It is occasionally accompanied by spasm of the cervical or thoracic muscles.

Treatment.—Must be directed to the cause. If ulceration be discovered, it must be dealt with as described above. If errors in diet of a nature capable of producing spasm be detected, they must be amended. The hysterical or hypochondriacal condition must be attended to on general principles. In these last cases the systematic use of the bougie is often followed by marked improvement, a result possibly mental rather than physical.

Diagnosis of esophageal affections.—Difficulty in swallowing is the symptom which almost invariably attracts attention to an affection of the esophagus. “The food sticks,” is an expression commonly used by the patient. Regurgitation (“the food returns”) is a frequent accompaniment. In stricture of the lower end of the esophagus the patient’s perception of obstruction may be less distinct, and regurgitation, *described as vomiting*, may be the chief or only symptom detailed. The criteria of esophageal regurgitation are the reaction of the ejecta, which are alkaline, and the absence of the effects of gastric digestion in the articles of food brought back, which are merely sodden and partly decomposed. The dysphagia being thus localized in the esophagus, the distinction between organic and spasmodic obstruction must be made. The gradual onset of the symptoms, their constant character and localization, and the comparative degrees of immunity found in attempting to swallow food of varying degrees of fluidity, are indicative of the former; sudden onset, paroxysmal character, shifting of situation, relief afforded by repeated efforts of deglutition, and special susceptibilities to particular articles of diet, apart from their solidity or fluidity, suggest the latter.

The presence of much mucus in the ejecta points to organic stricture; blood indicates either cancer or ulceration.

Some clew to the seat and degree of obstruction may be obtained by observing the patient as he takes food or drink, and by auscultating, while he is drinking, the left side of the spine, from the neck to the lower dorsal region. The rapid gurgle heard over the healthy esophagus is checked at the seat of stricture, or replaced by a slow, dribbling murmur.

The presence or absence of hysterical or hypochondriacal manifestations, of evidences of syphilis, and of the cancerous cachexia must be taken into account, as well as the patient's family history.

A severe, sharp, and narrowly localized pain, increased by deglutition, is the special symptom of ulceration; a deep-seated and radiating pain, that of a malignant disease.

The neck and thorax must next be carefully examined for signs of dilatation of the esophagus, as well as for morbid growths. This having been done, and *the absence of an aneurism as far as possible ascertained*, a well-oiled bougie or esophageal tube may be carefully passed. If it meet with no obstruction, the occurrence of any localized pain in its passage, as indicative of an ulcer, should be noted. If an obstruction be experienced, the instrument should not at once be withdrawn, but by gentle, persistent pressure it should be made out whether the hindrance to its passage is permanent or temporary (*i. e.*, spasmodic), partial or complete. The length of tube passed will give a rough idea of the seat of disease. Any matters brought away on the tip of the instrument should be examined microscopically for cancer cells, and also for blood and pus. The possibility of the obstruction being due to the tube passing into a diverticulum from an otherwise healthy esophagus should not be altogether overlooked.

ISAMBARD OWEN.

Symptomatic Indications.—*Belladonna* is valuable in intense esophagitis, with great pain and distress; *cocculus* for esophagitis with intense burning; *ignatia*, spasmodic stricture; *veratrum viride*, spasmodic stricture; *Kali brom.*, inability to swallow liquids, although solids can be readily swallowed; *gelsemium*, sudden paralysis of esophagus.

ŒSOPHAGUS, INJURIES OF THE.—Wounds of the esophagus.—

May be divided into those made from without inward; and those from within outward. The first class includes incised, punctured, and contused; they may be made by knife, by sword, bayonet, by firearms, or by the surgeon. The second class may be due to accidental causes, as during the passage of a bougie, or by foreign bodies, or they may be made by the operation of internal esophagotomy.

Rupture of the esophagus may take place during vomiting, or as a sequence of malignant disease, or of stricture.

The symptoms vary, as the wound of the tube communicates with the exterior or not. If, in wounds of the neck, the esophagus has been opened, swallowing becomes impossible, and saliva, with any food taken by the mouth, appears at the wound.

The wound itself is at first pale, and covered with exudations; then granulations appear, and more or less complete cicatrization ensues. It may heal completely or result in a fistula.

Wounds which do not communicate with the exterior, such as perforations or ruptures, give rise to much acute pain at the moment of infliction. Ruptures are marked by decided prostration, and even collapse, which may end fatally. The accident is attended by bleeding, and is soon followed by swelling, which may be accompanied by crepitation and emphysema. Deglutition is difficult, or even impossible. If the lesion is in the thoracic part of the esophagus, abscess may form in the mediastinum and pleurisy may occur. These wounds are not necessarily fatal; their progress and result depend greatly on their situation and extent. These wounds are subject to such complications as beset wounds generally.

Treatment.—If practicable, the edges of the wound should be brought together by sutures. The head should be kept flexed in order to favor cicatrization. Feeding should be performed by the esophagus tube. In some cases, it may be necessary to leave the wound entirely at rest, and to feed the patient by the rectum. Rupture of the tube seems to be beyond the reach of direct treatment. Feeding must be performed by the rectum.

Foreign bodies in the esophagus.—These may reach the esophagus by the mouth, from the stomach, and by wounds of the neck, as seen in military practice.

Owing partly to the construction of the tube, the foreign body may become arrested at the opening into the pharynx, or in the cervical division of its course; in its thoracic portion where it joins the stomach, or at an intermediate narrowed part opposite the third dorsal vertebra (left bronchus).

Symptoms.—When a large and firm body is impacted in the pharyngeal aperture or cervical part of the tube, there follows: a sense of suffocation, which may be paroxysmal; violent efforts at deglutition and retching; coughing and spitting; turgid, congested face; starting eyes; lachrymation; anxious and frightened countenance; sweating and prostration. The patient may rapidly die, asphyxiated. A body less in bulk, but irregular and sharp-pointed, gives rise to acute pains and sensations of pricking or tearing, bloodstained sputa, and some of the above symptoms, but in a less severe degree. Aphonia and wheezing have been observed. If the body is small, as a fishbone, pin, or spicula of bone, there is proportionate dysphagia, increased by movement, pressure, and coughing. Muscular spasm of the canal is sometimes excited, and even spasm of the laryngeal glottis.

Physical signs.—When the foreign body is in the cervical part of the esophagus, and is of sufficient dimensions, it is within reach of (*a*) palpitation from the outside, (*b*) sight, or (*c*) touch by the finger in the mouth. The best and most satisfactory mode of examination is by the sound or bougie. The passage of the bougie or sound is of itself sometimes a mode of cure. The instruments commonly used are first, a flexible whalebone blade, armed with an olive-shaped end of ivory or metal; and secondly, the bougie, made of gum-elastic material; the former may elicit a sound or click. A sounding board or drum has been added to intensify the sound. It must be remembered that it is possible to pass the instrument by the side of the foreign body without eliciting any reliable indication of its presence. Auscultation has been employed as successfully to assist in discovering the situation of a foreign body, as in the diagnosis of stricture.

Prognosis and Pathological Anatomy.

—If the foreign body has been lodged in the canal for a short time only, the lesion (if any) will probably be transient and trifling; but if the body has been such as to have caused punctures and lacerations, then more or less inflammation and ulceration will ensue, and these secondary lesions will cause corresponding pain and discomfort for ten days or a fortnight. When a rough body has been impacted for some days or weeks, the consequences may be numerous and serious; for example, inflammation of the coats of the tube; ulceration, perforation, abscess, and periesophagitis. If these processes end in cicatrization, a stricture of an intractable character may ensue. The tube above the obstacle may undergo dilatation, while the part below it may contract.

Perforation, primary or secondary, of important structures along the course of the tube may lead to a fatal result, immediate or remote, as perforation of the heart, aorta, pericardium, trachea, pleura, or mediastinum. These perforations may occur by ulceration from close contact of the foreign body, or by consecutive abscess.

Treatment.—There are three ways by which the foreign body may be removed: first, by extraction through the mouth; second, by pushing it on into the stomach; and third, by esophagotomy.

In suitable cases, turning the body upside down may prove successful. The ejection of the body by vomiting is included in the first method. The act may be voluntary on the part of the patient, or induced by an emetic administered by the mouth or subcutaneously. When the body projects into the pharynx from the esophagus, the surgeon can remove it by his fingers or by suitable forceps.

If the body is small and situated lower down, it may be extracted by one of the instruments commonly in use, viz., the coin-catcher; De Graefe's crochet, which is very similar; a probang armed at the end with a piece of dried compressed sponge; a probang furnished at the end with a snare of horsehair; or the esophagus forceps of various forms, devised for general or particular service. The probang can only be used when the foreign body is of such form and limited dimensions as to permit the passage of the snare beyond it.

Forcible attempts at extraction may

aggravate the lesions of the walls, or even rupture them.

By propulsion: a bolus of food or foreign body which has passed as far as the thoracic part of the canal, may be gently and gradually pushed on until it passes into the stomach. It is unsafe to use force in this operation, for the mucous coat may be made to separate from its muscular coat, or the walls may be ruptured.

If all other means have failed to dislodge the mass from its position in the cervical part of the esophagus, the next resort is to the operation of esophagotomy.

Malformations of the esophagus.—Part of the esophagus may be deficient; there may be a communication between this canal and the trachea, or one of the bronchi.

These errors in development may be met with in monsters, stillborn infants, or in infants born alive and otherwise healthy.

Inability to swallow, or an attack of suffocation on attempting to swallow, should draw attention to the unfortunate state of the infant.

Internal esophagotomy has been practiced for stricture with the object of curing it, and with the view of facilitating treatment by dilatation. The mode of operating from above downward has been abandoned as inefficient, uncertain, and unsafe. Cutting from below upward is not looked upon with favor. It implies that an instrument can be passed through the stricture with facility. If it is open to treatment by the esophagotome, it is also open to the treatment by gradual dilatation. The use of the cutting instrument has these additional objections, that in obstructions in the lower half of the canal there is no little danger of wounding vital structures, and that in long, dense, fibrous strictures the incision is insufficient. The safe use of this instrument is limited to short, annular strictures in the upper part of the tube, where also gradual dilatation proves equally efficient and less perilous.

External Esophagotomy, or esophagostomy, is reserved for those cases of impassable stricture limited to the upper part of the cervical region of the canal. It is obvious that the operation is only practicable below the stricture, and when that part is accessible on the neck.

When inanition is progressive, the stric-

ture is below the upper part of the esophagus, and is impassable; then the only remaining resource is in the operation of gastrostomy. The operation is very often too long delayed.

Esophagotomy.—External esophagotomy is practiced for two conditions: first, when a foreign body cannot be otherwise extracted; and, secondly, for cancerous or fibrous stricture of the upper extremity of the canal which is practically impassable.

The patient should be placed in a recumbent posture, the head and neck slightly elevated and extended, and the face turned toward the right side.

The external incision is to commence at the upper border of the thyroid cartilage, and to be extended downward parallel with the anterior border of the sterno-mastoid muscle, toward the sterno-clavicular joint. The dissection is to be conducted carefully between the depressor muscles of the hyoid bone and the sheath of the great vessels of the neck. The omohyoid is to be drawn outward or cut through; the thyroid body and trachea, with the muscles, are to be drawn inward. The following parts are to be sought for and protected: the thyroid artery above, and the recurrent laryngeal nerve, where it enters the larynx, between the esophagus and trachea. When the esophagus has been reached a suitable sound may be passed by the mouth, if the esophagus is permeable, and made to project its walls into the wound. The foreign body may prove a good guide. The opening into the canal should be small at first, then enlarged to admit a finger, and subsequently extended gradually, regard being had to the safety of the recurrent laryngeal nerve. If the operation has been performed for stricture, the incision may be extended through it. Silk sutures may be passed through the edges of the esophageal wound to facilitate examination of the interior and the passage of the instruments. The object of the operation having been attained, the edges of the external incision should be attached to those of the wound in the esophagus. It is not desirable to close the external wound. The patient is to be fed by a tube and with fluid nourishment.

The results of this operation, except when performed for foreign bodies, have not been at all encouraging. The percentage of deaths has been estimated at 59.37.

Gastrostomy (*q. v.*) is less unfavorable in its results, having yielded a mortality of 29.47 per. cent.

JOHN CROFT.

ODIUM ALBICANS.—See THRUSH.

OLD AGE.—The period of life in which the degenerative changes that set in after middle age become obvious.

This period does not correspond to any definite term of years. Its time of commencement is matter of inherited and individual idiosyncrasy, modified by external circumstances. It is particularly hastened by want, confinement, hardship, and mental anxiety, by exposure to nitrous or mercurial fumes, and by the habitual use of morphine. Some persons may be said to be old at forty, or even earlier; others can hardly be so regarded at seventy.

The following are the more marked anatomical and physiological changes of this period of life. The bones become lighter and more brittle, without reduction in size, owing to absorption of the cancellous tissue, and, later, of the compact portions from within outward. Fractures are in consequence more readily produced, especially in the spongy portions of the bones, and noticeably in the neck and trochanteric region of the femur. The cartilaginous parts of the skeleton are thinned, producing a slight loss of height. The alveolar processes of the jaws are absorbed, causing the teeth to loosen and drop out, and the angle of the lower jaw is enlarged. The face is thus shortened and the chin thrown into increased prominence. The voluntary muscles waste, causing a loss of athletic and respiratory power, a hesitating and staccato articulation, and an increased difficulty in maintaining the erect posture. The resulting stoop of the back may cause a further change in the shape of the vertebræ. The cardiac muscle shares in the general wasting. The heart's beat becomes weakened and often intermittent, but its rate is not materially altered. The involuntary muscles also diminish, lessening the powers of digestion, inducing constipation, detracting from the power of circulatory and ophthalmic accommodation, and diminishing the expulsive force of the bladder. A general atrophy of elastic tissue renders the skin wrinkled and less extensible, augments the circula-

tory difficulty, permits of passive dilatation of the lung vesicles, and hinders the expulsion of mucus from the air sacs and bronchi, while dwindling of the gastric and intestinal glands further lessens the digestive powers. Adipose tissue is absorbed and the cutis is thinned; the cuticle and its appendages become friable and the roots of the scalp-hairs undergo atrophy, while the color of the hair, which usually begins to be discharged in middle life, is still further lost. The lungs, the spleen, the lymphatic glands, the uterus and the ovaries undergo more or less atrophy, and the functional powers of the testes diminish or cease. They may be retained in some degree to an extreme old age. The brain and spinal cord shrink in size, reflex action becomes sluggish, the power of mental concentration and the memory for recent events markedly lessen. The fluids of the eye undergo partial absorption, lengthening the focal distance, and thus correcting myopia, if present, or inducing presbyopia in the healthy eye.

The above changes are normal to the advanced stage of life, but the old are subject to other degenerative alterations of tissue, which may properly be considered *morbid*. The walls of the arteries are liable to fibroid thickening, atheroma, and calcification, by which the passage of blood is impeded. Thrombosis and embolism, and a dry form of gangrene ("senile gangrene") are frequent results of the state of the vessels, and the risk of cerebral hemorrhage is always present. The valves of the heart are often atheromatous or calcified, and increase the circulatory trouble. The costal cartilages in many cases calcify and become rigid, so that respiratory movements are impeded. A ring of degeneration ("arcus senilis") is often seen near the margin of the cornea, and cataract is common. The atrophy of the brain may be carried to the point of actual dementia; that of the lungs may extend to serious emphysema. Deafness and paralysis agitans are common, and the wasting of the heart muscle becomes a source of serious danger. The joints are liable to the changes known as rheumatoid arthritis, though this lesion more commonly commences in middle life. Cirrhosis is seldom delayed to old age, but granular degeneration of the kidney not seldom commences in it. A form of glycosuria,

unaccompanied by special symptoms or special danger to life, is often met with. The prostate is liable to fibroid enlargement, causing retention of urine and the train of results dependent on it.

Old age is to a marked degree exempt from acute rheumatism, enteric fever, diphtheria, and tubercular diseases. Acute affections generally are less common than in earlier life, and, when they occur, are apt to assume an asthenic or an insidious form, and readily lapse into chronic maladies. Few aged people escape chronic rheumatism in some shape or another. Gout, though its onset is most usual in middle life, may make its first appearance at any age. Cancer is common in advanced life, but runs a slower course than when it appears at an earlier period, and in extreme old age has been known to dry up and wither. The aged are especially subject to catarrhs of the air passages, which are prone to persist and extend and to set up a form of lobular pneumonia.

Wounds in the old are liable to slough, but, apart from this risk, heal even more readily than in middle life. Fractures, except those about the neck of the femur, repair with facility.

A fatal issue may occur in old age from general enfeeblement of the vital functions without predominant lesion of any one organ. Cerebral hemorrhage and cardiac failure are frequent modes of death; but bronchial catarrh, leading on to lobular pneumonia, is responsible for the largest mortality at this time of life.

Professor Humphry has lately shown that longevity is, to a large extent, hereditary. Women have a greater tendency than men to long life, which is not necessarily forfeited by repeated parturition. A robust frame, a bodily and mental stature above the average, the power of sound sleep and of speedy recovery after fatigue, good reproductive power, and long retention of the hair of the scalp are the criteria of the capacity for prolonged life. Serious illnesses, as might be expected, are calculated to lessen the prospect. The very aged are seldom found to be the offspring of immature marriages or to have contracted such themselves. The elder children of a large family appear to have an advantage over the younger.

The habits of life which, according to the same authority, most conduce to length of years may almost be summed

up in the phrase, "temperance in all things." Moderate and continuous activity of mind and body, moderate and regular hours of sleep, a somewhat spare diet, little or no indulgence in alcoholic liquors, and in particular a guarded use of flesh food, are the most salient points. It is noticeable, also, that the very old have seldom been in the habit of resorting much to drugs during life.

"In the *treatment* of aged persons, the failing powers of digestion, of repair, and of vasomotor accommodation must be constantly kept in mind. The need of regular and sufficient hours of sleep, and of a period of rest after any unusual demand upon the brain, muscles, or heart, must be duly impressed upon the patient.

The enfeebled digestive powers require a restriction of the habitual amount of food, and, in many cases, a prolongation of the intervals between meals, and between the last meal and the hour of retiring to rest. With this restricted dietary it may be advisable to have nourishment ready for administration during the night in case the patient should be awake, and to give some light refreshment, a cup of milk with tea or coffee, or one of beef-tea, immediately on waking in the morning.

The dietary of the elderly should consist in less degree of meat, and in larger degree of milk and farinaceous matters, than that of the young or middle-aged. The stimulus of much flesh food is neither needed by the habits nor compatible with the diminished capacity for muscular and cardiac effort of old age, while the powers of nitrogenous elimination may be readily overtaxed. Milk, owing to the diminished acidity of the gastric secretion, is better borne by the old than by the middle-aged. Fatty matters, on the other hand, are less easily tolerated, and should be taken with caution. The teeth should always be looked to, and, if they are insufficient for mastication, either artificial ones supplied or food given in such a condition as to be independent of them. Severe dyspeptic symptoms often arise from imperfect mastication in the aged. Malted and predigested aliments may be required to supplement the diet as age advances, but it is remarkable upon how little food the very old contrive to support life.

Though the popular idea that old people require alcoholic liquors "to keep

their strength up" is not borne out by exact observation, these liquors are of considerable service as stimulants to the failing appetite and digestion in advanced old age. White wines seem to be more appreciated by the very old than the red varieties, and brandy is the most valuable form of distilled spirit (*see* ALCOHOL; ALCOHOLIC LIQUORS). Alcohol serves another useful purpose in old age in combating restlessness and inducing an inclination for necessary repose and sleep.

The reduction of the power of vascular accommodation renders the aged very susceptible to the influences of changes of temperature, which must be guarded against by the use of sufficient or even superfluous clothing, the under-garments being of flannel, and by the practice of carrying extra wraps to be used in case of emergency. Care must be taken of the head and extremities as well as of the trunk. A cardigan jacket, with close-fitting sleeves, and a light silk cap, to be carried in the pocket, are useful additions to the equipment of old age, and the thickness of the footgear should always engage our attention. The liability of the aged to bronchitis should dictate caution in breathing cold or damp air, and the onset of catarrh of any kind should never be neglected.

The condition of the arterial walls should not be overlooked, and, if a tendency to degeneration be observed, the patient should receive a special caution against sudden or severe muscular exertion, heavy meals, and neglect of the state of the bowels (*see* CONSTIPATION).

Finally, we must never forget that the life of the aged, even when they appear to present striking examples of robust health, is held on but a frail tenure. Shocks and disturbances that would pass unheeded in earlier life may precipitate an impending and irrevocable catastrophe in an individual seemingly vigorous and well.

ISAMBARD OWEN.

OLFACTORY NERVE, DISEASES

OF.—Alterations in the sense of smell may be considered under (1) Loss of smell due to peripheral causes. (2) Subjective sensation of smell produced by central changes in the brain. Besides these two conditions, hyperæsthesia of smell, occurring in hysteria and insanity, and perverted sensations of smell have

been described, but they are not of sufficient importance to require a special notice.

1. Loss of Smell is caused: (*a*) By diseases which affect the nasal cavity, such as acute or chronic catarrh of the nose, polypus obstructing the nasal passage, paralysis of the fifth nerve, producing dryness of the nasal mucous membrane—this last condition is also brought about in hemianæsthesia involving the mucous membrane of one-half of the face, due to lesions of the posterior part of the opposite internal capsule—and also occasionally by a complete paralysis of the facial nerve, which prevents the nostrils being opened in the act of sniffing. (*b*) By lesions involving the olfactory nerve itself, from caries of the bones due to simple meningitis or syphilis, or from abscess of the olfactory bulb or tract is also liable to be compressed or destroyed by tumors in the anterior fossa of the skull, and also to be torn by falls or blows on the head. The loss of smell may be complete or partial, and may involve one or both sides of the nose. In testing the nerve, aromatic substances such as oil of cloves, and not pungent bodies like ammonia, which act on the sensory nerves of the nasal cavity, should be used.

Prognosis in loss of smell is favorable in cases due to local causes, but in cases where the olfactory nerve has been destroyed by tumors or lacerated by injury the prognosis is necessarily unfavorable.

Treatment is that for the disease causing it. The constant current, with the negative pole inside the nasal cavity, is said to have done good in some cases.

2. Subjective sensations of smell have been observed, as warnings before some epileptic fits. They are usually described as of an unpleasant nature, such as "chloride of lime," "burning rags," or "dirty water." In some of the cases the sense of smell has not been affected, and, in those in which an autopsy has been made, a tumor has been found in the hippocampal lobule in the anterior end of the temporo-sphenoidal lobe of the same side—the part assigned by Broca and Ferrier to the sense of smell.

C. E. BEEVOR.

OINOMANIA.—See ALCOHOLISM.

ONYCHIA.—See NAILS, DISEASES OF.

ONYCHIA MALIGNA, a term applied to a specific form of ulceration commencing about the matrix of the finger-nails. The disease is almost confined to children under ten years of age, and is not of frequent occurrence. It usually has its origin in a pinch or a crush of the finger-end, such as may either bruise the matrix or loosen the attachments of the nail. Soon after the injury the finger-ends swell and fluid is effused beneath the nail, which latter loses its natural color, and becomes thin and flattened at the end, occasionally curled up laterally. As it grows, it turns upward from its normal attachment, and exposes beneath it an exceedingly painful foul ulcer, having a characteristic and peculiar fetor; while the finger-end becomes enlarged, and its integuments become hardened, shining, and of a livid red color.

Recovery is rare without treatment, the disease may continue its progress until the last joint of the finger is lost, or the phalanx necrosed by extension of the ulceration.

Treatment.—First in importance is the evulsion of the nail, if it be loose, displaced, or discolored; subsequently the ulcerated surface may be dressed with black wash, or a lotion formed of two drams of the liquor potassæ arsenitis to an ounce of water. The arsenical application appears to exercise some specific effect, and rarely fails. Such constitutional remedies as seem suitable to each case must at the same time be employed; chlorate of potash, with bark, appears to be of frequent use. Amputation has been occasionally practiced as a cure for this disease, and a mercurial course has been recommended. The former is an unnecessary mutilation, and the latter is not required in this form of the disease.

T. SMITH.

Symptomatic Indications.—*Silicea* is very valuable, often arrests, especially useful when bone is affected; *calcium sulphide* controls suppuration and mitigates suffering; *stramonium* is useful to relieve excessive pain.

ONYCHOGRYPHOSIS.—An irregular clawlike or horny growth of the central portion of the nail, most frequently found in the little and great toes, caused by the hypertrophy of the papillæ of the matrix, and of the nail bed in front of it, the re-

sult of continued pressure. The papillæ, sometimes two or three lines in length, project into the horny mass, forming a tender, vascular core imbedded in greatly thickened epithelial layers, the nail becoming ridged, brittle, and opaque.

ONYX.—See CORNEA, DISEASES OF.

OOPHORITIS (Inflammation of the Ovaries).—It is believed that the ovaries are subject to acute and chronic inflammation. Our knowledge of acute oöphoritis is almost entirely derived from post-mortem examination; chronic oöphoritis, on the other hand, is inferred from clinical phenomena.

The first stage is one of *hyperæmia*. This is physiological during menstruation, sexual intercourse, and pregnancy. Menstruation is often accompanied by ovarian pain; sexual excesses produce similar pain, and in pregnancy ovarian pain is common. It has been supposed that ovarian congestion may lead to hemorrhage into Graafian follicles, interfering with their natural maturation and bursting, and thus entail sterility; but of this there is no proof. Nor is there any evidence to show that cystic disease of the ovaries is at all dependent on their congestion.

Hemorrhage may take place into the follicles or into the stroma. How to draw the line between the normal hemorrhage which accompanies the bursting of a Graafian follicle and a hemorrhage slightly in excess of that, we do not know. Nor do we know why some follicles into which there has been hemorrhage burst, and others do not; nor what are the symptoms, if any, which distended but unruptured follicles cause. There are rare cases in which the ovary is found enlarged and ruptured, in which fatal hemorrhage has occurred. We know nothing definite about the pathology of such cases; but analogy would make us suspect them to have been due to twisting of the pedicle of a small cystoma.

Hemorrhage into the stroma takes place in diseases in which there is a tendency to hemorrhage, such as purpura, scurvy, typhus, septicæmia, etc. The hemorrhage may be confined to the production of small points of effused blood, or it may be so great that the organ resembles a sponge soaked in blood. These large

hemorrhages are rare, and are probably due to obstruction to the return of blood from the ovary.

Small hemorrhages into the ovary are probably absorbed without leaving any trace behind. Large ones may lead to complete destruction of the parenchyma and to suppuration, the organ being converted into a brownish pulp.

Hemorrhage into the ovary, either follicles or stroma, is not known to produce any symptoms unless rupture takes place. If there be any, they are usually overshadowed by the symptoms proper to the disease which has caused the hemorrhage, or by those which are consequent on rupture; so that it has generally been discovered unexpectedly on post-mortem examination. Hematoceles have been suspected to be due to this cause, but no case has been published in which such a diagnosis has been made and verified.

More advanced changes due to oöphoritis have been described. These are of two kinds: *Parenchymatous* or *Follicular*, and *Interstitial*. They seldom exist separately, and both forms are usually accompanied by some inflammation of the surrounding peritoneum.

In **follicular inflammation**, the contents of the follicles become first turbid, then purulent. When extensive, the interstitial tissue becomes also affected.

Follicular oöphoritis is said to be not rare in the acute exanthemata, in cholera, relapsing fever, septicæmia, arsenic, and phosphorus poisoning. Occurring in these conditions, it has no special symptoms, and cannot be recognized clinically. Occasionally, cases are seen of persistent ovarian pain following one of the acute exanthemata, and possibly due to acute inflammation of the ovary during the height of the disease; but a connection of such pain with persistent change in the ovary has not yet been shown.

Interstitial oöphoritis has been described as presenting three forms or degrees—(a) serous, in which the ovary is infiltrated with serous fluid; (b) suppurative or hemorrhagic, in which there are either yellow lines running from the hilus, or these lines have coalesced, forming small cavities containing pus; and in the tissue between these purulent collections are small capillary apoplexies; (c) necrotic. In the worst and most acute cases the organ is converted into a brown

pulp, its structure being no longer recognizable.

Interstitial oöphoritis may arise by the extension of follicular inflammation. Its most common cause is labor. It is then usually part of general septicæmia or pyæmia. But it may be a primary disease, existing by itself; this, however, is exceedingly rare.

Suppression of the menses, and gonorrhea, are described as causes of oöphoritis. There is no evidence that either of these conditions leads to any change in the substance of the ovary, although they may lead to inflammation of its peritoneal covering—*i. e.*, peri-oöphoritis.

It is believed that oöphoritis may lead to the production of large abscesses of the ovary. But in cases of large ovarian abscesses it is possible and probable that they may have been suppurated cysts.

When well-marked changes, such as suppuration and disintegration, are seen, there can be no doubt of their pathological nature. But such conditions as hyperæmia, slight hemorrhages, atrophy of follicles, thickening of the albuginea, cicatrices on the surface, are all accompaniments or consequences of the natural ripening and bursting of follicles; and we do not yet know how to draw the line between physiological and pathological changes of this kind. It has been supposed that follicular inflammation may lead to shrinking and obliteration of follicles, and to thickening of the surrounding stroma, and the formation of cysts; but of this there is no proof.

Hypertrophy of the ovary has been described as a result of oöphoritis leading to overgrowth of the stroma with destruction of the follicles, the organ becoming enlarged, it may be to the size of the fist, but retaining its natural shape. Some might call this the production of a tumor. The connection between either hypertrophy of the ovary or solid ovarian tumors and previous inflammation has not yet been demonstrated.

Cirrhosis of the ovary.—Destruction of the follicles, with shrinking of the stroma and puckering of the surface, has been described as a result of the inflammation. A condition similar, but, it is said, less advanced, occurs in women who have had many children. We have as yet no criteria by which to distinguish between a cirrhotic ovary, the product of

inflammation, and one which was originally small, and has become smaller as the result of age.

Diagnosis.—Acute oöphoritis may be suspected if, in one of the diseases which are apt to be complicated by it, there be much tenderness per vaginam or per rectum in the situation of one or both ovaries. But no case has been reported in which it has been diagnosed, and the diagnosis verified. All the forms of disease which have been described are rare, even in the experience of expert morbid anatomists; and the descriptions, even in the best standard works on gynecology, are based on very few cases. Until we can diagnose the affection it is unnecessary to discuss treatment.

Peri-oophoritis, or inflammation of the peritoneum covering and around the ovary, is fairly common. It may be acute, subacute, or chronic. It leads to the formation of adhesions. These may be simply a few thin filaments, or the ovary may be imbedded in dense fibrous tissue. The ovary may be displaced and fixed in its altered position.

The most common cause of peri-oöphoritis is inflammation of the tubes, either catarrhal, as from suppression of menses, or gonorrheal. If the tubal disease persist, there may be repeated attacks of peri-oöphoritis. The symptoms are those of slight perimetritis, and the signs those of perimetritis limited to the situation of the ovary: viz., a fixed tender lump at the side of and behind the uterus. Its treatment is that of perimetritis.

Chronic oöphoritis and ovarian pain.—Some authorities on the diseases of women teach that chronic oöphoritis is very common, others seldom, if ever, mention it. The explanation of the apparently contradictory teaching is, that there is a group of symptoms very commonly met with, the anatomical condition underlying which is unknown. Some think that this group of symptoms warrants the inference that inflammation is present, and they call it oöphoritis; others do not, and they call it ovarian pain. There is no conclusive evidence either one way or the other. The symptoms are persistent burning, aching, pain and tenderness, lasting for months or years, varying in severity, sometimes intermitting, usually presenting a monthly exacerbation. The site of the pain is

pointed out by the patient as a spot about two inches internal to the antero-superior iliac spine.

Those who think this group of symptoms justifies the inference that inflammation is present, point to its persistence and its characters, which are unlike neuralgic pain, and to its relief by treatment like that which benefits pelvic inflammation. Against this view is the fact that no kind of chronic inflammation of the ovary has been demonstrated, either by post-mortem examination or by abdominal section, to exist in these cases. There is no doubt that symptoms like these are produced by peri-oöphoritis, but in some of the worst cases of chronic ovarian pain, the uterus and ovaries are quite movable and non-adherent. Further, removal of the ovaries does not quickly cure these patients, if it cures them at all.

There is a physical sign described by the older authors as evidence of oöphoritis—viz., the occurrence, with pain and tenderness in the ovaries, of swelling, which increases, and then diminishes and disappears, the symptoms undergoing similar changes. This combination of signs and symptoms is not uncommon. But morbid anatomists and abdominal surgeons are alike in knowing little or nothing of such swollen ovaries; while they agree also in the opinion that distention of the tubes is common. It is highly probable that in these cases, assumed to be instances of inflamed and swollen ovaries, inflammation and dilatation of the tubes is the real condition.

The tenderness is ascertained by examining bimanually. The best way to feel the ovary is to put the patient on her back, to stand on the side corresponding to the ovary that is to be examined, and use for external examination the hand of that side. Then, if the patient be not too fat, or the abdominal walls too resistant, the uterine appendages can be traced outward from the upper corner of the uterus, and the ovary arrived at, and seized between the hands.

This chronic ovarian pain is relieved by lying down, but not removed. It is aggravated by alcohol; indeed, in some cases produced by it; and this class of cases can be cured by stopping the alcohol. It is aggravated by constipation, and is lessened by tonics. It is more often in the left side, because the left side is weaker

than the right as to resistance to pain as well as in muscular power.

Its most common cause is parturition. It may be consequent on dysmenorrhea of long standing. Most chronic diseases of the uterus are accompanied by pain having this character. Morbid sexual excitement and chronic alcoholism are exciting causes. It occurs chiefly in nervous and anæmic subjects, and is associated with atonic dyspepsia, disturbed sleep, headaches, and symptoms of hysteria and nervous exhaustion.

Treatment.—To find out and remedy any uterine disease that may be present; to administer tonics; to give such advice as may lead to the correction of anything unhealthy in the patient's mode of life; and to regulate the bowels. Alcohol should be forbidden, unless it be clear that a small dose with meals enables the patient to digest more food. The patient should be kept recumbent while in pain, and counter-irritation used to the lower part of the abdomen, the best form being flying blisters. If the patient be free from pain while recumbent, but cannot walk without pain, support of the parts by a vaginal pessary will be found beneficial.

Prolapse of the ovary means that the ovary is displaced so that it lies behind the uterus, in Douglas's pouch.

One or both ovaries may be so displaced, and yet be neither tender nor painful. In that case there will be no symptoms of any kind.

The ovaries, so displaced, may be tender, but not painful. In such a case there will be no suffering unless the ovaries are pressed on. The patient will then complain of pain on passing a hard motion, and of pain in sexual intercourse.

The pain is of a burning, aching character, and is often described as lasting an hour or so after the occasion which produced it. The treatment is to keep the motions soft with laxatives, and support the ovary, and protect it from contact by a thick india-rubber ring pessary in the vagina.

The displaced ovaries may be both tender and painful. If so, besides the symptoms above mentioned, there will be the symptoms of so-called chronic oöphoritis above described.

The treatment follows from what has already been said, with the addition that a thick india-rubber ring pessary will be of marked utility. G. E. HERMAN.

Symptomatic Indications.—*Veratrum viride* is useful in inflammatory conditions with high fever; *pulsatilla*, in subacute cases; *mercurius sol.*, when pain runs toward hip or upward; *phosphorus*, pain extending downward along inner side of the thigh; *graphites*, chronic inflammation with induration, sterility, tardy, scanty menses; *thuja*, chronic inflammation, much pain, aggravation at periods; *apis*, in parenchymatous ovaritis, pain of a stinging character; *calcium sulphide*, when suppuration appears or threatens.

OPHTHALMOPLEGIA.—See EYE, DISEASES OF.

OPERATION, TREATMENT OF PATIENTS BEFORE AND AFTER.

—I. **Before Operations.**—(1) *Constitutional Treatment.*—Much depends on the patient's general health, and this may be paraphrased into the efficiency of all the organs under the conditions which follow the operation. To secure this, some preliminary treatment may be called for, either (1) to regulate some system or organ, and improve the blood; or, (2) to accustom the patient to the fixture and surroundings which must follow the operation.

In many patients a special diet, rest in bed, or particular drugs, may be required to improve digestion, stimulate elimination, relieve congested liver or kidneys, regulate the action of the heart, or improve nutrition. For instance, persons who regularly overload their systems with an access of alcohol keep up the appearance of health for a long time, if they are able to take active exercise. Should they be suddenly laid up, however, from a fractured limb or other cause, their health at once gives way. Symptoms of delirium tremens appear, and wounds are exceedingly apt to develop erysipelas or other septic conditions. In such cases, preliminary treatment by sparing diet, and diminished allowance of alcohol, laxatives, and rest in bed, would go far to lessen these unfortunate tendencies. In other cases, tonics, iron, and cod-liver oil may be required, and so on.

Where cases are not systematically taken, the heart and lungs should be examined, and the digestive system inquired into, the morning and evening temperature ascertained, and the urine tested. It is better to have this examina-

tion of the heart made while the patient is resting quietly, rather than add to his alarm by sounding the heart just before the anæsthetic is given.

The bowels should be well opened the day before an operation, and no food should be allowed for at least four hours before anæsthetics are administered. In females, no operation should be undertaken during or immediately before the menstrual period.

(2) *Local Treatment*.—The area of skin which may be covered by dressings should be thoroughly cleansed with soap and water, and afterward also with turpentine, or with washing soda, and all hairy parts shaved. Afterward a towel soaked in 1-20 carbolic lotion, or 1-2000 corrosive lotion, should be applied, and covered with a mackintosh. These proceedings should be carried out, if possible, the night before any operation.

(3) *Special Treatment*.—For operations about the face in men, the directions regarding shaving are especially necessary, as it is a troublesome delay for the surgeon to have this to do before he can begin the operation itself.

In operations on the bladder, rectum, and perineum, besides the previous opening medicine, the lower bowel should be cleared out by an enema, a few hours before the operation.

There are many cases where necessity precludes any preliminary treatment, except, perhaps, a hurried cleansing with washing soda or turpentine, and a nail-brush, to prepare for the more effective acting of the antiseptic lotion. The best that is possible under the circumstances must, of course, be the rule.

Where plastic operations involving the transplanting of skin-flaps by stages from distant parts are to be undertaken, the parts which are to be held in apposition must be fixed in their place for a week or ten days before, so that the patient may be accustomed to the constraint.

2. After Operation.—*Constitutional Treatment*.—The patient is usually kept on milk diet for a few days until the effects of the anæsthetic have passed off. When patients complain of much pain, the best analgesic is opium, given as morphia, hypodermically, or by the mouth. The amount of the dose will vary with the patient's tolerance of the drug; but it is best to begin with small doses—say, $\frac{1}{6}$ of a grain, which may be repeated if

necessary. Children, aged people, and those with renal disease or bronchitis, bear opium badly. In sleeplessness, where there is no pain, bromide of ammonium, chloral, and hyoscyamus prove useful.

As soon as digestion permits of it, fish or chicken is added to the diet, and, as soon as possible, full hospital diet is ordered. If the bowels do not act of themselves, they should be opened on the third or fourth day by an enema or simple laxative. The tongue, as indicative of the state of the digestive system, should be looked at from time to time. A favorite remedy in liver and stomach derangements is powders of rhubarb (grs. v) and soda (grs. v) given once or twice daily before meals, for a few days; to this bismuth may sometimes be added with advantage. Where the liver seems sluggish, a bitter infusion, with dilute mineral acid and tincture of nux vomica, is useful. Iron is often indicated by the anæmic state of the patient, and other remedies may be required according to circumstances.

Special Treatment.—(a) In all cases of operation about the anus and rectum, such as for fissure, fistula in ano, or piles, the bowels should remain unopened for about two days, and be opened on the third morning by castor oil or other mild aperient. The free opening of the bowels before the operation, and the low diet after it, generally suffice to keep the bowels from moving of themselves for some days. When morphia suppositories have been given to soothe pain after the operation, the bowels will be still more bound. It is better not to wait until the bowels move of themselves, because by that time firm fecal masses will have formed, which would be more irritating to the recent wound than the earlier passage of a liquid stool. An enema is necessarily contra-indicated.

It should be remembered that operations upon the anus, and in its neighborhood, are apt to cause retention of urine by reflex spasm of the constrictor urethræ. Some surgeons on this account pass a catheter at the end of the operation, and in any case provision must be made for drawing off the water within eight hours of that time and for repeating the proceeding if need be.

(b) The treatment of the bowels after the relief of a strangulated hernia,

whether by taxis or by operation, is a matter of dispute. Some surgeons freely administer opium or morphia, and keep the patient on low diet, to prevent any motion of the bowels for a week or ten days. This is done to insure rest for the injured and probably inflamed bowel, and in some cases may be necessary. Other surgeons act on the principle that if the bowel be inflamed, its peristalsis will be thereby checked, so that unless local pain or general restlessness call for the use of opium, it may be omitted and the action of the bowels left to nature. The latter seems the more rational plan.

Where it is known that the bowel itself is injured, efforts will, of course, be made to insure absolute quiet for the injured part, opium or morphia continued for a week or ten days, and the patient fed by nutrient enemata, supplemented only by small quantities of fluid food given by the mouth.

(c) After ovariectomy, there is also need for keeping the alimentary canal as quiet as possible to give rest, and especially to avoid sickness, lest the muscular efforts of retching should tear open the recent wound, and should start hemorrhage. Dr. Keith's plan is to give only a few teaspoonfuls of water, cold, if there be a tendency to sickness, but otherwise hot, for the rest of the day after an operation. During the night, if urine is being freely passed, 3 or 4 ounces of water may be allowed. Next day, teaspoonfuls of hot water when thirst is complained of. Should there be sickness with thirst, water, or milk and water may be administered per anum instead of by the mouth. After flatus has been passed, as it usually is twenty or twenty-four hours after the operation, the diet is gradually improved, beginning with milk and water. Nutrient enemata may sometimes be required, should tendency to vomiting continue.

(d) *Operations in the genito-urinary tract.*—The chief point to be attended to in the after-treatment of patients whose genito-urinary tract has been operated upon, is to diminish the acidity of the urine and lessen the work of the kidney by keeping down the albuminoid element in the food. A diet, consisting chiefly of milk and starchy foods, is best for this purpose. When the kidney has been injured, the bowels must be kept open. Fetid urine may be improved by the free administration, by the mouth, of

boracic acid ($\frac{1}{2}$ oz. sat. solution every three hours), sulpho-carbolate of soda (20 grs. every two hours), naphthalin, and probably also by sandalwood oil and copaiba, as well as by the injection of weak antiseptics into the bladder.

Washing out the bladder is often of great service when the urine is putrid, and the mucous membrane unhealthy. Some surgeons use a double-way catheter. With this instrument, fluid is injected by one of the channels, while it flows out by the other; but as the mucous membrane is not thus distended and its folds exposed to the fluid, we prefer the ordinary single-way catheter.

The fluids at first used must be warm (80° to 100° F.) and unirritating antiseptics, *e.g.* 1-4000 corrosive sublimate lotion, half strength boracic lotion, or 1-2000 carbolic acid; quinine, 2-3 grains per ounce, with one min. dilute sulphuric acid per grain; iodoform, 2-4 grains per ounce, with a little mucilage to suspend it.

When the urine is no longer septic, astringent injections may be required—acetate of lead, $\frac{1}{4}$ grain to $\frac{3}{4}$ i (in urine alkaline and depositing phosphates); nitrate of silver, $\frac{1}{4}$ to $\frac{3}{4}$ grain to $\frac{3}{4}$ i; tannin, $\frac{3}{4}$ i.

The quantity of fluid injected must depend on the state of the patient's bladder; 2 ounce, or as much as can be borne without much inconvenience.

A catheter (soft for preference) is passed into the bladder, and the urine drawn off. The selected fluid is then injected with a syringe, or is allowed (by syphon or waterhead) to flow in from a height of one or two feet at most. It is then allowed to escape, and is probably at first turbid: the process is repeated until the returning fluid is clear. Foulis has introduced a simple and cheap apparatus for washing out the bladder. He attaches a stopcock to the lower part of a common-handled mug, holding a pint. From the stopcock he leads an india-rubber tube to the catheter, to the end of which he fixes a T-tube. In washing out the bladder he has only alternately to open and close the end of the T-tube, and fluid will enter or leave the bladder as desired.

(e) *Operations on the mouth or jaws.*—After extensive operations in this region the difficulty of feeding the patient may be considerable. Mastication is generally impossible, and swallowing nearly so, as well as painful.

Frequent cleansing of the mouth with Condy's fluid or boracic lotion is a source of great comfort to such patients. A nurse may syringe the parts freely three or four times daily, or a syphon with clamp or stopcock may be laid close to the patient's bed, so that he may wash out his mouth himself as often as he pleases.

Difficulties in administering food: How to meet them.—Under these circumstances, liquid food must be administered, (a) *through a tube by the mouth*, or (b) *per anum*.

(a) Sometimes at the end of the operation, a gum-elastic or soft rubber catheter (about No. 12 to 18) is passed either through the nostril or the mouth into the esophagus, and is held in position by a stitch. In other cases a similar tube is passed each time the patient is fed. The food will generally consist of milk, beaten-up eggs, beef-tea, thin arrow-root, and (if necessary) alcohol in the form of brandy or whisky. It is needless to say that, if a tube has to be daily passed, care must be taken to insure that it enters the esophagus and not the trachea. It has happened that the patient's lungs have received the food meant for the stomach—an accident which involves nearly certain death, either by immediate suffocation or rapid pneumonia.

(b) *Rectal alimentation* is at best a poor substitute for feeding by the mouth. Life may be sustained by it, however, for several weeks and even months; and in certain circumstances the rectum becomes the only available channel for introducing nourishment into the system.

The physiological facts on which the proper management of rectal alimentation depends are briefly: that while the *absorptive* power of the large intestine is very great, *digestive* powers may be considered to be wanting in its juices altogether, and that, as its chief function is expulsive, fluids or solids introduced per anum, large in amount, or with irritating qualities, will be expelled before absorption can occur.

Nutrient enemata should, therefore, be predigested, should be small in amount (from 2 to 6 ounces), should be injected slowly, and as nearly as possible at the body-temperature (95° to 100° F.). Under favorable conditions, a reverse peristalsis seems often to occur, and the materials of enemata injected shortly be-

fore death have been found afterward at the cæcum.

The *food injected* should be (1) peptonized albuminoids, in the form of peptonized meat-juices sold ready for use; beef-tea, or white of egg, digested with pepsin and hydrochloric acid, or more conveniently with Liquor Pancreaticus, or some of the peptonizing powders (Fairchild's act admirably). (2) Diastased starch in the form of prepared malted foods, or starchy foods acted on by malt extract, or by artificial pancreatic juice. (3) Or the combination of starchy and albuminoid foods contained in peptonized milk, or peptonized milk-gruel.

Peptonized suppositories are a convenient form by which albuminoid substances may be administered.

To lessen the irritability of the rectum, all fecal matter should be cleared out from it by an enema of warm water, with or without soap, before rectal alimentation is begun, and from time to time during its progress.

The same care in maintaining an excess of carbohydrate over albuminoid food (in proportion of about 1 to 4) must be taken in dealing with this, as with the ordinary mode of feeding by the mouth.

Nourishment, general hints on.—Speaking generally, the nourishment of patients recovering from an operation is to be maintained on the principle of giving nutrition without increasing the nitrogenous waste. Beef-tea, chicken-broth, and other meat-infusions are recognized as stimulants to tissue-change rather than foods proper. They should not be omitted; but starchy foods should be chiefly relied on, and it should be remembered that meat-infusions alone will cause more rapid wasting than no food at all.

In *feverish conditions* (septic and otherwise) the digestive juices lose their power—hence the indication for giving artificially digested foods in extreme cases. When the mouth becomes dry and parched for lack of saliva, arrow-root, rice, and other starchy foods are contra-indicated, unless previously acted on by malt or pancreatic extract. In these cases, the use of artificially prepared foods specially intended for infants will be found of service. Various kinds seem to have this in common, that they contain starchy foods more or less changed by malting.

OPHTHALMOSCOPE. — A mirror with a central perforation, or sight hole, which enables the observer to throw light into a pupil, and to receive some of the reflected rays, through the sight hole, into his own eye, where they form a picture of the observed fundus. This manner of examining the eye is known as the direct method, in contra-distinction to the indirect method, in which a large concave mirror and a strong convex lens are employed.

Both methods are essential to the thorough examination of an eye, and can be conducted with greater ease if the physician uses an instrument possessing the latest mechanical improvements. It consists of a body and two mirrors, each with a central hole. The body contains a large series of convex and concave spherical lenses, which can be brought by the rotation of a wheel successively in front of the sight hole. Of the two mirrors, the smaller, highly concave and set at an angle, can be rotated around its own center; it is used in conjunction with the series of lenses for the direct method, while the larger and less concave is used, together with a convex lens of about three inches focus, in the indirect method.

Direct method.—The examination is made in a darkened room by means of an artificial light. When the patient is in bed the light should be placed on the pillow on the side opposite to the eye to be examined. The ophthalmoscope is held erect in the right hand, and close in front of the observer's right eye when a right eye is to be examined, and *vice versa* for the left. The apex of the wedge formed by the small tilted mirror must be directed vertically upward, and the light will then fall into the eye to be examined, as the observer, who stands opposite to the lamp, stoops over the patient.

When the patient can sit up in bed or in a chair, the light should be placed on a level with, but behind and to one side of, the eye to be examined. The observer sits beside the patient, opposite to the light and holds the ophthalmoscope erect and close to his own eye, with the apex of the wedge formed by the small mirror directed toward the root of his nose. He can now bring the mirror so close to the observed eye as almost to touch it, and still have room to move the wheel

without his hand coming in contact with the patient's face. The light will now fall on the eye, and as long as the small shadow which corresponds to the sight hole in the mirror is on the pupil, the fundus will remain illuminated and visible. If both physician and patient have normal (emmetropic) eyes, and neither accommodate, the details of the fundus should appear quite sharp and clear; if, on the other hand, either the physician or the patient has some abnormality of refraction (ametropia), then the series of lenses in the body of the instrument will have to be moved in sequence in front of the sight hole, until the fundus details are clearly seen.

The lens which produces this effect will indicate the amount of the ametropia either of the one or both eyes engaged in the observation. It is, therefore, absolutely necessary for the observer to know the amount and nature of his own error of refraction, if he has any; and, if it is one of any great amount, it is well to have the correcting glass set in the disk provided for such extra lenses in Moreton's instrument.

Thus corrected, the physician does not require to make any allowance for his own error, and the lens found to give the clearest image of the fundus represents the patient's defect. The direct method thus serves two purposes—viz., to obtain a very magnified view of the fundus, and also to find the glass the patient should wear to correct his ametropia.

Indirect method.—The light may be placed on either side of the patient's head. The observer is seated in front of and at about his own arm's length from the patient. The ophthalmoscope, held by the right hand in front of the right eye, throws the light upon the examined eye by means of the large mirror. In the left hand the large convex lens (13 D) is held about three inches from the patient's eye. The rays reflected from the back of the examined eye pass through and are brought to a focus at or near the principal focus of this lens, where they form an inverted image of the fundus. This aerial image, situated between the lens and the ophthalmoscope, is seen by the observer through the sight hole of the mirror, and, as it is situated at about the ordinary reading distance from the eye, he must either accommodate for it, or, what is better and less fatiguing, look at

it through a convex lens of four diopters placed behind the sight hole.

While examining the right eye it is well to direct the patient to look at the tip of the extended little finger of the hand holding the mirror, when the optic disk will come under observation. To see the disk of the left eye, the patient is directed to look at the observer's left ear, and when the yellow spot is to be examined he must look at the center of the observer's forehead. In some patients the pupils are too small to allow of sufficient light being thrown into the eye; it is then necessary to dilate them by applying a mydriatic to the conjunctiva. In homatropine and in cocaine we have two drugs, which, either separately, or, better still, in combination in a two per cent. solution, accomplish this perfectly without the effect lasting so long as when atropine and some similar drugs are employed. As the paralysis of the accommodation which accompanies the dilatation is very inconvenient, it is always well to apply a drop of eserine solution, one per cent., at the end of the examination, so as to neutralize the mydriatic, and thus avoid an attack of glaucoma, which occasionally supervenes when the pupil is left widely dilated.

The erect image, as seen by the direct method, magnifies the fundus about fourteen times; it is, therefore, useful for seeing minute changes; while the inverted image, seen by the indirect method, only magnifies the fundus about four times; consequently a larger area is seen at once, and the topography of a disease can be better appreciated. Since this latter method allows more light to enter the eye, it is more serviceable where the media are not clear, but both methods should be practiced in almost every case, as each is capable of showing something that is not to be seen by the other.

Before proceeding to examine the eye in either of these ways, the physician, standing about four feet in front of the patient, should throw the light by means of the large concave mirror on to the pupil—the lamp being so placed as to leave the patient's face in the shade. On rotating the mirror around an imaginary vertical axis, he will notice that a part of the fundus is not illuminated, and, as he moves the light from side to side across the patient's eye, this shadow will be observed to move either in the

same or in the opposite direction to the light.

The mirror must next be rotated around an imaginary horizontal axis, so that the light may be moved across the eye in a vertical direction. If the shadow move in the same direction as the light, the eye is myopic, and a concave lens will be required to see the fundus by the direct method; if it moves in the opposite direction, the eye is either hypermetropic or emmetropic, and the fundus details will be seen more clearly through a convex lens in the former case, but no lens will be necessary in the latter. If the shadow be of different intensity or moves in opposite directions in the two meridians, then astigmatism is present. By this method, known as "retinoscopy," not only the quality but also, by the placing of trial glasses in front of the patient's eye, the quantity of the refractive error can be ascertained.

Should the fundus reflex be obstructed by a fixed shadow while this examination is being conducted, an opacity in one or more of the clear media must be looked for by the oblique examination. To do this the lamp is placed two or three feet to one side and slightly in front of the patient's face; the rays of light are then brought to a focus by means of the large lens, in succession on the cornea and on the surfaces of the lens and on the vitreous; by this means the position and nature of the opacity can be studied.

The chief objects to be observed in a healthy eye are the round or oval pink optic disk with its central white excavation or physiological cup, varying in shape and size, and the emerging vessels, readily recognized from their difference in color, size, and tortuosity as arteries and veins, the latter being darker, larger, and more tortuous. The retina is invisible except for its just mentioned vessels and the slight pigmentation at the yellow spot. The red background of the fundus is formed by the vessels of the choroid covered by its own and by the retinal pigment, both of which vary according to the lighter or darker complexion of the individual. In the negro the fundus is nearly gray, while in the albino every branch of every vessel is clearly seen, and the light which streams through the sclerotic and iris, as well as through the pupil, thus gives rise to the characteristic pink eye.

These varieties of the healthy eye will soon become familiar to the observer who makes a practice even of examining only the eyes of those patients who come under his observation complaining of headache. Before long his reward will come in the discovery of an unsuspected optic neuritis or retinal hemorrhage.

W. LANG.

OPHTHALMIA.—See CONJUNCTIVA, DISEASES OF.

OPHTHALMIA, GONORRHEAL.—See GONORRHEAL OPHTHALMIA.

OPHTHALMITIS, SYMPATHETIC.—See EYE, DISEASES OF.

OPISTHOTONOS.—An arching backward of the trunk and head so that, in the dorsal decubitus, only the head and heels touch the bed. This condition is met with in tetanus, strychnine poisoning, hydrophobia, cerebro-spinal fever and some other diseases, and is due to a spasmodic contraction of the muscles of the neck, back, and legs. In rare instances the muscles in front of the spine are affected. Emprosthotonos is the term used to describe the condition in which the patient's body is arched forward, and pleurosthotonos when it is bent to one side or other.

OPIUM, POISONING BY.—The *symptoms* of poisoning by opium and its alkaloid—morphine—or their compounds, do not materially differ. The main feature is a gradual and increasing stupor. At first, especially when morphine has been used, there may be a short stage of excitement, with headache and dryness of the mouth, but in any case, within half an hour of taking the poison, drowsiness followed by stupor makes its appearance. The patient can be roused and made to answer questions, but when left to himself he at once lapses into stupor, and after a time he cannot be roused so easily, or perhaps at all. At this stage the pupils are contracted and insensible to light, the pulse, which was at first small and frequent, becomes fuller and less frequent, the breathing is slow and somewhat stertorous, the countenance of a dusky pallor, and the skin clammy or bathed in perspiration. The breath may exhale an odor of opium. In cases that are proceeding to a fatal termination, the muscular relaxation becomes complete,

the pulse is irregular, the breathing becomes slower and more stertorous, the intervals between each respiration becoming more prolonged. The duski-ness gives place to lividity, and the patient dies asphyxiated, the pupils sometimes becoming widely dilated toward the last. This latter sign is very unfavorable. Sometimes the patient, even after several hours of coma, rallies up to a certain point, but then relapses into a state of unconsciousness, and dies.

Vomiting is not an uncommon symptom in an early stage, where a large quantity of opium has been taken by the mouth; and in a few cases convulsions have been present. It is possible that the convulsions in such cases are of an uræmic nature, for it is noteworthy that, in fatal cases, the urine has frequently been found to be highly albuminous when drawn off or examined after death, although the patient was not the subject of any form of kidney disease.

Diagnosis.—In the absence of any history of the mode of appearance of the symptoms, it will sometimes be difficult, if not impossible, to make a certain diagnosis of opium poisoning. Hemorrhage into the pons Varolii may produce the complete muscular relaxation, the stertorous breathing, the lividity and the contraction of the pupils that are seen in the latter stages of opium poisoning; and if the patient were past middle life, and presented evidence of advanced arterial disease, it would hardly be safe, without any history, to treat him as for opium poisoning in the presence of these symptoms. Hemorrhage into other parts of the brain would probably be accompanied by unequal pupils, or by flaccidity on one side of the body more marked than the other, or by unilateral convulsion or spasm. In alcoholism the most reliable signs would be a flushed rather than a livid countenance, and the pupils would probably be dilated. In uræmia convulsion is usually a prominent feature, coma a secondary one. In the status epilepticus the pupils are dilated. In any case where there is the slightest doubt, the urine should be examined, the possibility of diabetes being borne in mind; the urine will probably be albuminous; a low specific gravity points to uræmia and granular kidneys; if high, the coma might be due to opium poisoning. The ophthalmoscope might be of aid in a doubtful

case by revealing the existence of albuminuric retinitis, but it must not be forgotten that the person might be the subject of chronic renal mischief, and yet be suffering from opium poisoning.

Post-mortem appearances.—The viscera may be congested, but, unless the smell of opium were recognizable, the cause of death could only be surmised on negative grounds.

Treatment.—The stomach should be at once washed out; if an instrument be not at hand, emetics, such as mustard (a tablespoonful of the powder in water), or grs. xx of sulphate of zinc in water, or ipecacuanha (grs. xx of the powder in water), may be given. The patient must be roused by flapping with a wet towel, by shouting at him, and later on by walking him about if he show signs of returning stupor. Ammonia may be applied to the nostrils, and hot strong coffee may be given with the same object. The hypodermic injection of sulphate of atropine, gr. $\frac{1}{40}$ — $\frac{1}{20}$ (the true physiological antidote), should never be omitted, though it must be confessed it very often fails to produce any effect. Artificial respiration should be employed if necessary. In cases of poisoning by morphine injection, the stomach pump and emetics will, of course, be of no avail. The importance of giving the patient rest and nourishment when a certain stage of improvement has been reached can hardly be overestimated; many patients die after having been sufficiently roused to give their names, etc., and sometimes even after having been able to walk; and it is highly probably that such relapse is due to exhaustion.

Chronic poisoning.—Opium when chewed or smoked in moderation probably does not do more harm than tobacco under similar circumstances, but when used to excess it produces dyspepsia, emaciation, a yellowish tint of skin and a stooping, shuffling gait; pain in the long bones is frequently complained of. In some persons the habit may be abruptly broken off; in others only a gradual change can be borne. The abuse of morphine by hypodermic injection gives rise to a train of symptoms which is detailed elsewhere (*see* MORPHINOMANIA).

OPTIC NERVE AND TRACT, DISEASES OF.—**Congestion of the disk.**—So variable are the appearances of

the healthy disk that it is extremely difficult to diagnose with certainty the slight changes which occur in the course of congestion. Indeed, unless they occur under observation, it is almost impossible in some cases to come to a definite conclusion. The color of the disk is increased, and it has a softer and rather velvety appearance. The physiological cup participates in these changes, and, when small, may be entirely lost to view. The outline of the disk is ill-defined in its whole extent. Such a condition may ensue as the result of injuries to the eye, in retro-ocular affections of the nerve, and in the course of toxic amblyopia due to tobacco, etc. Complete resolution may occur; if so, the disk regains its normal appearance and no permanent affection of sight results; frequently, however, atrophic changes take place, the disk gradually becomes paler, with ultimately a considerable loss of sight.

Tobacco amblyopia occurs generally in men about or beyond the middle age, with usually a history of some degree of alcoholism and of nerve exhaustion proceeding from one cause or another. The amount of tobacco necessary to induce amblyopia varies with the idiosyncrasy of the individual. It may be either smoked or chewed, and is generally of a strong variety, *e. g.*, twist or shag. There is a gradual, but extensive, loss of sight, equal in the two eyes, and specially affecting the center of the field of vision. There may be no other symptom complained of, and, except perhaps for some sluggishness of the pupils, the eyes may appear quite normal. Sometimes, however, there is congestion of the disks. In all cases there is a central scotoma for red and green. This is best obtained by making the patient fix some object with his eyes, and moving before him small squares of cardboard of a red and green color. It will be found that he is completely color-blind for these colors in an oval area bounded on one side by the blind spot and on the other by the fixation point, but that outside this region he readily names them correctly. If the indulgence in tobacco be persisted in, the disk eventually becomes universally pale, and an extensive and irrecoverable loss of sight occurs.

The *diagnosis* should never be difficult if the above characters of the disease be borne in mind.

The *prognosis* is good in recent cases if the patient be content to submit to the treatment; but if the condition be of long standing, and especially if atrophic changes be detected in the disks, little or no improvement results, although absolute blindness seldom, if ever, occurs.

Pathology.—The anatomical basis of the disease is an axial neuritis of the optic nerve. A condition very similar to tobacco amblyopia sometimes occurs as an hereditary defect, in bisulphide of carbon poisoning, and perhaps also in some cases of diabetes.

Treatment.—Consists in the absolute avoidance of tobacco, a careful limitation of alcohol, and the administration of nuxvomica or strychnine internally. Of these the first is by far the most important indication, and it will generally be found that it is easier for the patient to give up tobacco entirely than to limit himself to one or perhaps two pipes in the course of the day.

Optic Neuritis (Papillitis).—See EYE, DISEASES OF.

WM. GAY.

ORCHITIS.—See TESTICLE, DISEASE OF.

OSMIDORSIS.—See SWEAT GLANDS, DISEASES OF.

OSTEO-ARTHRITIS.—See RHEUMATIC ARTHRITIS.

OSTEITIS DEFORMANS. — See BONES, DISEASES OF.

OSTEO-ANEURISMS.—See BONES, DISEASES OF.

OSTEOMATA.—See EXOSTOSES.

OSTEOMALACIA, INFANTILE.—See RICKETS.

OSTEO-MYELITIS. — Is a diffuse inflammation and suppuration in the cancellous tissue, an affection more frequently recognized in post-mortem examinations than at the bedside. The more acute and more extensive cases of this affection are closely allied to pyæmia, and are usually, or at any rate very frequently, followed by that mode of death. It bears the same relation to the medullary tissue as periostitis does to the periosteum; but the difference in character between the periosteum and the medullary tissue, the latter being so much more rich in vessels, especially in large patulous venous channels, gives to osteo-myelitis a gravity even beyond that of diffuse peri-

ostitis. It is well known how often diffuse suppuration is found in the diploe of the cranium after scalp-wounds, and how the “puffy tumor of Pott” is frequently only the sign of such suppuration; and further, in what a large percentage of such cases evident pyæmia is found. It is probable that in all these cases the external table of the bone has been wounded, and the diploe thus exposed; in fact, the only known cause of osteo-myelitis is a wound which exposes the cancellous interior, or an injury to the interior of the bone, perhaps unaccompanied by external wound, as in fracture. It is a frequent cause of death after amputations and other surgical operations in which bone is divided.

When a bone is examined in which osteo-myelitis has run an acute course, the cancelli are found loaded with pus, and the medullary tissue usually injected and often sprinkled with ecchymoses; the periosteum also is often in the course of separation from the bone; but the bony tissue itself does not generally show appreciable change. In the larger bones the disease usually terminates fatally at this stage; but should the patient survive, the pus may penetrate into neighboring parts, most probably into the nearest joint, or central necrosis may result.

Symptoms are not well defined; it, like other extensive and acute affections of bones, is often accompanied by diffuse inflammation of the soft parts, which then masks the deeper affection. Rigors and general fever mark the onset of acute osteo-myelitis, but the only known spinal symptom of the disease in the bone is the separation or recession of the periosteum from it, accompanying diffused pain in the bone, and not caused by effusion on the external surface of the latter. After amputations, a prominent fungus mass is often seen projecting from the end of the bone, and proves the existence of a certain extent of inflammation of the medullary tissue; but this need not necessarily have affected the bone so extensively as to deserve the name of osteo-myelitis; in fact, that affection is seldom recognized before death.

To obviate the formidable dangers, and the extensive disintegration of parts connected with osteo-myelitis, it is justifiable in any case where pain in the bone, accompanied with the ordinary symptoms of acute suppuration (rigors, fevers, etc.),

but without signs of external or periosteal mischief, induces a reasonable suspicion of this affection, to expose the surface of the bone by a free incision. Should the periosteum be found separated, or even separating, from the bone, the diagnosis of diffused suppuration in the cancelli will be rendered highly probable. When this separation of the periosteum has proceeded to any great extent, amputation of the member, or excision of the diseased bone, is certainly indicated. It should be remembered that the disease is a rapid one, the fatal complications of internal phlebitis and pyæmia imminent, and, therefore, treatment, to be effectual, must be adopted early. Medicine, as might be expected, has little effect on the disease; but the fever which accompanies it should, of course, be treated on the ordinary principles. In deciding on the question of removing the diseased bone (an operation which would in ordinary cases be held to be contra-indicated if pyæmia had set in), it should not be forgotten how much the early symptoms of systemic infection resemble those of typhoid fever, so that it may be proper, in doubtful cases, to give the patient the benefit of the doubt and attempt to relieve him from the source of irritation.

In chronic osteo-myelitis the removal of the limb is frequently successful in affording the patient relief from an abiding source of irritation, which will at length otherwise prove fatal; but when this affection is limited to a portion only of the bone, the expectant treatment is indicated, and the patient may recover after the extraction of a sequestrum.

T. HOLMES.

Symptomatic Indications.—*Arnica* in the beginning of treatment will often give excellent results; *arsenicum* is useful when the symptoms are of a very low grade, with much restlessness, thirst, and delirium, and when symptoms of pyæmia or ichorrhæmia present, and the pus is sanious and offensive, with blueness of surface, coldness of skin, and thirst; *nitric acid* is useful when there is a syphilitic dyscrasia present, or the patient has been mercurialized; *mercurius*, when there are bone-pains with swelling and tenseness of the parts, rapid progress of the disease.

OSTEOTOMY.—A term practically confined to the division of bone for de-

formity, with, at most, the removal of a wedge-shaped piece.

Instruments.—Saws, osteotomes, and chisels. Saws are very narrow and either blades or chains. Osteotomes resemble chisels, but they are beveled on both surfaces, while the chisel proper is beveled only on one. The temper of the steel and angle of the bevel are of high importance in the case of osteotomes and chisels. Improper instruments would easily cause fatal results, or, at all events, splintering of bone, great shock, perhaps failure to attain the object aimed at, and occasionally a piece of the chisel left in the bone. A proper osteotome can be driven by a mallet through the femur of an ox without splintering the latter or damaging itself. Never use a hammer. Osteotomes are used for simple division. Chisels are entirely unfit for this purpose except in the case of very small bones, and should be reserved for removing wedge-shaped pieces. Place limb on a sand pillow, moistened just before operation and covered with waterproof.

Management of the Saw.—Adam's is generally used. It has a shank and is usually pointed. The soft structures are incised with a long tenotomy knife down to the bone, and the periosteum is cut with the same knife. The orifice of the incision is usually only half an inch long, or even less. The knife being withdrawn, the saw is passed into the tunnel just prepared for it, and its cutting edge turned to the bone. The saw is generally withdrawn when two-thirds of the bone are divided; then the remainder is broken.

Use of the Osteotome.—Insert a scalpel right down to the bone at the place to be divided. Wait two or three seconds, to give the muscles penetrated time to quiet; then complete incision. Size of incision should at first be large enough to admit finger. As operator gains experience he will venture safely to dispense with this and pass in the osteotome alone. Incise in line with the bone to be divided. Rotate osteotome when it reaches the bone. Do this lightly, so as not to damage the periosteum. Hold handle of osteotome firmly in left hand, with ulnar border of that hand against the skin of the limb. The direction and management of the instrument vary with the site of operation. As a rule cut away from large arteries and divide the hardest

part of the bone first. When removing the osteotome, keep the thumb and first two fingers closed upon it, and gradually work it out by alternate contractions and relaxations of the other fingers. When two-thirds of the bone are divided, the rest can usually be broken. In using the chisel, turn the beveled side toward the wedge. If the wedge is to be thick, cut a thin wedge first and chip away other pieces from each side of the gap.

Never use either osteotome or chisel as a lever to break bone. Keep saws, osteotomes, and chisels bright and free from rust, or they clean themselves in the bone. Check all hemorrhage before dressing. When both limbs are osteotomized, the first wound can be compressed with an antiseptic sponge and gauze bandage while the other is being operated on. Operate strictly antiseptically. Cut away any projecting cellular tissue, as it delays cicatrization. Use no drainage-tube unless some accidental circumstance, occurring during the operation, leads you to expect suppuration. Healing usually takes place by organization of blood-clot, but by granulation where cellular tissue is exposed uncovered by blood.

After Treatment.—Note temperature morning and evening. A temperature of 101° demands inquiry. It may arise from some quite accidental complication independent of the operation, or from a tight bandage, or from an accidental sore throat, or trivial ailment. If it cannot be thus accounted for, expose and examine the wound. After osteotomy of the lower limbs, unless the divided bone is supported in a firm plaster case, some contrivance is useful to facilitate defecation, *e. g.*, a mattress with a movable central piece, or stretcher. Immediately after the bone has been divided it should at once be put into the position ultimately required. After osteotomy of the limbs, attend during the first twenty-four and forty-eight hours very carefully to the state of the toes or fingers, as the case may be. They should be free from numbness and obstructed circulation. Permeation of discharge should be looked for from day to day, though it seldom occurs after the first two days. So long as it is absent the dressing does not need removal.

Osteotomy for Genu-valgum.—The place of incision for McEwen's operation is on the inner side of the limb, at

a point where the two following lines bisect one another: a line drawn a finger's breadth above the level of the upper border of the external condyle, and a line drawn parallel to and half an inch in front of the tendon of the abductor magnus. To begin with, place the osteotome against posterior part of inner border of femur, and cut from behind, forward and outward, away from femoral artery. Remember that, just above the condyles, the outer border of the femur is thicker than the inner. In Chiene's operation, an incision two to three inches in length is to be made over the tubercle (that of the abductor magnus), and to be carried upward for a sufficient distance. The long axis of the wedge runs downward and outward toward the notch between the condyles. Grasp the tibia at its lower extremity, and by pressure upward bend the neck of bone attaching the condyle to the femur. Ogston's operation.—If the genu-valgum be severe, operate with the knee bent, otherwise with the knee extended. A tenotomy-knife is inserted at a point as far back as the level of the internal condyloid ridge, and about four inches above the most prominent point of the internal condyle. It is passed downward, outward, and forward to the notch between the two condyles, until the point can be left projecting in front of that notch. Before withdrawing it, the periosteum and cartilage are incised. An Adam's saw is now passed in, and the internal condyle sawn two-thirds off. Now, extending the limb (if it has been flexed hitherto), and using the tibia as a lever, with the operator's knee as a fulcrum, the limb should be bent inward till the internal condyle cracks off and slips upward. With splints and pads place and keep the limb straight till union has taken place. Commence passive motion about the end of the third week; use strict antiseptic treatment. Well and judiciously padded box-splints are commonly used. But, as few or no changes of dressing are usually required, the limb can be once for all fixed in a molded case of plaster of Paris or similar material.

Osteotomy for Anchylosis of Hip in a Bad Position.—If there be a good neck to the femur, in other words, if the great trochanter appear to be set far enough away from the os innominatum, divide the neck of the femur. Otherwise operate below the great trochanter.

Division of Neck of Femur with an Osteotome.—Bisect a line between the ant. sup. spine of ilium and the ant. sup. angle of the great trochanter. At the point thus found, pass in a sharp-pointed steel director backward, inward, and a little downward till it stops at the neck of the femur. Along the director pass a scalpel down to the bone; first, cut toward the trochanter, then, rotating the director and reinserting the scalpel, cut toward the anter. sup. spine. The incision should just admit the forefinger. Do not draw the director till the osteotome is inserted. Rotate osteotome so as to bring it across the neck of the femur, cut nearly through, and break the rest.

Division of Neck of Femur with Saw (Adams's operation).—W. Adams passes in a long tenotomy knife "a little above the top of the great trochanter," and straight down to the neck of the femur. He divides the muscles and "opens the capsular ligament freely." A narrow-bladed saw is passed into the wound and across the front of the neck of the femur, with its flat side against the bone. It is now turned on edge and the division accomplished. Extension by weight, and without any splint, after osteotomy of the neck of the femur, is to be preferred. Sometimes a second weight pulling outward from upper third of thigh adds to comfort. When it is used a felt splint should be molded to the inner side of the thigh to distribute the pressure. Keep the foot perpendicular, or even little inverted.

Removal of Wedge of Bone for Curvature of Tibia.—Use a chisel. Make a single incision; the loose skin will permit this to be moved up and down. The wedge need not go more than three-fourths through the bone. Supposing it to be made at the apex or the angle of curvature, its upper surface should be at right angle to the border of the tibia above, and its lower surface at right angles to the border of the tibia below. When adjusting the bony surface avoid nipping muscle. The fibula can either be broken or divided through a separate incision of the soft parts. See general directions above. C. B. KEETLEY.

OSTITIS.—See BONE, DISEASES OF.

OS UTERI, RIGIDITY OF THE.—A condition of the os uteri in parturition

where dilatation is extremely slow or entirely arrested. Rigidity of the os may be due to a great variety of causes, among which may be named: early escape of the amniotic fluid, abnormal toughness of the lower segment of the cervix, elongation of the cervix, induration of the os, nervousness, cancer of the cervix, etc. The condition is not difficult to detect, as the os may be felt, on examination, as a non-dilatable, rigid ring, on which the pains make little or no impression. In case of cancer the cervix may be felt as a hard, irregular, nodulated ring. The prognosis varies with the cause.

Treatment.—Application of small quantities of belladonna to the cervix, inunction with lard, hot vaginal injections, hot hip baths. Internally, tartar emetic, chloral; inhalation of chloroform. Should the condition not yield to this treatment, resort may be had to dilatation by Barnes's bags, and if necessary, incision of the os, cephalotomy, or Cæsarian section may be performed; or forceps applied.

Symptomatic Indications.—*Gelsemium, belladonna.*

OTORRHŒA.—See EAR, DISEASES OF.

OVARY AND BROAD LIGAMENT.—**Tumors of the Ovary and Broad Ligament.**—These growths, which must be considered collectively, may be classified as follows:

- | | | |
|----------------------------|---|--|
| <i>The ovary.</i> | { | 1. Multilocular cystic tumors. |
| | | 2. Papillomatous cysts. |
| | | 3. Dermoid cysts. |
| | | 4. Solid tumors. |
| <i>The broad ligament.</i> | { | 5. Simple cysts of the broad ligament. |
| | | 6. Parovarian cysts. |

Of these tumors, the multilocular cyst of the ovary is by far the most common. With regard to the solid tumors of the ovary, the great majority of them are either sarcomata or cancers. Apart from these malignant growths, solid tumors of the ovary are exceedingly rare.

1. Multilocular Cystic Tumors.—These tumors may attain enormous size, are roundish in outline, and are apt to be irregular upon the surface on account of the protrusion of some of the secondary cysts. They are found to be composed of an aggregation of a large number of cysts (secondary cysts) of all sizes, and

arranged without order. Within these cysts is contained a fluid material. It usually happens that one, or perhaps two of the component cysts predominate over all the others, so that at first sight the tumor may appear to be unilocular or bilocular. The smaller cysts, which may vary in size from a pea to a child's head, are arranged about the walls of these predominating cysts. It is the projection



FIG. 1.—Multilocular Cystic Tumor of the Ovary.

of the tumor irregular. The whole growth is inclosed within a sac of dense, opaque, fibrous tissue, which, however, cannot be separated from the walls of the contained cysts. (Fig. 1).

The outer surface of this sac is covered with endothelium-like cells, and presents a smooth, glistening, and silvery appearance.

The fluid contained within the tumor may amount to several gallons. It is usually grayish or colorless, glairy and albuminous. If any hemorrhage has taken place into the cysts, the color of the fluid will be reddish or reddish-brown. If colloid changes have taken place in the cyst contents, then the fluid will be found to be thick and jelly-like, and of a faint yellow color.

The walls of the smaller cysts are lined with columnar cells, the larger and tensor cysts with endothelium-like cells. This difference is probably the result of distention merely. It is evident that the larger cysts are, to a great extent, due to the fusion of smaller cysts. Growing cysts meet; their walls are pressed against one another; in time these opposed walls atrophy, and the two cavities become one. In this way are produced the loculi, the bars, septa, meshes, and ridges, that are found upon the walls of the predominant cysts.

A large secondary cyst may protrude through the main wall and form a considerable projection. Or the main wall may, after rupturing, undergo atrophy, leaving a tumor composed of secondary

cysts. This, the so-called exogenous cyst, has been aptly compared to a pile of cannon balls.

When cystomata of both ovaries exist, the tumors may meet, may fuse by the bursting of some secondary cysts of the one into those of the other, and so in time form a single tumor with a double pedicle.

About thirty per cent. of these tumors contain solid growths. These growths occupy the secondary cysts, and are usually glandular (adenoma). They appear upon the cyst walls as soft, succulent, and semi-transparent masses of a greenish-gray color. These masses, when examined, are found to be composed of innumerable minute cysts and loculi, lined with columnar epithelium, occupied by a mucoid fluid, and supported by young, succulent connective tissue.

The fluid from the secondary cysts that contain these solid growths is marked by being unusually glairy and mixed with semi-solid and opaque fragments of tissue. In rare instances the supporting tissue in the solid growths is sarcomatous (adeno-sarcoma), and, in still rarer cases, the solid growth presents the characters of colloid cancer.

The precise mode of origin of these cysts is still open to some doubt. The most commonly accepted theory is that they are developed from the normal ovarian follicles. It must be remembered that the proper function of the ovary is to develop cysts, and it is not difficult to conceive that a morbid deviation of that function may lead to these multilocular cystomata. There are a vast number of follicles in the ovary that never become concerned in either menstruation or pregnancy. In the ordinary course of events these follicles atrophy. An arrest, or rather a perversion of this atrophic process, may readily lead to the tumors in question. "The most probable origin of cystic disease of the ovary is an arrest of the normal retrograde metamorphosis of Graafian follicles that have never become corpora lutea of menstruation or pregnancy." The term "proliferous," that is sometimes applied to these tumors, is open to direct objection. Such a term implies that the smaller cysts developed within the main sac are the progeny of a primary cyst, about and from the walls of which they have sprung. If the theory just expressed be true, then all the cysts,

both great and small, that the tumor contains, are derived from the same source—ovarian follicles. They differ only in age, in rate of growth, and in the accidents of position. They differ in degree, but not in kind, and are, so far as their immediate origin is concerned, quite independent of one another.

2. Papillomatous Cysts.—These are multilocular cysts, differing in no way from those just described, save in the important particular that the component cysts contain exuberant papillary growths. These tumors spring from the hilus of the ovary, and not from the parenchyma. In the hilus are traces of the Wolffian body, and from these remains the present form of tumor is supposed to be developed. It is affirmed, also, that when the common multilocular tumor presents traces, as it sometimes does, of papillary growths, then the cyst must have spread from the parenchyma to the hilus. Pure growths from the hilus contain only papillary growths. These growths appear as luxuriant cauliflower masses. Their surface is covered with cylindrical epithelium, and they readily bleed if touched. They are apt to spread rapidly. They may burst through the capsule of the main cyst, and invading the peritoneum, may spread over



FIG. 2.—An Ovarian Tumor, associated with Papillomatous Growths. (After Robert Barnes.)

it and grow and extend with great vigor (Fig. 2). The cysts themselves may attain immense proportions. The fluid within cysts that contain papillary growths is peculiar. It is clear, thin, not glairy, and almost devoid of organic products. Hemorrhage into cysts of this nature is common.

3. Dermoid cysts.—These tumors are precisely similar to the dermoid cysts that are found in other parts of the body. Their precise mode of origin is unknown. Their walls vary in thickness, and are lined with dense layers of squamous epithelium. Their contents may be like sebaceous matter, or if this matter be

mixed with blood, like a brown or chocolate-colored paste. In other instances the contents are more fluid, may be glairy, or like oil or glycerine.

In addition, these cysts nearly always contain hair, and often teeth. In other cases they may contain portions of bone and of cartilage. They are commonly multilocular. Unlike the cystomata, already dealt with, the outer wall of the dermoid cyst is not smooth and silvery, but is dull of aspect and of a gray or greenish color, mottled with deeper tints.

These tumors are usually small; commonly about the size of an orange, and rarely as large as a man's head. They do not fluctuate, but feel hard and irregular. In about one-fourth of the cases both ovaries are involved. These tumors may remain long stationary.

4. Solid tumors.—The majority of these are sarcomata and cancers. The usual form of sarcoma met with is of the spindle-celled variety. Rare instances of fibroma and of fibro-myoma have been recorded, and enchondroma of the ovary has been observed.

5. Simple cysts of the broad ligament.—Ovarian cysts are multilocular. All cysts of the broad ligament, or of the parovarium, are unilocular. With regard to the former, some appear to be developed from the connective tissue of the ligament, others may be due to an enlargement of the dilated outer end of the horizontal tube of the parovarium, while a third set appear to be developed from the tissue in the vicinity of the ovarian fimbria of the fallopian tube. All these cysts are quite simple and unilocular. They may attain great size. They appear as rounded tumors of regular outline. Their walls are thin and have a dark aspect, due to the fact that the contained fluid shows through them. In this respect they differ from the ovarian cystomata. The contained fluid is thin and watery.

6. Parovarian cysts.—The parovarium, or organ of Rosenmüller, can be seen on holding the broad ligament up to the light. It lies between the ovary and the fallopian tube and between the layers of the ligament. It is composed of some fifteen vertical tubes that end above in a horizontal canal. The outer tubes are lined with imperfect cubical epithelium; the inner tubes are represented by slender and impervious cords. The horizontal tube ends internally in a cord-like band which

can be followed as far as the uterus (the obliterated duct of Gartner). Parovarian cysts are developed from such tubes of the organ of Rosenmüller as contain epithelium. They resemble, in their general features, the simple broad ligament cysts, but differ in this, that they contain, often in large amount, papillary growths of the same character as those met with in the hilus cysts of the ovary.

The pedicle of all ovarian cysts, with the exception of such as grow from the hilus, is composed of the fallopian tube, much elongated, of the thickened broad ligament, of the utero-ovarian and round ligaments, and of many large blood vessels. The length of the pedicle varies from two inches to several inches, and Sir Spencer Wells records one instance in which it measured over a foot. It may appear in two divisions.

The papillomatous cysts that grow from the hilus tend to be sessile. They grow between the layers of the broad ligament and carry the ovary upon their surface. Even when a pedicle exists in the other ovarian cystomata, the ovary is usually found in very close contact with the tumor, and often flattened out upon its surface.

The broad ligament and parovarian cysts present pedicles containing the same structures as those attaching ovarian tumors, but such pedicles are shorter and broader. If the broad ligament cyst spreads upward it may present a good pedicle, but the parovarian tumors are often sessile, like those that grow from the ovarian hilus. In any instance, the fallopian tube, or a large part of it, will be found stretched out over the surface of the cyst, while the ovary may hang free by the side of the tumor.

Twisting of the pedicle.—This is due to the rotation of the tumor, but the causes of that rotation are unknown. The condition can only be met with when the pedicle is of the fair length and comparatively narrow. Sir Spencer Wells states that the tumor may be rotated round its axis as many as two or three times. The uterus is pulled in the direction of the rotation. The twisting may be spontaneously reversed, and after such recovery it may again recur. It follows from this twisting that the veins become compressed, while the arteries are not entirely occluded. The result is great congestion of the cyst, with much exudation of serum,

and possibly extensive hemorrhage and subsequent rupture of the sac. In other instances gangrene and sloughing of the tumor, or of parts of it, follow. In a third series of cases the cyst atrophies, and this wasting may in rare instances reduce the tumor to a small and inert mass, and so effect a cure. In a fourth class of cases, where extensive adhesions are connected with the cyst, the pedicle may waste and disappear, and the tumor derive its future blood supply entirely through the adhesions.

The symptoms of twisting of the pedicle are: sudden accession or increase of pain; altered pressure sensation from change in the position of the tumor; alteration in the relative position of the tumor and the adjacent viscera; change in the contour of the abdomen, and, in certain cases, evidence of internal hemorrhage. In one instance sudden death followed; in other cases vomiting set in, with some of the phenomena of peritonitis.

Prognosis.—The prognosis attending cancer and sarcoma of the ovaries is identical with that of internal malignant disease in other organs.

Cystic tumors may undergo *spontaneous cure* under the following circumstances:

1. Atrophy depending upon twisting of the pedicle.
2. Rupture of the cyst into the bowel, with evacuation of its contents and subsequent closure.
3. Suppuration of the cyst and discharge of its contents through some opening upon the surface.
4. Some dermoid cysts may remain quiescent for a lifetime.

All these modes of cure, however, are exceedingly rare, so rare that they have little or no influence in directing the treatment of the disease. Putting aside these very exceptional accidents, it may be said that ovarian tumors will sooner or later end in death (in seventy-five per cent. the disease runs its course within two years) if some active treatment be not adopted.

Cause of Death.—Bryant's statistics show that thirty per cent. died from exhaustion, twenty per cent. from peritonitis, seventeen per cent. from suppuration of the cyst (many of these cases, however, resulting from tapping, a mode of treatment that at the present time is seldom adopted), nine per cent. from the two last causes combined, ten per cent. from rupture of the cyst, and ten per cent. from the cyst ulcerating into some viscus such as the intestine or bladder. Among

other causes of death may be mentioned hemorrhage, and strangulation of the intestine by the pedicle of the tumor.

Rupture of the cyst.—This may occur spontaneously or as the result of accident or injury. The rupture may be sudden and complete, and death follow from hemorrhage or peritonitis; or the cyst may yield gradually, a slight leakage being produced from time to time, slight discomfort following, with a trifling amount of peritonitis.

The cysts of all others that are the most liable to rupture are the dermoid; next in order in their liability may be placed the cysts that contain papillary growths. When such tumors give way the papillary growth is set free, it spreads with vigor, and is soon found to be disseminated throughout the abdomen. The rupture of a simple broad ligament cyst may cause but little trouble, the fluid that they contain being apparently harmless to the peritoneum.

When the outer wall of a multilocular cystoma gives way, the rupture may be blocked by the protrusion of a secondary cyst.

The rupture is, in any case, most usually into the peritoneal cavity.

The Symptoms of Diagnosis and Ovarian Tumors.—Ovarian tumors have been met with at all periods of life, in infants as well as in the aged. The great majority, however, of the cases are in women whose ages lie between twenty-five and fifty-five. Ovarian growths appear to be much more common in the married than in the single, and are met with in individuals of all nationalities and in all stations of life. The rate of growth of these tumors is most uncertain, and mere size is no guide to the severity of the symptoms. A small tumor may cause the direct distress, while a cyst that fills the abdomen may produce, for a time at any rate, comparatively slight inconvenience. In its early stages the ovarian tumor usually produces no symptoms. It is most commonly discovered by accident, and the patient's account of its origin is often of little value, and sometimes actually misleading. In some instances there is distinct evidence that the mass has sprung from one or the other side. As the tumor enlarges it begins to press upon adjacent structures. As a rule it presses first upon the bladder or the rectum, producing incontinence of

urine or dysuria on the one hand, and constipation on the other. It may bring pressure to bear upon the sacral nerves, and thus be the cause of vague pains about the lower part of the back, the vulva, the perineum, and the lower extremities. By possible narrowing of the iliac veins it leads to congestion of the vagina and of the external genitals, to œdema of the feet and legs, and, in time, of the anterior abdominal wall.

As it mounts up among the intestines it may irritate the bowels, and so produce colic and diarrhea, or may press upon the stomach and excite nausea and vomiting. As the abdomen is occupied, the respiration becomes more and more entirely thoracic. When the tumor attains great size it may press up the diaphragm, may displace the heart apex, and lead to considerable dyspnoea. In advanced cases much fluid may be found in the pleuræ, the lungs may be œdematous, and portions of their bases may be consolidated. With the larger tumors there is usually some ascites. The urine passed is often small in amount, highly concentrated, and loaded with urates; in other cases it may contain albumin. The more serious renal troubles in ovarian disease are probably due to the effects of pressure on the ureter. Such pressure leads to dilatation of the pelvis, to congestion of the kidney, and ultimately to an interstitial nephritis. During the progress of the growth menstruation may, in rare instances, be quite normal and regular. It is more commonly irregular, or excessive, or entirely arrested. Before the abdomen has attained great size the patient's health begins to suffer. She is worn by the pain and the increasing burden of the growing mass; she is unable to sleep, finding it, perhaps, difficult to lie, or able to lie only in one position. There is naturally, also, no little mental anxiety. Her appetite fails, her digestion is disturbed, her blood impoverished, and her nervous system shattered by imperfect assimilation. She emaciates, and her face soon shows that peculiar physiognomy which has been described as the *facies ovariana*. The emaciation, the prominent or almost uncovered muscles and bones, the expression of anxiety and suffering, the furrowed forehead, the sunken eyes, the open and sharply defined nostrils, the long, compressed lips, the depressed angles of the mouth, and the deep wrinkles curving

round these angles, form together a face which is strikingly characteristic.

In every case a pelvic examination should be conducted. For this purpose the patient is placed upon her back with her shoulders and knees raised so as to relax the abdominal walls. The finger is then introduced into the vagina, while the other hand presses upon the belly just above the pubes. By this means the outline and consistence of the tumor can often be made out, as well as its general relations to the contents of the pelvis. The tumor as a rule lies behind the uterus. This organ will be displaced, will be thrust to one side, or retroverted or anteverted. In some cases it may be so dragged up by the tumor as to be beyond the reach of the finger. Generally speaking, the tumor will be found to be round, and, if small, movable. If on vaginal examination the pelvis be found to be clear, it may be taken to indicate a long pedicle. The mass will be found to be free of the uterus, but a sound should not be introduced until the surgeon is satisfied that there is no suspicion of pregnancy. The physical characters of these tumors can be best dealt with in considering the differential diagnosis.

Differential Diagnosis.—*Multilocular and unilocular cysts.*—This differentiation really resolves itself into the separating of ovarian cystomata from those of the broad ligament or parovarium.

The unilocular broad ligament, or parovarian cyst.—The tumor is rounded, smooth, and of regular surface. These features are made manifest both by the abdominal and vaginal examinations. It feels elastic, and presents a sense of fluctuation that is equally felt in all parts. Again, if the fingers of one hand be placed flat upon the swelling, and maintained steadily against it, while a distant part of the tumor is sharply tapped by the fingers of the other hand, a thrill will be felt to pass through the mass. This fluctuation wave will be made out in all diameters of the tumor, and is most distinct when the walls of the belly and the cyst are both thin, and the latter fully distended. The mass will of course be dull on percussion. The margin of the dullness will be precise, and will be surrounded by a resonant area (intestinal). These tumors are much more likely to be freely movable than are multilocular cysts of equal size. They may have lasted for

years with little damage to the health, and, other things being equal, cause much less distress than the multilocular cysts. They are, moreover, less likely to contract adhesions.

The multilocular cyst is more substantial. Although in general outline round, its surface is usually irregular, and sometimes very irregular. Fluctuation is not so well marked as in the previous form of growth. When present it will be less distinctly felt in some places than in others. If the contents are very colloid, the component cysts small, and the parietes thick, it may be impossible to detect any fluctuation, and in its physical characters such a tumor could not be distinguished from a sarcoma. The thrill of the fluctuation wave on percussion will be absent. In some cases, however, a secondary cyst attains such size that it forms the greater part of the tumor, and, in such an instance, the part of the tumor occupied by the secondary cyst will present the features of the unilocular cyst. As already stated, these growths cause more distress, and are more likely to contract adhesions than are the simple tumors.

The dermoid cyst will be small, will most probably be met with in a young subject, will be dull on percussion, of irregular outline, and quite hard to the touch. Such cysts may present nodular projections that feel as hard as cartilage. Some of them may feel elastic, but they do not fluctuate.

Errors in diagnosis.—There are few abdominal swellings, and certainly none taking origin from the pelvis, that have not, at one time or another, been suspected of being ovarian. The following are the conditions that most readily lead to error.

1. Ascites.—(a) *Form of abdomen.*—In ascites the sides of the abdomen protrude more than the front. In ovarian disease this condition is reversed. Alteration in the posture of the body produces greater and more immediate changes in the form of the belly in ascites than it does in ovarian disease. In ascites, the greatest circumference of the abdomen will be about the umbilicus, whereas in ovarian cystoma it will usually be some inches lower down.

(b) *Dullness and fluctuation.*—It is assumed that the examination is conducted while the patient lies flat upon her

back. In ovarian tumor the area of dullness is in the front of the abdomen; its limits are sharply marked, and it is surrounded by an area of resonance (intestinal) (Fig. 3). Even when the cyst is of large size, resonance can usually be detected in one or both flanks. In ascites, the abdomen is resonant in front, but dull at the flanks, owing to the gravitation of the fluid thither (Fig. 4). Its limits,

tained within a cyst, fluctuation cannot be detected beyond the boundaries of the cyst. Hence the outline of the cyst, traceable by dullness on percussion, and the line where fluctuation can be perceived, must be the same."

(c) *Character of fluid*.—This may sometimes be ascertained by exploratory aspiration. The thin, serous fluid of ascites is readily distinguished from the

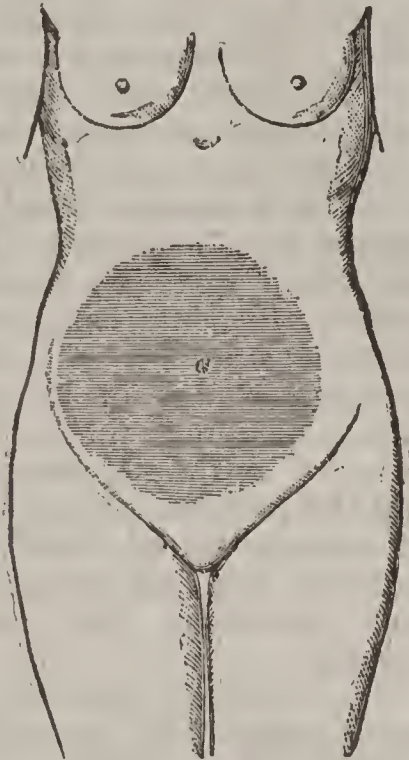


FIG. 3.—Area of Dullness Ovarian Tumor.



FIG. 4.—Area of Dullness in Ascites.

moreover, are not well marked. In ascites, the dullness varies with change of posture, *e. g.*, if the patient turn over to one side, then the other side that was before dull will be found to be resonant. In the cystomata change of posture does not affect the dullness.

"In ascites, at any spot near the level where the resonance of the intestines ends, and the dullness of the fluid begins, and a dull sound is elicited by gentle pressure and percussion, a deeper pressure will displace the fluid, and the resonance of the intestines will be heard. Superficial and deep percussion cannot produce such difference in the sounds in ovarian disease.

"When fluid is free in the peritoneal cavity, the wave of fluctuation may be felt not only where the sound is dull on percussion, but also beyond the line of dullness, even where resonance may be tympanitic. The intestines float in the fluid, and the fluid may be thrown in waves among them. But when fluid is con-

thick, glairy fluid [of the most common form of ovarian growth. It may, however, not be distinguishable from the thin and limpid fluid that escapes from unilocular cysts. Numerous tests have been devised to separate such fluid from that met with in ascites, but without very satisfactory results. The two tests upon which some still place reliance are the following: (1) Boil the fluid. A coagulum forms. If this dissolves in boiling acetic acid, the fluid is ovarian; if it will not dissolve, it is ascitic. (2) Allow some of the fluid to stand for twenty-four hours. If at the end of that time a slight coagulum of fibrine filaments is to be noticed, the fluid is ascitic, for there is no spontaneously coagulating fibrin in ovarian fluid.

(d) *Other points*.—The history of the case will be of great importance, and also evidence of the presence of such diseases as produce ascites.

The diagnosis is complicated when air or gas is found within an ovarian cyst

(since it will produce a resonant note in the middle line), when ascites coexists with ovarian disease, and when a simple dropsy is so considerable that the anterior wall of the abdomen is pushed beyond the reach of the intestines, and the dull note of the fluid is to be heard all over the front of the belly.

2. Encysted dropsy of the peritoneum.

—This condition results from chronic peritonitis. Some of the fluid effused is inclosed in a cyst-like cavity formed by adhesions that connect adjacent viscera. The amount so encysted is usually small, although it may amount to several quarts. This encysted dropsy is most common in cancerous and tubercular peritonitis, and therefore the history and general health of the patient are matters of primary import in the diagnosis. These collections have less defined boundaries than ovarian cysts; fluctuation is less distinct, the abdomen is flatter, the collection is not movable; often the collection is so shallow that, on deep percussion, the resonance of the bowels beneath the fluid can be brought out.

3. **Hysterical tympanitis.**—Here the abdomen is uniformly distended; is round, hard, and resistant; is everywhere tympanitic; the patient is the subject of hysteria, and under chloroform the whole tumor disappears.

4. **Pregnancy.**—*a.* The age of the patient may at once settle the question of pregnancy. *b.* There may be such disease or deformity of genitals as to render conception impossible. *c.* The pregnant uterus forms a tumor that commences in the median line. *d.* A tumor, known to have been present for nine months and yet no larger than a uterus at the fourth month, cannot be due to pregnancy. *e.* The ovarian tumor causes more distress. *f.* There are the familiar signs of pregnancy. To these, however, too much attention must not be given, since they may be imitated in ovarian disease. *g.* The fetal heart sounds can be heard, and the fetal movement felt, after the sixth month. *h.* It can be established by pelvic examination that the tumor and the uterus are one.

5. **Extra-uterine pregnancy.**—The chief points are the age of the patient, the history of conception, the signs of pregnancy, the fetal heart and fetal movements, the signs of spurious labor at the end of nine months, with sub-

sequent diminution in the size of the cyst.

Errors in diagnosis have also depended upon fatty tumors of omentum; tumors of the peritoneum or subserous tissue; hydatids; distended bladder; fecal accumulations; diseases of the uterus, especially such as are attended with distention of its cavity; renal cysts; pelvic abscess; hematocele.

6. **Recognition of adhesions.**—Adhesions between the cyst and adjacent parts are frequent, are invariably the result of some local peritonitis, and may seriously complicate an operation. They may connect the cyst with the parietes, the intestines, the omentum, the bladder, uterus, and rectum, and in rare cases with the liver, or stomach, or spleen. The relative frequency of such adhesions is shown by the following table drawn up by Sir Spencer Wells: In 500 cases. No adhesions in 212 of the cases. Parietal adhesions in 61. Parietal and omental in 63, omental only in 62. Intestinal adhesions, pelvic and others, in 102. The most serious adhesions are those about the pelvis that connect the cyst to the bladder or rectum, or the appendix vermiformis, or to coils of ileum lying in the pelvis, or to the iliac vessel. Instances where the tumor is so fixed by adhesions that it has practically to be enucleated, may be expected in five cases out of every hundred. Adhesions are difficult to recognize before operation. They may be absent in cases where severe symptoms of peritonitis have existed, and present where no such symptoms have been noted. Doran states that out of 500 cases of ovariectomy he has witnessed, were forty-five examples of multiple adhesions without any previous history of peritonitis.

To detect adhesions.—Place the patient on her back with the belly a little relaxed. If the cyst be free it will move up and down with the respirations, descending one or two inches with each inspiration. If close adhesions exist there is no such movement, but the cyst and the abdominal wall move together. If, however, the adhesion be very long the cyst may still move; but in such a case, if the hand be placed flat upon the abdomen, a grating or creaking (due to the friction of long adhesions) will be felt, and also a friction sound heard. These signs may be to some extent imitated by omentum lying in front of the sac and by the

rubbing of surfaces covered by recent lymph. So long as the signs are present the cyst must be movable. They cease where the cyst is quite fixed. The umbilicus is not affected by the movements of a free cyst during respiration, or when pushed in various directions. But any movement communicated to a cyst which adheres to the front of the abdominal wall is immediately followed by a corresponding movement of the navel. In the next place the patient may be placed upon her knees, with her chin resting upon the bed. If extensive pelvic adhesions exist, the finger in the vagina or rectum will recognize that in this posture the cyst does not move toward the thorax.

Treatment.—1. *General.*—In any instance a patient suffering from ovarian diseases should be placed under the most favorable hygienic conditions. The diet should be simple and nutritious, and the usual measures should be adopted to correct any digestive disturbances when such exist. If constipation is present, the bowels must be kept open by the use of enemata and gentle aperients. Pain may be relieved by morphia in the form of hypodermic injection or suppository. Mere restlessness and inability to sleep, independently of any pain, may be met by bromide of potash. The abdomen, if of large size, should be supported by a suitable belt or binder, and the posture of the patient should be consulted, so as to relieve, as far as possible, the symptoms due to pressure. It will sometimes be found that the patient is passing only a small quantity of highly concentrated urine, that deposits mixed urates in abundance. If ovariectomy be performed on a patient in this condition, a serious amount of kidney congestion, with symptoms almost amounting to uræmic fever, is almost certain to follow the operation. The state of the urine may be improved by the use of warm baths, by promoting a free action of the skin and of the bowels, and by the administration of the alkaline carbonates with lithia. The patient's condition may be improved by tonics, and especially by the administration of iron.

2. *Operative.*—There is only one certain means of relieving a patient of an ovarian tumor, and that is by the operation of ovariectomy. Before ovariectomy became an established procedure, various surgical measures were in vogue. Cysts

were tapped and injected with iodine, or were kept of small size by many repeated tapplings. They were evacuated, also, through openings made in the vagina or rectum, or they were cut into and drained. These various measures were attended by a fearful mortality, and do not call for serious comment at the present day. They have become merely matters of history. One procedure, however, demands some notice, and that is the process of simple tapping.

Tapping through the abdominal parietes.—There are cases where a patient and her friends will not consent to a cutting operation, and there are other cases where, for various reasons, medical and otherwise, the question of ovariectomy has to be for a time postponed. In such instances the point may be raised as to the value of a simple tapping through the anterior abdominal wall. Such tapping, it must be confessed, is very seldom justifiable. Not only is it dangerous in itself, but it is, in the vast majority of cases, only of temporary utility, and is apt to be followed by adhesions, whereby the success of a subsequent ovariectomy may be seriously involved. There is, however, one form of cyst, and probably one only, in which a single tapping may be followed by a complete cure. This is the simple unilocular cyst of the broad ligament; nevertheless, most surgeons at the present day would prefer to treat such a cyst by ovariectomy rather than by tapping. The reasons for this preference are these: 1. The tapping may not be successful. 2. If unsuccessful it may lead to the formation of serious adhesions. 3. It is not possible to distinguish the simple cyst of the broad ligament from the unilocular parovarian cyst. Now this latter cystoma contains papillary growths, and the tapping of its sac would probably encourage the increase of these growths and their invasion of the peritoneum. This is perhaps the most serious objection that can be urged against the tapping of cysts supposed to be simple broad ligament tumors. 4. Ovariectomy is, as a rule, peculiarly simple when these unilocular cystomata are concerned.

With regard to multilocular and dermoid cysts, it will be seen that, not only can they not be cured by the process of tapping alone, but they cannot even be evacuated by a trocar.

Sir Spencer Wells's conclusions with

regard to tapping in these multilocular cysts are as follows: "It may sometimes be a useful prelude to ovariectomy, either as a means of gaining time for a patient's general health to recover, of clearing the urine of the albumin with which it is sometimes charged under the mere influence of pressure, or of lessening shock by relieving her of the fluid a few hours or days before removing the solid portion of an ovarian cyst."

If a cyst is to be tapped the patient should lie upon her side, at the edge of a bed, with the abdomen projecting a little beyond the edge. An incision large enough to take the trocar is made with a scalpel in the linea alba, below the umbilicus. The best trocar for the present purpose is that invented by Spencer Wells, since it prevents the admission of air into the cyst. After the cyst has been slowly evacuated, a pad of lint, secured by strapping, is placed over the skin wound.

Ovariectomy.—When the diagnosis of an ovarian tumor has been clearly established, the sooner the growth is removed the better. No substantial reasons can be urged in favor of delay; even small tumors, such as dermoid cysts, that have remained quiescent for years may at any time enlarge and, after no prolonged period of growth, rupture. The mortality after the operation is now so low that the patient will run greater risks by retaining an apparently quiescent tumor than by subjecting to its removal by the knife.

It is important that the patient should at the time of operation be in a fairly good state of health. The general health has, perhaps, more to do with the success of the operation than the condition of the cyst. The size of the growth, regarded as an isolated factor, has practically no influence upon the result of the treatment. It is obvious, however, that large tumors mean longer duration and a more prolonged period of distress, and of drain upon the system.

Contra-indications.—The operation should not be performed if the patient's health be exceedingly poor, and there is great prostration. In this matter the general surgical principles that would forbid any great operation will equally forbid an ovariectomy. The operation should not be performed if any independent organic disease exists, which, apart from the

local malady, would lead to a comparatively early death. Thus, it would not be justifiable in patients exhausted by diabetes, or in advanced stages of phthisis, or of Bright's disease. In such individuals a threatened rupture of the cyst may be averted by tapping, and life be thus prolonged with some increased degree of comfort. In cases of malignant disease an operation would only be justifiable while the growth remained limited to the single organ. Ovariectomy would be worse than useless if the disease had spread to adjacent parts, and had led to the cachectic state of advanced cancer. The careful selection of cases for operation, upon sound surgical grounds, has had much to do with the present success of ovariectomy.

The part played by adhesion.—Adhesions, especially when extensive and matured, and attached to adjacent viscera, add in a very special manner to the gravity of the operation. The following table, showing the result of the operation in Sir Spencer Wells's second series of five hundred cases, will express the degree of danger that attend this complication:

<i>Adhesion.</i>	<i>Cases.</i>	<i>Mortality.</i>
None.....	212	13.67
Parietal.....	61	18
Parietal and omental.....	63	19
Omental.....	62	24.19
Intestinal, pelvic, and other	102	37.25

Operation.—The ovariectomy should be performed in a small, well-lighted, and well-ventilated room, which should be maintained at a temperature of about 65° during the operation. The less furniture the room contains the better, and all carpets and curtains should be removed. As the operation should be conducted with the strictest Listerian precautions, it is as well that a carbolic spray be set going in the room for some two or three hours before the operation, and before the patient is admitted. No food should be taken for three or four hours before the operation; the bowels should be well cleared out by enema, and the bladder emptied by the catheter just before the patient is placed on the table. Her lower limbs should be enveloped in warm woolen stockings, and the upper part of her body in a thick flannel jacket. It must be borne in mind that without such protection the body may be much chilled by the spray, the temperature of which will be some degrees below that of the surrounding air. The

pubic hair should be shaved off, and the front of the abdomen well washed with soap and water, and then with a carbolic solution. A large waterproof sheet is now to be applied. This is provided with an oval hole, measuring eight inches by six inches; around the margin of the opening a strip of adhesive plaster, one inch in width, is sewn. When everything is ready the strapping is warmed, and the sheets applied so that through the opening is exposed the front of the abdomen, the lower extremity of the opening corresponding to the symphysis. The lower limbs should be enveloped in a blanket, and then wrapped round in a mackintosh sheet; in fact, the whole body, with the exception of the face and front of the belly, should be protected by a waterproof covering. The spray should be employed during the whole of the procedure, and the usual details of Listerism carried out. In connection with the question of antiseptic measure in ovariectomy, it is only fair to say that certain eminent surgeons, notably Mr. Bryant and Dr. Keith, do not adopt the Listerian method, and yet obtain most successful results.

Ether is the best anæsthetic under most circumstances. Sir Spencer Wells always uses and strongly advocates bichloride of methylene.

The incision is made between the umbilicus and the pubes, should be precisely in the median line, and large enough to at once admit the hand. There is practically no linea alba below the umbilicus, and thus it happens that the sheath of one rectus is often opened. The tissues should be divided with the knife alone, and should not be disturbed and mutilated with a director; any bleeding that occurs may be checked by Wells's clamp forceps. When the peritoneum is exposed it should be pinched up between the fingers and the thumb to insure that it is free. This having been made clear, a minute fold is to be picked up with the forceps and divided, the cavity being thus opened. If the incision requires enlarging it should be enlarged upward; the first two fingers of the left hand are introduced into the belly, and play the part of a director, while the cut is made with a straight blunt-pointed bistoury. When the cyst has been exposed the hand is at once introduced into the belly, and passed all around the tumor to ascertain that it is free from all adhesions.

If adhesions exist between the cyst and the belly wall, the incision had better be continued up until the adhesion area is cleared. If, however, it is impossible to clear the area by a moderate incision, the cyst had better be tapped at once, and, as the collapsed sac is being withdrawn, the limit and extent of the adhesions will become more apparent.

In an uncomplicated case the cyst, on being exposed, is at once tapped with a Wells trocar. If multilocular, the chief sacs can be tapped one after the other, without withdrawing the trocar.

The collapsed cyst is then drawn through the incision. If the tumor be of large size by reason of much solid growth in its walls, the incision may require to be much enlarged. No special risk attends a large incision, but great risks attend the forcible dragging forth of a cyst through a small opening.

Any protrusion of intestines is prevented by an assistant, by means of a large flat sponge, wrung out in a warm carbolic solution.

The pedicle having been exposed, it is transfixed by a stout needle in a handle carrying (through an eye near its point) some strong whipcord, or thick "Chinese twist." The pedicle so transfixed is then ligatured in two parts. The ligatures should be tied as tightly as possible, and the pedicle then divided immediately beyond them. The ligatures are cut short, and the stump dropped into the pelvis. The other ovary should be carefully examined for disease before the wound is closed. The pedicle having been secured, the pelvis requires to be *thoroughly* wiped out with warm carbolic sponges. I am in the habit, as soon as the abdomen is opened, of introducing one large warmed sponge at once deep into the pelvis, and leaving it there until the time for cleansing the peritoneum has arrived. It may be pointed out that, from carelessness, sponges and even forceps have been left in the patient's abdomen.

The wound is now to be closed. A flat sponge may be placed just within the incision while the sutures are being introduced, and removed before they are drawn tight. Chinese twist is the best material for the sutures. Two straight needles are used, and into them a long piece of "twist" is threaded at either end. By using two needles, all the sutures can be introduced from within out, the serous

membrane being pierced first and the skin last. In this way deep sutures, all taking in the peritoneum, should be applied at intervals of one inch. The intervening parts are closed by superficial sutures, most conveniently introduced by Hagedorn's needle and needle holder. No drainage-tube is required.

Complications of the operation.—Slight adhesions may be broken down with the finger, or torn across. Larger and more substantial bands must be divided between ligatures. In separating the tumor from adhesions, the latter may be temporarily secured by Wells's larger clamps, divided, and then dealt with after the removal of the cyst. If a surface, from which adhesions have been stripped, continues to ooze, it may be necessary to check the bleeding with the actual cautery. In dealing with deep pelvic adhesions, care should be taken to ascertain the position of the ureter, which may easily be divided or ligatured by mistake.

If the bladder should be accidentally wounded the wound should be closed by the Czerny-Lembert suture, so as to bring the serous surfaces together, and a catheter tied in. Wounds of the rectum or intestine should be at once closed by the same form of suture. If the adhesions are so extensive that removal is practically impossible, it may be necessary either to abandon the operation or remove as much of the growth as possible, and then to close the wound, after having inserted a large drainage-tube.

If the cyst has suppurated, it should be removed when possible. If impossible, the cyst should be opened, the edges of the opening secured to the margins of the abdominal wound, and the cyst cavity freely drained.

The removal of both ovaries at one operation adds distinctly to the risks of the procedure. Sir Spencer Wells's statistics show that the mortality of double ovariectomies is twelve per cent. higher than that attending the ordinary operation.

In many instances two successive ovariectomies, undertaken at varying intervals, have been performed upon the same patient. The mortality in these cases has not been above that attending single ovariectomies.

Pregnancy is in itself no bar to the performance of ovariectomy. Patients with ovarian tumors have passed through the period of pregnancy without trouble, and

have been delivered safely at the full term. In the majority of instances, however, these patients abort. In any case, if the tumor be increasing rapidly, it is better to perform the operation at as early a period in the pregnancy as possible. Sir Spencer Wells details thirteen cases of ovariectomy during pregnancy. Of this number one only died.

Mortality.—The mortality attending Sir Spencer Wells's first 100 cases of ovariectomy was 34 per cent.; that with his last 100 cases was 11 per cent. "We may now," writes this surgeon, "confidently calculate upon an average death-rate of not more than three or four per cent."

After-treatment.—The patient must be kept in every sense at rest. If she vomits after the operation the nurse should press her hand over the site of the wound during the act of retching. The patient must on no account move from the recumbent posture. For the first three days her water should be drawn off by a catheter every six hours. Pain may be met by morphia. The bowels may be left to act spontaneously, but if no motion has been passed by the seventh day, an enema may be administered. For the first forty-eight hours, at least, and, if necessary, for the first three days, no food must be given by the mouth. Thirst may be quenched by a little iced water, or by warm milk and water, or a small quantity of hot tea. Hot fluids are usually better borne than iced water. After the first twenty-four hours, two ounces of peptonized beef tea may be introduced into the rectum every three hours, and continued until food can be taken by the mouth. The food first administered should consist of a little milk and beef tea, followed in a few days by arrowroot, or bread and milk. Stimulants should not be given unless demanded by the state of the pulse. The stitches may be removed on the third day, and the antiseptic dressing may be in most cases discarded entirely on the sixth or seventh day. The wound should then be supported with strips of strapping, and dressed with iodoform.

Oophorectomy; Battey's operation; spaying; castration of women.—By this operation is implied the removal of ovaries that are either apparently normal, or that present other structural changes than those of a new growth. Dr. Battey defines the operation as follows: "By the extirpation of an offending organ, endowed

with a peculiar and essential function, the performance of which function has become morbid and destructive of health, or endangering life, we seek to abrogate the function itself, and thus do away with its pernicious consequences." Elsewhere he speaks of it as "an ovariectomy to determine the 'change of life' for any grave disease which is incurable without it, and which is curable with it." It may at once be said that in the great majority of the operations already performed, the ovaries have presented some evidences of structural disease. In the complete operation both ovaries are removed.

Indications.—The indications for this operation have not yet been very distinctly formulated, and considerable difference of opinion exists as to the propriety of performing oöphorectomy for certain of the conditions for which it has already been adopted.

Keeping as far as possible to structural changes in the list given, oöphorectomy has been undertaken for the following conditions: 1. Persisting hyperæmia of the ovary. 2. Ovaritis. 3. Amenorrhœa, attended with hystero-epilepsy. 4. Occlusion, or absence of uterus or vagina, with violent menses. 5. Certain cases of uterine tumor. 6. Neuralgia of the ovary, and some cases of mania, epilepsy, and hysteria.

The operation differs in no essential detail from ovariectomy. The incision is made in the linea alba, below the umbilicus, and must be large enough to admit two fingers. One ovary after the other is drawn out of the wound. The broad ligament is transfixed, and, with the structures it contains, is ligatured in two parts, a third ligature being placed behind the other two. The knots are cut short and the stump dropped into the pelvis. When adhesions exist the incision must be of greater extent, so as to expose the ovary *in situ*.

The mortality after the operation, as estimated from 218 cases collected by Dr. Battey, is 18 per cent. Of those who recovered from the operation, 72 per cent. are reported "cured," 19 per cent. "benefited," and 9 per cent. "not relieved."

Symptomatic Indications.—One case of ovarian cyst has been reported cured by *apis mel.* and *arsenicum*. *Apis* is useful in the more acute form, pain increased by stooping and walking, pres-

sure on the bladder, frequent micturition; *ignatia*, for spasmodic pain in both ovaries, with contracted sensation at the stomach; *graphites*, swelling of both ovaries as if they were in motion, enlargement caused by sexual excesses; *platina*, enlargement of ovaries, catamenial discharge coagulated and thick.

OXALIC ACID, POISONING BY.—

The *symptoms* produced by oxalic acid taken in a concentrated form are those of an irritant poison, and consist of a burning, sour, acid taste in the mouth, which is perceived immediately, followed by burning in the throat, gullet, and stomach, grumous and bloodstained vomit, and cramps in the limbs. The patient may die from collapse in less than half an hour. When taken in a less concentrated form there may be tetanic spasms, and, when still more dilute, the patient may pass quietly into a somnolent state from which he never arouses.

In non-fatal cases there will be varying degrees of inflammation of the mouth, throat, and stomach, as well as cramps and numbness of the limbs, loss of voice, dyspnœa, and a dull red mottling of the skin in circular patches. The binoxalate of potash produces the same symptoms as the acid itself. A sudden indisposition, with symptoms of irritant poisoning, followed by speedy collapse, is characteristic of oxalic acid poisoning.

Post-mortem appearances.—The mucous membrane of the mouth and throat is whitened, the stomach contains a dark, mucous, gelatinous fluid, its mucous membrane is soft and in places abraded, the intestines are more or less congested and contracted.

Treatment.—The stomach-pump and emetics are contra-indicated, but warm water in sufficient quantity to insure speedy vomiting may be administered; the proper antidote is a saccharated solution of lime, a dram of which should be given immediately and repeated frequently. Failing this, magnesia or chalk, mixed into a paste with milk, may be given. A dose of castor oil ($\frac{3}{4}$ j) should be given to clear the bowels.

OXALURIA.—A persistent and copious deposit of oxalate of lime from the urine.

Oxalate of lime is a normal constituent of the urine. It is very frequently de-

posited as isolated crystals when the urine is slightly acid or even faintly alkaline. The crystals are always small, sometimes exceedingly minute, and occur in two forms. Their most common shape is that of an octahedron, presenting itself in various aspects; but they may also appear as dumb-bells or ovoids. The latter forms are due to the different views which are obtained when a bi-concave disk, the real shape of the crystal, rolls over in the fluid. From the analogy of other salts it seems probable that the formation of disklike crystals is determined by the presence in the urine of some viscid substance, such as mucus. The two forms of crystals are identical in composition.

When the deposit exceeds what may be a normal amount, its naked-eye appearances are characteristic. Shortly after the urine is voided, a white mucus-like cloud is seen, which gradually settles at the bottom of the urine-glass. The upper layer of the deposit forms a wavy film-like membrane, sharply separating the deposit from the supernatant urine. On the sides of the glass, too, there are seen fine lines of crystals running in all directions.

A deposit of oxalate of lime does not disappear when the urine is heated; it is insoluble in acetic acid, alcohol, and ether, but soluble in the mineral acids.

Oxalic acid is a result of the disintegration of organic substances in the body. It represents a lesser degree of oxidation than carbonic acid, which is one of the final terms of tissue metamorphosis. In the laboratory uric acid can readily be made to yield oxalic acid, and it has been suggested that the same reaction occurs in the urine; that, in fact, amorphous urates, by their decomposition, constitute the sole source of the oxalic acid of the urine. It is interesting to note, in connection with this, that the urine of gouty subjects, which habitually deposits uric acid on standing, not infrequently for a time deposits oxalate of lime. It must not be concluded, however, that this is caused by a decomposition of the uric acid. It is much more probably due to a variation in the acidity of the urine, which favors the precipitation of oxalic acid, but not that of uric acid. The oxalic acid of the urine exists almost entirely as the lime salt, and this, sparingly soluble in water, is nevertheless

somewhat freely soluble in a solution of the acid phosphate of sodium. Such a solution, however, when neutralized, deposits the lime salt in octahedral crystals. Probably the same phenomena take place in the urine. An excess of alkaline bases in the blood favors the excretion of oxalic acid, and the more lime there is present the more oxalate of lime will be deposited.

Oxalic acid administered in the food has been found to appear in the urine. It has, therefore, been thought, though probably on insufficient grounds, that such vegetables as rhubarb and sorrel, when taken with the food, may cause a deposit of oxalate of lime in the urinary passages.

Clinical Significance.—The main interest of the presence of oxalate of lime in the urine attaches to the possibility of its deposition while the urine is still in the urinary passages, thus forming a calculus (see RENAL CALCULUS). But it has been maintained that the persistent presence of more than normal quantities of oxalate of lime as a deposit in the voided urine is associated with a definite group of symptoms. Those supposed to be suffering from the so-called *Oxalic Acid Diathesis* complain of hypochondriasis and nervous depression. They also have vague nervous symptoms, such as tingling in the limbs, anæsthesia of irregular distribution, depression of spirits, irritability of temper, headache, loss of memory, and pain in the back, while with these symptoms there may be disinclination for exertion, irritability of bladder, flatulence, and other symptoms of atonic dyspepsia. But this clinical picture may be present without the occurrence of oxalate deposit in the urine, and the deposit may coexist with various diseases unattended by the symptoms above mentioned. Further, the occurrence of deposit of oxalate of lime in the urine is no proof that this substance is present in abnormal quantity, and, as has already been stated, there is no reliable clinical method for the quantitative determination of oxalate of lime in the urine. The deposit is due probably to an alteration in the acidity of the urine, and both this and the assemblage of symptoms described may be produced by the same causes. These causes have been fully investigated by Beneke, who showed that they lead to

an impeded metamorphosis of nitrogenous substances, and consist of excessive use of nitrogenous matters and also of carbo-hydrates as food, together with anæmia, insufficient fresh air, and hindrances to the respiration and circulation. A definite oxalic acid diathesis, however, must now be assumed to be non-existent. The occurrence of oxaluria, as an occasional phase of the gouty diathesis, has already been mentioned.

Treatment.—See RENAL CALCULUS. The other conditions which occur in association with oxaluria demand treatment directed to a general stimulation of the metabolic processes. The diet should be arranged so as to provide for a due proportion between the nitrogenous and other food stuffs. Digestion should be assisted; in the majority of cases the atonic state of the stomach demands the administration of the mineral acids, but in other cases, where there may chance to be irritant dyspepsia, alkalies and bismuth are called for. Due exercise in the open air should be prescribed, and, if possible, change of scene and removal to a bracing climate. Not infrequently domestic worries are at the same time interfering with the general health, and the patient should be warned to avoid them if possible.

ROBERT MAGUIRE.

PACHYMENINGITIS HEMORRHAGICA.—See MENINGES, DISEASES OF.

PAIN, SENSIBILITY TO.—See TOUCH, DISORDERS OF.

PAINTERS' COLIC.—See LEAD, POISONING BY.

PALMAR FASCIA, CONTRACTION OF.—The palmar fascia is an aponeurotic expansion beneath the integument of the palm of the hand, attached at its upper extremity to the transverse carpal ligament, and to the aponeurosis of the palmaris longus, where it is not more than an inch in breadth, and where its fibers are compacted into a firm mass of considerable thickness. The lower extremity expands to nearly the whole breadth of the hand, and is much thinner than the upper extremity—many of the fibers being inserted into the skin in front of the metacarpo-phalangeal articulations, and others, extending along the sides of the fingers, are attached to

the sheaths of the flexor tendons. The morbid condition of the fascia is of traumatic origin, being the result of frequently repeated and protracted pressure of hard substances against the palmar integument, such as rowing a boat, or handling a hammer or other tools.

As a consequence of the pressure to which the integument of the palm is subjected, it becomes more or less inflamed and indurated, and more firmly adherent to the subjacent fascia, which gradually contracts so as to induce a permanent flexion of the fingers, at first to a slight degree, but progressively increasing until in some cases the ends of the fingers are almost in contact with the palm of the hand. There is, generally, little or no pain when the parts are left to themselves, but great resistance is offered to any attempt at extension, and severe pain is induced if much force be employed. No resistance is offered to the attempt to flex the fingers to an additional degree. Indurated and knotty cords can be seen and felt, extending from the palm to the fingers, and the firmness of these cords is greatly increased by an attempt to extend the fingers. These cords are formed by contracted bands of the palmar fascia together with the closely adherent integument. The skin of the palm at a number of points is drawn into folds in the form of arcs of circles whose concavities look downward toward the fingers. The disease not only produces very considerable deformity, but the functions of the hand are seriously impaired. This morbid condition may be confined to one hand, or both may be involved. The fingers are not usually all contracted to the same degree. The ring finger is generally more flexed than the others, and the little finger more than the index or middle finger. In some cases there is, in addition to the contraction of the palmar fascia, a contraction of the sheath of one of the flexor tendons, producing a more obstinate and unyielding flexion of the affected finger. This contraction of the sheath of the tendon is usually confined to the vicinity of a single articulation, ordinarily that of the first with the second phalanx.

Contraction of the palmar fascia is to be carefully diagnosticated from persistent flexion of the fingers occasioned by other causes. One or more of the fingers may be permanently flexed in consequence

of division of the extensor tendon of the same finger or fingers by direct mechanical violence or by sloughing. Flexion of the fingers may also occur from cicatricial contraction after severe burns, or wounds, or contusions with loss of substance. It may occur from paralysis of the extensor muscles, from gouty, or rheumatic inflammation of the digital articulations, or from spasmodic or organic contraction of the flexor muscles. There is, for the most part, no difficulty in the diagnosis, if the condition of the parts and the history of the case be carefully investigated. Flexion from paralysis of the extensor muscle, or division of the corresponding tendon, is distinguished by the fact that no resistance is offered to passive extension of the finger. Cicatricial contractions are recognized by the history of the case, and by the obvious appearance of the scar. Flexion from articular inflammation is distinguished by the swollen condition of the joint; and the rigidity which constitutes an obstacle not only to extension but to further flexion, from persistent contraction of the flexor muscle or tendon, is recognized by the tension of the affected tendon, and the ease with which the finger may be extended when the flexor muscle is relaxed by extreme passive flexion of the wrist. Contraction of the palmar fascia has not often been recognized by writers on surgery.

Prognosis.—The disease, when left to itself, undergoes no amelioration, and whatever change takes place is for the worse. But if the contracted bands be thoroughly divided, and the affected fingers brought into an extended position, and secured by proper splints, and if passive motion be vigorously and persistently applied, the deformity may be effectually overcome, and a very useful degree of motion may be restored. But in old cases, perfect freedom of motion cannot ordinarily be regained. The operation of dividing the contracted bands should be performed while the patient is under the full influence of an anæsthetic, and consequently the operation itself occasions no pain. But the subsequent treatment is tedious and painful, being protracted through a period of several months. The patient should be fully informed beforehand that it is no trifling infliction that he is to undergo. But if he has the proper degree of fortitude

to endure the curative process, he will be amply rewarded by the result of the treatment.

In dividing the contracted bands of the palmar fascia, incisions are made at a number of points, wherever they are capable of relieving tension. The adhesion of the palmar fascia to the skin is so close that a strictly subcutaneous section cannot be made, but the skin should not be divided more extensively than is absolutely required. The wounds should be at once closed with adhesive plaster, and the fingers brought into an extended position. This position should be maintained by applying to the back part of the forearm and hand, and of the affected fingers, a metallic splint, adapted to the surface, with an intervening layer of lint, or of cotton or woolen batting. The fingers should be secured to the corresponding portions of the splint by narrow strips of adhesive plaster. The forearm and hand may be secured by means of a roller bandage. The dressings should be renewed at intervals of one, two, or three days, the parts washed, and wiped dry, and passive motion freely applied. Passive motion is quite painful to the patient, but it is an important means of restoring mobility to the fingers.

In the hands on which I have operated for contraction of the palmar fascia, and of the sheaths of the flexor tendons, after the fingers had been straightened, and the deformity removed, the power of flexing the affected fingers was very much diminished, and the attempt to flex them occasioned severe pain. The inability fully to flex the fingers, and the pain occasioned by the attempt, occurred not only in those fingers which had been abnormally flexed by the disease, but in those whose condition had been normal when the treatment was commenced, whether the affected fingers had been confined to the splint, or had been left at full liberty during the whole of this treatment. The ability to flex the fingers to the full extent is very slowly regained, and in some cases the patient never fully regains it. It is somewhat remarkable that, while the obstinate forced flexion occasioned by the disease can be in a great measure or wholly overcome in a comparatively brief period, the power of flexion should be lost, and that its restoration should be attended with so great difficulty, and should require so

long time. But even with this drawback, the substantial benefits resulting from the treatment commend the curative process to the attention of surgeons, and entitle it to rank among the established resources of the healing art.

ALFRED C. POST.

PALSY, SCRIVENER'S. — See WRITER'S CRAMP.

PALSY, SHAKING.—See PARALYSIS AGITANS.

PALPATION.—The use of the hands in physical examination, so as to obtain information through the medium of the sense of touch.

Chest.—In the article on FREMITUS (*q. v.*) the normal conditions and the significance of alterations of the various kinds of fremitus are fully described.

Heart.—The right hand should be placed flat upon the chest over the precordial region, first about the apex and then at the base; at the same time the point of the left thumb should be placed upon the right carotid artery in the superior triangle of the neck, on a level with the thyroid cartilage (just internal to the sterno-mastoid muscle). It is of importance to practice this combined palpation of the heart and the carotid pulse in order (1) to time any *thrill* which may be present; (2) to ascertain the relation of the apex beat to the carotid pulse, whether, as under normal conditions, the two are practically synchronous ($\frac{1}{10}$ second interval), or whether, as occasionally happens in cases of aortic regurgitation, they alternate, or whether the carotid pulse is delayed; (3) to ascertain that every beat of the heart is represented in the carotid pulse. This latter point will be further confirmed on auscultation, if, as recommended in the article on that subject (*q. v.*), the thumb be still retained upon the carotid pulse.

The position of the cardiac apex, which may or may not have already been observed on inspection, will be more definitely ascertained by palpation. It may be here stated that the importance in all cases of fixing this point accurately cannot be overestimated, as *the position of the cardiac apex is the key to the diagnosis of nearly all affections of the chest and heart.*

The character of the impulse, whether forcible and thrusting, as in hypertrophy,

or sudden, short, and tapping, as in dilatation, will also be ascertained.

The force of the ventricular systole can be best estimated by pressing the point of the thumb between the ribs over the apex beat. It must be noticed also whether the impulse is due chiefly to the contraction of the left or right ventricle.

The presence of *any abnormal bulging* will be noted, and especially whether or no it be a pulsating swelling.

Abdomen.—During the act of palpation of the abdomen the patient should lie upon the back with the legs fully extended and the shoulders slightly raised. If the abdominal walls be rigid, it is rarely of any use to make the patient flex the thighs upon the abdomen; as a rule, the effect of so doing is to render the muscles more tense than before; it may, however, be of service when the psoas muscles are in a state of undue tension. Rigidity of the abdominal wall may often be overcome by making the patient take a succession of deep inspirations, the chest being as much as possible emptied of air between each act. At first slight resistance is maintained as the abdominal walls rise owing to the descent of the diaphragm; but immediately expiration begins the hand is quickly pressed downward as far as possible, and is maintained in its position. Greater resistance is then offered to the rise during the next inspiration, while, with the following expiration the hand is pressed still farther downward. In this way it is generally possible to overcome rigidity, unless it be due to inflammation of the underlying peritoneum. If there be no rigidity, the fingers of one or both hands (the fingers being slightly flexed and in contact) should be employed in palpation, quick movements of flexion being constantly made, by which means any fluid in the cavity is suddenly displaced, and a solid organ or tumor, if lying near to the surface, is easily felt.

When it is desired to ascertain the lower limits of an organ, such as the liver or spleen, the hand should invariably be placed on the abdominal wall *below* the margin of the organ, and *gradually moved upward*, never in the opposite direction. A marked difference in the resistance is almost always noted as soon as the organ is reached, even if its margin be not distinctly felt. In "mapping out" any organ it is approached in this way from all

sides, and the spot where the edge is felt is marked with ink or an aniline pencil.

In the case of an abdominal tumor it is very important to place the whole hand flat upon the abdomen over the tumor, in order to ascertain its consistence, outline, and degree of mobility.

In the article on FLUCTUATION, the method of ascertaining the presence of fluid in the peritoneal cavity is fully described.

Pain may be complained of on palpation; when due to hyperæsthesia of the surface the slightest touch may cause intense suffering, whereas, if the patient's attention be distracted by conversation, deep pressure may be made without so much as attracting attention to the spot.

J. K. FOWLER.

PALPITATION is usually a subjective symptom, the patient complaining that he feels the beating of his heart. The action of the heart may be found to be tumultuous or only forcible, or nothing abnormal may be detected as regards the force, frequency, or regularity of its action. It is usually present at some period in organic disease of the heart, and may then be a symptom of failure of compensation or of degeneration of the cardiac walls. In functional affections of the heart, as seen in Graves's disease, or in hysteria, it may be constant or occur in paroxysms, while, in a considerable number of the cases in which it is present it is dependent upon indigestion. Gout, nervous exhaustion, venereal excesses, the abuse of alcohol, tea, coffee, and tobacco are also common exciting causes of this condition. When due to valvular disease it is generally increased on exertion, while, in other cases, it may be relieved by moderate exercise, and in gastric cases it is often worst when the patient is in bed. Even in cases of heart disease it is often dependent on the condition of the stomach, and will be relieved by treatment directed accordingly. See also **HEART, DISEASES OF MUSCULAR WALLS**, and **HEART, NEUROSIS OF**.

PANCREAS, DISEASES OF.—Diseases of this organ are uncommon, and are often unrecognized.

1. Obstruction of the Pancreatic Duct.—*Symptoms.*—The absence of pancreatic juice from the intestines, owing to complete obstruction of the pancreatic

duct, produces a condition of the fæces which is characteristic; the stools are copious, loose, putrescent, greasy, and stone or clay colored. The presence of fat in the stools has long been recognized, but the significance of the pale color has been only recently pointed out.

Beyond this condition of the stools there appears to be no constant symptom; epigastric pain may be slight, of short duration, or absent; glycosuria has been observed in some cases, and there may be considerable emaciation and debility. On the other hand, complete obstruction is not incompatible with long life, the patient continuing to pass the characteristic stools for many years. In a few cases the obstruction has been followed by the formation of large cysts, which have been mistaken for ovarian cysts. Such a cyst, if of moderate size, presents a rounded elastic or fluctuating tumor beneath the right costal border; pulsation may be transmitted from the abdominal aorta, and a blowing murmur may be heard over it from pressure on the same vessel. Percussion may be sub-tympanitic, owing to interposition of intestine. In other cases the cyst presses forward under the right lobe of the liver, and the physical signs are then very obscure.

Pathology.—In man the pancreatic juice is conducted into the duodenum by a single main duct—the duct of Wirsung—but small supplementary ducts draining a few acini may open independently into the intestine. For the last inch or more of its course the duct of Wirsung is in intimate relation with the ductus communis choledochus, and opens with it by a common orifice about three inches below the pylorus. The action of the pancreatic juice on the chyme is threefold—it transforms starch into sugar and dextrin; it acts upon albuminous bodies, producing in the first place soluble peptones—in some portion the peptones are further converted into leucin and tyrosin—and finally a number of bodies belonging to the aromatic series are formed; among these are phenol, indol, and skatol, the characteristic odor of the fæces being mainly due to the two last named bodies; it emulsifies and assists in the saponification of fats. The pancreatic juice decomposes neutral fats into fatty acids and glycerine; the fatty acids thus set free combine with the alkalies of the pancreatic juice and the

alkaline bases of the bile salts to form soaps, and the liberated bile salts continue the process of saponification by saponifying neutral fats, which may be present in the intestines. Recent researches show that the presence of bile also renders the pancreatic digestion of starches and albumins more rapid and complete; the two secretions, therefore, are in their function intimately related, and in some degree complementary to each other.

The color of the fæces is mainly due to altered bile-pigments, of which the most constant and important appears to be stercobilin, nearly related to urobilin, which is the chief urinary pigment.

If, owing to obstruction of the pancreatic duct, the secretion of the gland be no longer poured into the intestine, the fats, which are unaffected by salivary or peptic digestion, failing to be emulsified or saponified in the intestines, are found unaltered in the fæces, and nutrition suffers owing to imperfect digestion of starchy and albuminous foods. The absence of bile-pigments from the intestines would explain more or less completely the pale color of the stools. It remains, therefore, to account for the sudden disappearance of bile. That this is not due to arrest of secretion appears to be proved by the fact that jaundice may be entirely absent or may be present temporarily, showing that the liver has not ceased to form bile. The only remaining hypotheses are that the bile-pigments and their derivatives are reabsorbed in, probably, the small intestines, or destroyed; it is known that stercobilin "accompanied by imperfectly changed biliary pigments is taken up by the branches of the portal vein and carried into the liver, where it is probably again changed by the action of a ferment into a chromogen," whereas, there appears to be no analogy for the other alternative. Bernard found that destruction of the pancreas produced symptoms exactly parallel, and made the observation that the bile alone only gave a light yellow color to the fæces, whereas, when the pancreatic juice was also present, the color was a distinct brown. "The pancreatic juice," he concludes, "therefore contributes indirectly to the coloration of the fæces."

Morbid Anatomy.—Obstruction of the pancreatic duct may be due to impacted calculus, to cicatricial contraction after ulceration, or to pressure by a tumor or

enlarged glands. The calculi may be spherical, oval, or branched, single or multiple; they are composed of carbonate of lime, or of a mixture of carbonate, phosphate, and oxalate. The duct and its branches become dilated, and the gland tissue undergoes a process of fatty degeneration with some accompanying fibrous overgrowth. The dilated branches of the duct may form sacculi; one or more of these sacculi may become much enlarged, forming a distinct cyst, which may attain large dimensions so as to be capable of containing several liters of fluid; the walls of these large cysts are lined by friable phosphatic concretions, and the fluid contained in them is frequently of a chocolate color owing to hemorrhage.

Treatment.—This has hitherto been mainly symptomatic; benefit is believed to have been derived from the administration of pancreatin.

Large cysts have been successfully treated by laparotomy performed in two stages. The first stage consists in producing adhesive inflammation between the cyst and the abdominal wall, thus closing the peritoneal cavity; the second in opening and draining the cyst with antiseptic precautions.

2. Cancer of the Pancreas is either secondary to growths in the stomach, gall-bladder, liver, or duodenum, or, more rarely, primary; in either case it usually begins in the head of the gland, and is commonly of the scirrhus variety.

Symptoms.—Emaciation is generally an early symptom, and is very rapid in its progress. There may be deep-seated burning pain in the epigastrium, with occasional exacerbations of a neuralgic character; the pain is relieved by relaxing the abdominal muscles; it is not aggravated by food, nor relieved by pressure. A pancreatic tumor presents at the right edge of the epigastrium just below the ribs, but often it pushes the edge of the liver in front of it, in which case a distinct tumor may not be apparent; in either case the percussion note is not absolutely dull. Pressure on, or secondary involvement of, the common bile duct generally ensues sooner or later, and then jaundice is extreme and persistent. Ascites from pressure on the portal vein, anasarca from pressure on the vena cava, or both conditions, frequently occur. Dyspeptic symptoms are often severe,

and nausea and vomiting cause much distress; constipation is the rule.

The *diagnosis* is often difficult; rapid emaciation, with fatty stools, deep-seated epigastric pain, and a tumor in that situation not freely movable, make the diagnosis highly probable in the absence of jaundice. but all the symptoms may be produced by a growth in the hilum of the liver. As in either case the prognosis is hopeless, the differential diagnosis is not of much clinical importance, and is often impossible; the tumor of cancer of the stomach is more movable, hematemesis is generally present, and vomiting occurs early in the disease; cancer of the transverse colon is, at some period of the case, generally more movable, there is hemorrhage from the bowels, pain aggravated some hours after food, and often chronic obstruction; in cancer of the gall-bladder the tumor is more superficial, defined, and rapid in growth, and there are attacks of biliary colic; a merely distended gall-bladder may be recognized by its pyriform shape and fluctuation, while a bladder containing gall-stones is, though hard, nearly painless. Aneurism of the aorta or cœliac axis may be confounded with malignant disease of the pancreas, but in the latter case the pulsation is not distensile, and disappears when the patient is placed on his elbows and knees; in addition, the course of the symptoms is entirely different. Cancer must also be distinguished from *cyst* of the pancreas; the latter may be produced by pressure or by calculi impacted in the duct. Such cysts are occasionally met with, and have been cured by incision and drainage; but it must be remembered that they may be produced by the pressure of malignant disease of the pancreas itself or of the liver.

In a certain proportion of cases of diabetes the pancreas has been found to be the seat of fatty degeneration; calculi and cancer have also been met with, and an attempt has been made to constitute a special variety of diabetes in which there is degenerative disease of the pancreas, accompanied by, perhaps in all cases, disease of the cœliac plexus. This is said to be characterized by a rapid course, diarrhea, and greasy stools, containing scraps of undigested nitrogenous food.

3. Acute Pancreatitis.—The pancreas

is liable to become acutely inflamed, probably by extension from the duodenum.

Symptoms.—These generally commence quite suddenly, severe epigastric pain followed by nausea, vomiting, tenderness in the epigastrium, and tympanitic swelling in the same region being the most prominent; there is marked prostration, and death may be due to collapse.

Diagnosis.—This is very difficult. The condition must be distinguished from irritant poisoning, and from perforation of the stomach and duodenum, chiefly by the history. Diarrhea is often present, and serves to distinguish pancreatitis from intestinal obstruction, with which, if constipation exist, it is otherwise liable to be confounded.

The morbid appearances vary with the stage and intensity of the inflammation; three forms have been described—hemorrhagic, suppurative, and gangrenous. When suppuration occurs the pus may find its way into the stomach, the duodenum, or the great omentum.

Hemorrhagic Pancreatitis appears to be the most acute form of inflammation; it usually leads to death in two to four days, but if the patient survive, the whole gland may slough, and eventually find its way into the intestine and be discharged per anum. *Gangrenous Pancreatitis* may also be due to ulceration and perforation of the gastro-intestinal or biliary tracts.

In cases of acute pancreatitis it is usual to find in the subperitoneal tissue of the omentum, mesentery, and pancreas scattered areas of fat necrosis, which vary in size from a pin's head to a hen's egg.

4. Pancreatic Hemorrhage is a rare cause of sudden death. The patient is seized by sudden collapse which may or may not be preceded by abdominal pain; death may occur within half an hour or less. After death diffuse hemorrhage or multiple circumscribed extravasations are found in the pancreas, in the surrounding subperitoneal tissue, the omentum, the mesentery, and the perinephric fat. The sudden collapse appears to be produced reflexly through the medium of the sympathetic nerve.

Ætiology.—The causation of this hemorrhage is obscure; it may possibly be due to rupture of small aneurisms, analogous to those which are frequently

the cause of fatal hemoptysis, but none have been found in any case.

5. The "Cœliac Affection of Children."—There is a disorder not very rarely observed in children under the age of five years, which is most probably due to a temporary suspension of the functions of the pancreas. It is characterized by the passage of large, loose, white or grayish, frothy and intensely fetid motions once, twice, or thrice a day. The appetite is poor, the abdomen large and doughy; the child suffers from abdominal pain, and gradually becomes anæmic and debilitated without much emaciation. Intercurrent attacks of watery diarrhea are frequent, and contribute to produce a degree of exhaustion which may end in death. No lesion of the pancreas or its duct has been found post mortem, but it is doubtful whether sufficient attention has been given to this point.

Treatment.—Cows' milk should be replaced by goats' or asses' milk, or by a mixture of cream and scalded whey. The principal meal should consist of raw meat freed from fat, pounded and rubbed through a hair sieve; one to four table-spoonfuls may be given according to the age of the child, mixed with sifted sugar or fruit jelly with a pinch of salt. If this be not well taken, it may be replaced by the juice extracted from raw meat by dilute hydrochloric acid. Malted food with well-cooked rusks and some butter may also be allowed. The general hygienic surroundings should be inquired into, and the trunk and limbs should be clothed in woolen garments. As to drugs papaine is often useful; it is best given in powder shortly after milk has been taken (papaina, gr. j, sodii, grs. ij, saccharin, gr. $\frac{1}{2}$); pancreatized milk also would appear to be indicated.

Intercurrent attacks of watery diarrhea are best controlled by large doses of bismuth combined with a few drops of tincture of opium or the compound tincture of camphor, or in powder with pulv. kino co.

DAWSON WILLIAMS.

Symptomatic Indications. Calcareo carb.

PAPILLITIS.—See EYE, DISEASES OF.

PARACENTESIS.—Means literally a piercing or pricking through. The name

was applied by Galen to the operation of tapping in cases of dropsy or of couching for cataract, and it is now in medical language synonymous with the English word "tapping," the object being the removal of fluid. Since the introduction into medical practice of improved instruments, it has been employed very freely both as a means of diagnosis and treatment. In illustration of this it is only necessary to refer to the tapping of joints distended with effusion of hydatid cysts, abscesses of the liver, and the like. In this article it will be considered only as regards the thorax, abdomen, and cranium.

Paracentesis may be performed with a simple trocar and cannula; but it is best, in the case of the pleura and pericardium at least, to use an aspirator, to guard against the entrance of air.

Paracentesis Thoracis or **Thoracocentesis** may be very well effected by means of a large syringe having such a stop-cock arrangement that when the tap is turned in the direction of the long axis of the syringe the way is open toward the chest; when at a right angle to this the way is closed toward the chest and opened toward the outside; and when turned half-way between these points the stop-cock is airtight for the production of a vacuum. The syringe is composed partly of glass, so that it may be at once seen whether fluid flows into it, and it has an airtight piston, which, when pulled out, is fixed by a turn of the handle. It is connected to the cannula by an india-rubber tube, from about the middle of which another tube, protected by a metal tap, passes at a right angle. When the apparatus is used, the vacuum being made in the syringe, the tap opening the way from the chest is turned on, and the syringe soon nearly fills. The tap to which the other tube is attached being then opened, the fluid then flows into a vessel placed on the floor until a sufficient quantity has been removed, the tube acting partly after the manner of a siphon. Or a Potain's aspirator may be used, in which the vacuum is created in a bottle, which may be graduated so that the quantity of fluid removed may be read off as it flows.

Cases of aspirating apparatus are provided with trocars and cannulæ of various sizes, and it is best to use one of small diameter, say from $\frac{1}{32}$ to $\frac{1}{16}$ inch. The

idea that small cannulæ are more apt to become plugged by fibrinous masses than those of larger caliber is erroneous, the converse being more nearly correct. If plugging does occur, the trocar, or what is better, a blunt-ended stiletto, must be passed through to clear the tube.

One or two preliminary precautions must be attended to. In the first place, it need hardly be said that the puncturing instrument, and indeed all the apparatus, must be scrupulously clean. To this end some strong, hot antiseptic solution should be used, and, in addition, the trocar and cannula should be rubbed over with carbolized oil and passed through the flame of a spirit-lamp. In the second place, the whole apparatus should be put together and tested to see that every part of it is air-tight. It should also be seen that the collar of the cannula fits closely round the neck of the trocar; otherwise, unnecessary pain may be caused, in making the puncture; and when the instrument enters the chest, it may carry the parietal pleura or a lining of lymph before it, and so fail to reach the fluid at all.

Before the operation is performed, it is well to freeze the skin, so as to diminish, if not abolish, the pain of the prick. This may be most conveniently done with a small piece of ice cut flat with a knife, the flat surface measuring about an inch square. The ice is dipped in salt, held in the corner of a towel or handkerchief, and applied firmly for half a minute or less to the spot which has been chosen for the puncture. When the ice is removed, the skin will be found frozen and insensitive, and, having been wiped free from salt and moisture, it is ready for the operation. As to the place for puncture, there is considerable latitude of choice, but none is better than the sixth or seventh interspace on the left, and the sixth on the right side in the mid-axillary line. A spot posterior to this is often selected—namely, in the seventh or eighth interspace, just outside the inferior angle of the scapula. There is, however, this objection to it, that although fluid may be undoubtedly present, it is not always reached. The reason of this, probably, is that the cannula becomes blocked by flakes of coagulated fibrin adhering to the thoracic wall. A dull percussion note must of course, be found at the spot selected.

In making the puncture the operator should press the tip of the forefinger of the left hand firmly into the intercostal space, and plunge the trocar, at a right angle to the surface, quickly through the chest-wall alongside his finger, causing it to enter the interspace close to the upper border of the rib, so as to keep as far as possible from the line of the intercostal vessels and nerve. The skin should be drawn aside a little, when anything but a fine instrument is used for the puncture.

It is very desirable to draw off the fluid slowly (hence the importance of a *small* cannula), so as to allow the lung an opportunity of gradual re-expansion. If this precaution be attended to, syncope need not be feared, and it does not much matter whether the patient be sitting up in bed or lying down. When severe cough is set up, or a feeling of tightness in the chest is complained of, or bloodstaining appears, the removal of fluid should be stopped, the cannula withdrawn, and the wound covered with a pledget of cotton-wool dipped in collodion and kept in its place by strapping.

It is a good plan to make a preliminary incision through the skin before using the trocar, especially when the skin cannot be rendered anæsthetic by freezing, or when it is necessary to employ a trocar and cannula of somewhat large size. If, on emergency, an aspirator cannot be got, and an ordinary small trocar and cannula have to be used, a piece of goldbeater's skin must be tied to form a valve round the end, or some other similar arrangement made to prevent the passage of air into the chest. In the case of nervous persons and children, it is well to use a general anæsthetic, and chloroform is best suited for the purpose. The freezing of the skin is then, of course, unnecessary.

Paracentesis Abdominis may be performed with an ordinary full-sized trocar and cannula, but the plan introduced by Dr. Southey, of using a very small instrument (capillary, so called), by means of which the fluid is very slowly removed and the risk of syncope obviated, is much to be preferred.

The best spot for puncture is in the middle line, half-way between the pubes and umbilicus, care being taken that the bladder is empty and an undoubtedly

dull note on percussion obtained at this point. The instrument is pushed with a stabbing motion through the parietes into the peritoneal sac, the trocar is withdrawn, and a fine india-rubber tube affixed to the end of the cannula, and also fastened by a strip of plaster to the skin to prevent kinking or displacement. This tube is long enough to pass over the side of the bed to a vessel placed on the floor, into which the fluid gradually runs. From four to six hours generally suffice to get all the fluid away. When the flow has ceased, the cannula is withdrawn and the wound closed, as in the case of the thorax. With the larger instrument and more rapid emptying of the peritoneum, a bandage or binder should be used, and gradually tightened, to give support to the abdominal wall as the fluid diminishes, and so avert the risk of syncope. When the small cannula is used this is unnecessary, but a binder should be applied after the operation and should be left on for some days.

Paracentesis Capitis.—Is occasionally practiced for the removal of effusion in cases of chronic hydrocephalus, but very rarely indeed with any substantial benefit. For the operation a very fine trocar and cannula or hollow needle should be used, and the puncture should be made in the neighborhood of the anterior fontanelle to one side of the middle line, so as not to wound the longitudinal sinus. It is generally recommended to remove only a small quantity of fluid at a time, and to counteract the diminished internal pressure by the application of an elastic bandage. The aspirator must not be used in this operation.

Paracentesis Pericardii.—A state of affairs calling for puncture of the pericardial sac is much less frequent than in the case of the pleura or peritoneum; nevertheless, the operation has been occasionally performed with great advantage. The aspirator should be used with a very small trocar and cannula or hollow needle. The best spot at which to make the puncture will vary somewhat with circumstances. Generally speaking, it will be found to be the fourth interspace, right or left, as close as possible to the sternal border. In this situation the thoracic wall will be pierced to the inside of the internal mammary vessels. A lower interspace should not be chosen unless the puncture be made an inch or more

from the border of the sternum. It is not safe to puncture close to the sternum in the fifth space, as one or other of the internal mammary vessels or a branch may be pierced.

If the presence of pus be suspected, it is best to make the puncture well outside the vessels, say $1\frac{1}{2}$ inch from the border of the sternum, so that the cannula may serve as the guide to the knife by which a free incision may subsequently have to be made. If the trocar or needle should have been introduced close to the sternal margin, it could not be properly made use of in this way, inasmuch as an incision of sufficient length outward would divide the internal mammary vessels, and troublesome hemorrhage would result. In this case the left side of the chest should be chosen for the operation.

Paracentesis Pulmonis.—This is done as an exploratory operation merely, preliminary to free incision for abscess or for opening up a gangrenous or bronchiectatic cavity. The trocar and cannula are used as in the operation for the removal of pleural effusions; and, if the focus of disease be reached, which may be judged by the character of the discharge coming through the tube, or, in absence of this, by the fetid smell, the cannula is utilized as a guide for the knife, and a free incision made into the lung substance.

DAVID W. FINLAY.

PARALYSIS, ACUTE ASCENDING (Landry's Paralysis).—A disease characterized by motor paralysis, beginning in the lower limbs, and spreading rapidly upward so as to involve the trunk, upper extremities and, finally, the parts innervated by the medulla oblongata. The disease was first described by Landry in 1859.

The affected muscles retain their normal bulk, and exhibit no change in their electrical reactions. The pathological nature of the disease is obscure.

Symptoms.—Before the onset of the characteristic symptoms, slight pyrexia, pains in the back and limbs, numbness and formication of the extremities are occasionally experienced for a few days. The paralysis, with rare exceptions, begins in the lower limbs, attacking first the muscles which move the toes and ankles. In a day or two, or even in a few hours, the paralysis of the lower extremities may be

absolute. While the weakness is progressing in the legs the muscles of the trunk become invaded, so that there is inability to sit up; coughing, defecation, and such-like acts become enfeebled, and respiration is embarrassed. The arms are then implicated, the weakness usually extending upward from the hands and rapidly increasing in intensity, so that in a brief space the upper limbs may become quite motionless. Finally, the diaphragm and muscles of the neck are attacked, as well as those of the tongue, soft palate, and face; deglutition becomes difficult, articulation embarrassed, and dyspnœa urgent.

The paralyzed muscles, though flaccid, do not waste, and the electrical reactions of both muscles and nerves are unchanged. The cutaneous and tendon reflexes disappear early. Various subjective disorders of sensation are often present, but there is rarely any actual anæsthesia. The nutrition of the skin is unimpaired, there is no tendency to the formation of bed-sores, the general health is good, and the mental state is unaffected. There is frequently some difficulty in voiding the urine and fæces from paralysis of the abdominal muscles, but paralysis of the sphincters never occurs. Pyrexia is absent, except occasionally in the initial stage, when there may be some slight fever. In exceptional cases diplopia, paralysis of accommodation, and inequality of pupils have been described. An acute increase in the size of the spleen has been occasionally noted.

In a few instances the paralysis has taken a descending course, the arms or the muscles supplied from the medulla oblongata being first involved.

Course.—The majority of cases are fatal within a week, but death may be delayed for three or four weeks. In about a third of the cases recovery has been recorded, arrest taking place at any stage of the disease. Convalescence is slow; complete power often not being regained for two or three months. The parts last involved are the first to show signs of amendment.

Diagnosis.—Acute ascending paralysis has some features in common with acute anterior poliomyelitis. In the latter, however, there is rapid muscular wasting with the reaction of degeneration, and the paralysis has no progressive tendency. The normal electrical reactions and the

absence of muscular atrophy in Landry's paralysis serve to distinguish it from all acute affections of the spinal anterior gray matter. In diphtheritic paralysis the soft palate and power of accommodation are first implicated, and there is loss of sensation.

Prognosis.—The danger to life is very great, even in the more chronic cases. A favorable opinion may be entertained when distinct return of power has begun to take place.

Morbid Anatomy and Pathology.—No constant or adequate changes have been discovered in the various parts of the nervous system. Slight inflammatory lesions in the gray matter of the cord, and some degenerative changes in the anterior roots, have been noted in a few cases, but these alterations seem to be quite exceptional. The absence of muscular wasting, and the normal electrical reactions in all cases of acute ascending paralysis, are against the view that the seat of the disease is in the anterior cornua. It has been suggested that this affection is due to some toxic effect. It is possible that acute ascending paralysis is sometimes the paralytic variety of rabies.

Ætiology.—Very little is known as to causation. The disease has been ascribed to cold, and occasionally is said to follow an acute affection, such as smallpox and typhoid fever. By some the disease has been attributed to syphilis. Males are more frequently attacked than females, and the onset occurs chiefly between the ages of twenty and forty.

Treatment.—The use of the hot or vapor bath and the application of counter-irritants along the spine have been recommended. Dr. Gowers suggests salicylate of soda, and, in addition, speaks favorably of ergotine given subcutaneously. In convalescence the constant current and tonics may prove of service.

W. B. HADDEN.

Symptomatic Indications.—*Gelsemium* is valuable in incomplete paralysis, where only the control of the muscles is lost, sensation remaining unimpaired; *arsenicum*, in anæmic or debilitated persons; *cocculus*, in debilitated nervous persons, where the circulation is defective; *phosphorus*, the paralysis is confined to the limbs, and seems to depend upon perverted nutrition; *dulcamara*, simple paralysis of the extremities, without loss of sensation, but icy coldness of the surface.

PARALYSIS AGITANS (Shaking Palsy ; Parkinson's Disease).—First described by Parkinson, in 1817, with great accuracy of detail.

Symptoms.—Although tremor is the most prominent feature, and the one which has given the name to the disease, there are other symptoms which are so marked as to enable the observer to diagnose the cases irrespective of the shaking, which in some cases is exceedingly slight.

In the early stages tremor usually begins in one hand, and consists in a rapid to and fro movement of the thumb and forefinger, which are moved over each other as in the act of rolling a pill; this movement is accompanied by flexion and extension of the wrist; in other cases these joints do not move, but there is a rapid pronation and supination of the forearm. The movements of the upper limb are usually followed by movements in the lower limb of the same side—the hemiplegic type—rarely of the arm or leg of the opposite side. If the disease take the usual course, after some months the other arm begins to shake, and this is followed later by movements in the other leg. Even in the early stages the hand has a characteristic attitude: the phalangeal joints are extended while the metacarpophalangeal joints are flexed; the thumb is applied to the forefinger and becomes hyperextended, giving the appearance of a hand holding a pen. The movements cease during sleep, and are usually diminished or stopped by performing a voluntary movement with the hand, so much so that some cases with marked shaking can thread a needle.

One of the earliest symptoms is a characteristic appearance of the face and carriage of the individual. There is a lack of expression about the features, and, in speaking, the lips move without the rest of the face showing any expression; there is also a characteristic fixed look about the upper part of the face; in addition, it is noticeable, in walking, that the whole body moves as one piece, and this is especially obvious when the patient turns round. It is important to note that the symptoms referable to the face and trunk are present bilaterally, when perhaps only one arm may be affected by tremor. The speech is already monotonous, but not as yet high pitched. A slight stiffness at the back of the neck, which prevents the patient from looking upward with

comfort, may be complained of. The gait may not be altered, or may be somewhat slow and deliberate.

The symptoms of the early stages have been given in detail, as, when the disease is well marked, its characters are so evident that a mistake can hardly be made.

When this later stage is reached, there is tremor of all four limbs, rarely shaking of the head and tremor of the chin and tongue, the movements being synchronous. The attitude is still more characteristic; the patient stoops, the head is carried forward, the elbows are carried away from the trunk and flexed, the wrist directed toward the ulnar border and the hand in the writing position.

The gait is typical, and consists in taking very short rapid steps; when pulled backward till he is almost overbalanced, the patient takes short rapid steps backward to endeavor to get behind his center of gravity, but, as he is unable to do this, his movements get faster and faster, and he would eventually fall if not prevented; this is called "retropulsion." The same thing occurs in walking forward, but it is developed later than the backward movement. He appears now as if his whole body were solidified, and has great difficulty in rising from a chair or in looking upward; but the movements of the eyes always escape tremor and fixity, and this the writer thinks is best shown by making the patient suddenly look to his right or left, when the eyes will turn at once, but the head follows slowly in an appreciable time after the eyes, instead of the two movements being together. The movements of the hands are slow, both in beginning an action and in performing it. The speech is monotonous and high-pitched. In bed the patient is very restless and requires to be continually shifted into another position, and there is a great feeling of heat, so that only a slight amount of bed-covering can be borne. Although the disease is called "paralysis agitans," there is no diminution of muscular power, as tested by the dynamometer, till the latest stages. The writing is characteristic, the down-strokes being fairly well made, while the upstrokes consist of fine wavy lines. No alteration in the knee-jerks has been observed.

The duration of the initial stage is two or three years, and, when the disease is fully developed, it may last twenty or thirty years, till in the last stage, when the

patient is confined to his bed completely helpless, general exhaustion sets in, with mental obscurity and involuntary passing of excreta, and, with the occurrence of bed-sores, death ensues.

In rare cases all the symptoms of the disease may be developed without any tremor.

Diagnosis in well-marked cases is not difficult. When the disease appears in advanced life it has to be diagnosed from senile tremors, but these begin usually in both hands simultaneously, and there are not the fixed look and the rigidity of paralysis agitans, and shaking of the head is more common in the former disease. Disseminated sclerosis is a disease of youth; the movements only come on with voluntary effort, and nystagmus is common; it cannot, therefore, be easily confounded with paralysis agitans.

Prognosis is unfavorable, although some cases improve for a time; but, when the disease is well marked, recovery can hardly be hoped for.

Pathology.—This is at present unknown, but the most probable site of the lesion is the cerebrum, either in the cortex or more likely still in the basal ganglia.

Ætiology.—Paralysis agitans is a disease of middle life, usually not beginning before forty, though undoubted cases have been observed at thirty, or even younger. It affects both sexes, but men more commonly than women. As causes of the disease, mental worry and anxiety have been given, and the shaking has been observed to follow directly after some severe mental shock. In other cases the tremors have been first observed in the hand, in which a needle was evidently imbedded. Exposure to damp cold is also considered to be a cause. The onset is usually insidious, but after a sudden shock it may begin suddenly.

Treatment.—Improvement has been obtained in early cases by the use of liquor arsenicalis, cannabis indica, and morphine; other drugs have been tried, but in most cases have failed to do any good. Galvanism has appeared to modify the tremor when applied without interruption of the current, but it has not much effect in checking the disease. Statical electricity has been tried, but without any good results. The patient should live quietly and as much as possible away from all worry or anxiety, and he should be careful to avoid all exhaustion.

C. E. BEEVOR.

Symptomatic Indications.—*Plumbum* and *tarantula* have relieved.

PARALYSIS, ACUTE ATROPHIC.—See INFANTILE PARALYSIS.

PARALYSIS, DIPHTHERITIC.—See DIPHTHERIA.

PARALYSIS, ESSENTIAL.—See INFANTILE PARALYSIS.

PARALYSIS, GENERAL SPINAL.—See SPINAL PARALYSIS.

PARALYSIS, LARYNGEAL.—See LARYNX, NEUROSES OF.

PARALYSIS, PSEUDO-HYPERTROPHIC.—See PSEUDO-HYPERTROPHIC PARALYSIS.

PARALYSIS, SPASMODIC SPINAL.—See LATERAL SCLEROSIS.

PARALYTIC DEMENTIA.—See GENERAL PARALYSIS of THE INSANE.

PARAMETRITIS (Pelvic Cellulitis).—Inflammation of the cellular tissue about the uterus. Also called *pelvic cellulitis*. This latter term is objected to, because cellulitis, having its origin about the uterus, may spread beyond the pelvis, and inflammation of cellular tissue in the pelvis may be unconnected with the uterus.

Parametritis arises more especially from injury to the cervix uteri and vagina. It is met with chiefly after labor. It may also follow abortion, or operations on the cervix. It is by some, and with much reason, regarded as essentially a lymphangitis due to the entrance through wounds of the cervix or vagina of phlogogenic matters, which are then stopped by the lymphatic glands and so prevented from getting further into the system. Parametritis often accompanies perimetritis, the one disease arising by extension from the other.

Symptoms.—These are much the same as those of any other inflammation in the lower abdomen, being, in brief, fever and pelvic pain. Parametritis cannot by symptoms be distinguished from perimetritis. Taking all cases together, the pain in the early stages of parametritis is rather less than at the corresponding period of perimetritis; and gastro-intestinal disturbance, *e. g.*, vomiting, is less than in the peritoneal affection.

Signs.—These depend upon the seat of the inflammation, the stage at which it is seen, and its course. The most common form of puerperal parametritis is the inguinal. The inflammation generally be-

gins in the cellular tissue which laterally adjoins the cervix uteri. It may remain limited to this part. If it spread further, its most usual course is to follow the round ligament to the inguinal region. The inflammation presents two stages, first that of "phlegmon," or inflammatory œdema, then that of abscess. In many cases it does not go beyond the stages of phlegmon, the disease then ending by absorption of the inflammatory exudation. In cases which terminate thus, the inflammation seldom extends beyond the pelvis and the inguinal region. In such cases we often find that while there is a swelling in one inguinal region, no exudation can be felt per vaginam. Nevertheless, the known ætiology of the disease leads to the inference that the inflammation began in the neighborhood of the cervix, and that the products underwent absorption there before attention was directed to the inguinal swelling.

Puerperal parametritis tends to the inguinal region more often than parametritis apart from pregnancy, because at the full term of pregnancy the peritoneum leaves the uterus high up at the sides, so that there is then below it plenty of loose cellular tissue about the brim of the pelvis and the inguinal regions. Inflammation of the cellular tissue within the pelvis, and of the pelvic peritoneum, both produce a hard swelling in the pelvis. But while the induration produced by thickening of the peritoneum is bilateral, joins the uterus high up, retreats toward the sides of the pelvis out of reach of the examining finger, and dips down lowest behind, the parametric phlegmon is usually on one side only and is in continuity with the uterus as low down as the insertion of the vagina, and thence slopes off toward the wall of the pelvic outlet. In inguinal, or, as it is often called, "iliac," parametritis, there is a swelling on one side of the lower abdomen, lying close beneath the abdominal walls, feeling as if continuous with Poupart's ligament. The dimensions of this swelling present a remarkable similarity in different cases. Its upper outline is a curve starting from a little below the anterior superior iliac spine, reaching its highest level an inch or so internal to this point, where it may extend a little above it, and then descending till it sinks below the pelvic brim one-half inch or less beyond the middle line. The inner part of this swelling is usually formed by the body of

the uterus. As the absorption of the swelling progresses, its boundaries get less defined, and its upper limit becomes lower. The swelling, after it has become definite, is hard and non-fluctuating. If it end in absorption, the patient is usually well in three or four weeks' time. There is sometimes retraction of the thigh, from the cellular tissue around the psoas muscle being affected. The course of these cases is longer, and in them there is generally, but not always, suppuration. When this takes place, it is marked by persistence of hectic fever, together with bulging, softening, and pointing of the swelling. In cases of suppuration with much retraction of the thigh, the pus usually extends under the psoas muscle, between it and the pelvic brim. The usual place for suppurative parametritis to burst is where the round ligament leaves the abdomen, viz., a little above the middle of Poupart's ligament. When the pus has been discharged, fever usually ceases, appetite returns and the patient's condition improves.

Course.—There are many variations. What determines them we do not know. While, speaking generally, the abscess points and the pus is discharged as in abscesses elsewhere, there are some cases in which hectic fever persists for weeks and yet no sign of pointing appears; nevertheless, an exploratory puncture with the aspirator-needle lets out pus, the matter seeming as if bound down by some structure which prevents its coming to the surface. In other cases the abscess bulges, and appears as if about to point and burst, but after a time the swelling diminishes, and ceases to be tense, and, if opened, the matter does not flow unless forced out by pressure.

The abscess does not always follow the course of the round ligament and burst into the inguinal region. It may pass under Poupart's ligament, and point in the thigh, or spread along the psoas muscle to the cellular tissue which surrounds the kidneys, and form a perinephritic abscess. It may extend downward, and open by the side of the anus, or burst into the bowel, either colon or rectum; it may also creep round the uterus and involve the cellular tissue between the uterus and bladder. In this situation it may form a communication with the vagina, or the bladder, or it may follow the urachus and present at the umbilicus or at some point in the middle-line between the pubes and

umbilicus. Again, the pus may travel backward through the sacro-sciatic notch, and open by the side of the sacrum. It may follow the obturator tendon to the thigh, and come to the surface near the trochanter. There may be more than one abscess, or the same abscess may open, in more than one place. Even after the abscess has been opened by the surgeon another opening may be formed spontaneously. An abscess may open into the bowel, and fæces or intestinal gases escape into the abscess cavity. Usually, although pus flows from the abscess into the bowel, fæces do not pass into the abscess cavity. As a rule, the communication with the bowel soon closes spontaneously, or, at least, the passage of gas and fæces into the abscess does not continue long. In the formation of a pelvic abscess, vessels of some size may be opened and hemorrhage take place, and such hemorrhage may be fatal.

Prognosis.—As a rule, favorable. It differs from perimetritis in this, that there is not in parametritis a tendency to relapse. If the inflammation end in absorption, the patient soon gets well. If suppuration take place, the patient remains very ill, with hectic fever, wasting, etc., until the abscess bursts, and then, as a rule, rapid amendment follows. The patient may die from hemorrhage, or from exhaustion from the long discharging of a sinus, or from some other disease brought about by the long-continued suppuration; but this is rare.

Treatment.—There is no drug that will certainly produce absorption or prevent suppuration. While there is any pyrexia, the patient should be kept in bed; appetite should be helped by tonic medicines, and the strength maintained and nutrition favored by easily digested food. To aid absorption and lessen inflammation, the skin of the abdomen may be painted with lin. iodi. Sedative local applications may be used, if necessary, to relieve pain. When suppuration has occurred, if the patient be free from pain, the abscess may be allowed to burst. But if there be much pain, it is better to open the abscess by a free incision, and insert a drainage-tube. In some cases, especially those in which the suppuration extends under the psoas muscle, it may be that the abscess will not heal until the parts are kept at absolute rest by fixing the limb, which can be done by

enveloping the pelvis and the thigh on the affected side in a plaster-of-Paris case.

Erysipelas Malignum Internum, so-called (Virchow).—The inflammation of cellular tissue that has so far been spoken of may be described as “subacute.” After delivery there is sometimes seen an acute, suppurative, rapidly spreading inflammation of cellular tissue, beginning in the pelvis, and resembling the so-called “phlegmonous erysipelas” which is seen in the subcutaneous cellular tissue. It is this disease which Virchow has described as one form of puerperal fever, and to which he has applied the name “erysipelas malignum internum.” This disease differs widely from erysipelas of the skin. It is usually rapidly fatal, and is generally associated with an unhealthy condition of wounds of the genital passage received in parturition, and with general pyæmia. It is to be prevented by the use of antiseptics at the time of delivery.

Cases have been recorded of a rare form of cellulitis dependent upon sloughing of the cellular tissue in the pelvis, like that which occurs when urine is extravasated, but occurring without any injury or disease of the urinary organs. It is usually fatal, but may take a chronic course and end in recovery. A similar disease has been observed in the scrotum of the male. The treatment is to open the abscesses and let out the sloughs.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is a valuable remedy in the stage of congestion, especially when the disease results from cold, high fever, hot, dry skin, great thirst, much anxiety and restlessness; *Belladonna* is also useful in the acute stage, particularly in the puerperal state. The fever is less violent than when aconite is indicated, the lochia are suppressed, the vagina hot, dry, and sensitive; throbbing of the blood vessels of the pelvis, abdomen painfully distended with much heat; burning and cutting pains, throbbing headache, flushed face. *Bryonia* follows aconite or belladonna well to absorb effusion of serum; stitching, lancinating pains, worse from the least motion; much thirst, obstinate constipation. *Mercurius* is valuable when there is exudation with a tendency to the formation of pus, or in the beginning of pelvic abscess, the indicating symptoms are creeping chills,

much perspiration without relief, great weakness and prostration; abdomen hard, distended and painful; mucous stools with burning and tenesmus. *Turpentine* is useful when there is great weakness and prostration, excessive distention of the abdomen, and a disposition to hemorrhage. *Apis mel.* will sometimes abort suppuration, and generally promotes absorption of exudation. It is indicated by burning, stinging pain in the uterine or ovarian region, great tenderness with bearing-down pain, leucorrhœa, painful urination, tendency to anasarca. *Calcium sulphide* is useful to hasten suppuration, when inevitable, and to control its formation.

PARAPLEGIA.—A term formerly applied to all forms of paralysis of spinal origin, and also to those which are now known to depend on disease of the peripheral nerves; has become more restricted, until it is now chiefly employed to denote those spinal affections the pathological nature of which cannot be definitely determined during life. The number of such affections is still considerable, for it is a matter of great, often insuperable difficulty to forecast during life the exact anatomical conditions of a spinal paralysis. But, although a precise pathological diagnosis is often impossible, it is usually justifiable to ascribe certain clinical states to lesion of well-defined parts of the spinal cord. An acute paralysis (provided this be clearly not due to affection of a definite nerve) accompanied by marked wasting of the muscles, with qualitative change in the electrical reactions, without impairment of sensation and without implication of the bladder and rectum, may be referred with confidence to disease of the anterior gray matter of the cord, or, more definitely, to the large multipolar cells.

Again, a slow paraplegia, with rigidity of the muscles and exaggeration of the tendon reflexes, is due to degeneration of the lateral columns, or rather of the pyramidal tracts which occupy the main part of these columns. Spasmodic paraplegia is a convenient clinical term for such a condition, and lateral sclerosis is commonly used to denote its anatomical cause.

It may, however, be observed that a spasmodic paraplegia, practically undistinguishable from that found in organic

disease of the cord, may be present in such conditions as hysteria, and may even result from prolonged over-use of the muscles, and that under such circumstances there is reason to believe that there is no coarse disease of the spinal cord. In most instances there is no doubt that spasmodic paraplegia is accompanied by degeneration of the lateral columns, but the difficulty is to determine on what such a degeneration depends. This is a matter of the greatest importance, for prognosis and treatment will be alike influenced by a knowledge of the underlying pathological conditions. Is the spasmodic paraplegia due to secondary degeneration in the lateral columns from the pressure on the cord of a tumor or aneurism or of inflammatory products (as in Pott's disease), or to a localized patch of softening? Or again, if it is part of a diffuse change in the nervous centers, such as is present in disseminated sclerosis, general paralysis of the insane, and amyotrophic lateral sclerosis? Finally, is the clinical condition to be ascribed to a primary degeneration of the pyramidal tracts? Such are the problems which present themselves, and it must be allowed that not infrequently the true nature of the affection remains undecided. To denote a clinical state, the term spasmodic paraplegia may, therefore, be justifiably employed, but the various underlying pathological causes should be borne in mind.

Another form of paraplegia is characterized by loss of motor power, with flaccidity and diffuse wasting of the muscles, and qualitative changes in their electrical reactions, absence of the reflexes together with loss of sensation, want of control over the sphincters of the bladder and rectum, and a tendency to rapid formation of bed-sores. Such a condition may occur suddenly as a primary affection, or may supervene acutely in various chronic affections of the cord. As a primary state, a paralysis with these characters is usually ascribed to acute myelitis (loosely termed "softening"); but here again there is a divergence of opinion as to the true nature of the morbid change. That there is a destructive alteration of the gray matter of the cord is undoubted, but it is by no means clear whether this depends on primary inflammation, or on degenerative processes, or on initial vascular changes such as throm-

bosis, or, lastly, on the presence of some infective agency.

Disease of the posterior columns of the cord, or, more precisely, of the external part of those columns or the posterior-root zones, gives rise to the condition now known under the name of locomotor ataxy or tabes dorsalis. In this affection motor power is retained, but there is inability to co-ordinate the voluntary muscles. Under the heading of "Paraplegia" it is convenient to describe two forms of paralysis. The first is characterized by combined inco-ordination and weakness, and is known under the name of "ataxic paraplegia." The second, which embraces several clinical types, although having a similar causation and anatomical nature, has been described under various terms, such as "birth palsy," "infantile spasmodic paralysis," "bilateral spastic hemiplegia," and "spastic diplegia."

Ataxic Paraplegia.—This disease, which is slowly progressive, is marked by the coexistence of weakness and inco-ordination, affecting first, and sometimes exclusively, the lower limbs. In the early period the ataxy is the predominant feature, and the unsteadiness and irregular gait are such as are seen in ordinary tabes dorsalis. Even in the early stage exaggeration of the knee-jerk, and the presence of clonus, mark off the affection from tabes, in which the knee-jerk is lost from the beginning.

With the progress of the disease the lower limbs slowly become weaker, rigidity supervenes, and a condition of spasmodic paraplegia, with some degree of inco-ordination, is established. The arms may suffer in the same way as the legs, but sometimes they remain unaffected. It is important to bear in mind, as distinguishing points from tabes, that lightning pains are of the rarest occurrence, that anæsthesia and hyperæsthesia are almost invariably absent, and that throughout the disease there is marked increase in the tendon reactions, and very commonly clonus may be elicited. The pupils, with rare exceptions, are normal; atrophy of the optic nerves is much less common than in tabes; and the external ocular muscles are generally unaffected. Girdle-pains are uncommon; but Dr. Gowers calls attention to a dull pain in the spine, frequently in the sacral region, which is often an early symptom.

The plantar reflexes are normal or increased. Sexual power may disappear early, and there is often loss of control over the bladder and rectum, though usually this is not extreme. Impaired articulation, with irregular movements of the face, is sometimes present, and this may be associated with mental change and sometimes with general paralysis of the insane. It is important to note that cases occur which seem to constitute a link between tabes dorsalis and the typical ataxic paraplegia.

Diagnosis.—The points of distinction between this disease, tabes dorsalis, and spasmodic paraplegia are evident from the foregoing description. Ataxic paraplegia resembles in many respects the hereditary ataxy of Friedreich. The main points of difference are the usual occurrence of the latter in members of the same family, the fact that the knee-jerk is commonly absent in hereditary ataxy, and that nystagmus and affection of speech are frequent. From cerebellar disease ataxic paraplegia is distinguished by the absence of headache, vomiting, and optic neuritis.

Morbid anatomy.—Both posterior and lateral columns are the seat of sclerosis, the change in the posterior column differs from that found in tabes in two respects—(1) the degeneration is usually not more marked in the lumbar region than elsewhere, and (2) the posterior-root zones are not especially affected. The sclerosis in the lateral columns is generally diffuse and more or less irregular; occasionally there is annular sclerosis, which extends into the substances of the cord in region of the lateral columns.

Ætiology.—Causation is obscure; a history of syphilis is as rare as it is frequent in pure tabes. Males are attacked in much the larger proportion. The period of greatest liability is between thirty and forty. Exposure to cold, injury to the spine, and sexual excesses are mentioned as antecedents.

Treatment.—Turkish baths and rubbing of the affected limbs are said to be of service. The effect of drugs is doubtful. The method of suspension (*see* LOCOMOTOR ATAXY) deserves a trial.

Infantile Spasmodic Paraplegia (*Spastic Cerebral Paraplegia; Spasmodic Tabes Dorsalis; Birth Palsy*).—In this affection there is muscular rigidity of the lower limbs, usually noticed at birth

or shortly after. The thighs are rigidly adducted and slightly flexed at the hips, the knees are in contact and often overlap, the heels are drawn up by the contraction of the calf-muscles, and the feet are in a position of talipes equinus or equino-varus. If progression be possible, the patient will be seen to walk on the toes, and as one or the other limb is brought forward the knees rub together and overlap. The gait is characteristic, and is known under the name of "cross-legged progression." The tendon reactions are exaggerated, but clonus is not usually to be elicited. The muscles do not undergo degenerative atrophy, and there is no change in the electrical reactions. Sensation is intact. The sphincters of the bladder and rectum are unaffected, except in cases where there is marked mental impairment. This condition of spasmodic paraplegia, which is believed by most authorities to have a primarily cerebral origin, may exist alone, though not uncommonly other symptoms are present which point to more widespread change in the brain. Some degree of awkwardness or ataxy of the hands may be evident, or there may be rigidity of the upper limbs, sometimes slight, sometimes extreme. In the latter case the arms are stiff and flexed at the various joints. When both arms and legs are affected the condition is sometimes termed "bilateral spastic hemiplegia of children," or "spastic diplegia." Sometimes there are irregular movements, most commonly affecting the upper limbs, which resemble chorea or athetosis, and hence such cases have been described under the terms "chorea spastica" and "double congenital athetosis." Irregular movements occasionally affect the face and tongue. In some instances the paraplegic rigidity of the lower limbs is associated with rigidity of one upper extremity. Weakness of the muscles of the neck and trunk is often present, so that the child is unable to sit upright or to maintain the head in position. When the lower limbs only are affected, speech may be unimpaired; but sometimes articulation is defective, and occasionally there is total inability to talk. Mental impairment, ranging from mere dullness to marked idiocy, may be present. Extreme defects of speech and great mental impairment are most commonly present when the upper limbs are markedly affected. Convulsive attacks,

which often occur immediately after birth, may persist. Among other occasional conditions, nystagmus, squint, inequality of pupils, retarded dentition, defective teeth, arching of the palate, asymmetry of the head and microcephalus may be noted.

In most cases of the condition just described there is a history of convulsions and asphyxia at birth, and, it is probable that in the majority the affection is due to damage to the brain during parturition.

Diagnosis.—When rigidity of the limbs is noticed at birth, or soon after, there can be no doubt as to the real nature of the condition. It often happens, however, that the state of the limbs does not attract attention for months, sometimes not until the period when the child should begin to walk. In a small proportion of birth palsies the condition is unilateral, and then the affection may be confounded with ordinary infantile hemiplegia. An important distinguishing point is the occurrence of an acute onset in the latter, whereas the former will be noticed at birth or very shortly after, or, when the condition does not attract notice until a later period, there is no history of an abrupt supervention of the hemiplegia.

Morbid anatomy.—In fatal cases of bilateral spastic hemiplegia there has been found sclerosis with atrophy of motor convolution or a simple arrest of development, and occasionally a condition of porencephalus. "It is supposed that the cortical sclerosis found in many of these cases is due to hemorrhage in the meninges and superficial part of the brain from prolonged pressure on the fetal head during childbirth. If the child survives, the meningeal extravasation becomes absorbed, but the cortex, which has been damaged partly by compression, partly by extravasation of blood into its substances, undergoes degenerative changes. The information regarding those cases in which the lower limbs are mainly or exclusively affected is less definite. There is reason to believe, however, that the condition is due to the causes already mentioned. The pyramidal tracts in the spinal cord have occasionally been found sclerosed, and in some instances undeveloped. It is not improbable that some cases of birth palsy are due to arrest of development, and some possibly to disease in fetal life.

Etiology.—A large proportion occurs among the first-born, and in most there is a history of prolonged labor or unnatural presentation, with convulsions and asphyxia at birth. In a few instances there is a history of premature labor.

Treatment.—There is a tendency to improvement in many cases. As voluntary control is acquired, some power of standing and of walking may be slowly gained. The prognosis is unfavorable when the arms are much affected and when there is great mental impairment. Prolonged massage of the limbs, gymnastics, and education should be employed. The ordinary go-cart is a useful agent. Sometimes division of tendons and muscles is attended with benefit, but very often the result is disappointing. Drugs, except in the case of persistent convulsive attacks, and the use of electricity, are without service.

W. B. HADDEN.

Symptomatic Indications.—*Ignatia*; *nuxvomica*; *phosphorus*; *cocculus*.

See PARALYSIS.

PARASITIC DISEASES OF THE SKIN.—See FAVUS: PEDICULOSIS; RINGWORM: SCABIES: TINEA VERSICOLOR.

PARKINSON'S DISEASE.—See PARALYSIS AGITANS.

PAROTID TUMORS, divided, for practical purposes, into (1) innocent, (2) malignant. Former commence near lobe of ear as small, hard swellings, perhaps originally enlargements of a lymphatic gland. They are fibro-cartilaginous. Increasing, they tend to grow outward as a square mass, and inward so as to displace part or whole of the parotid. But cancerous tumors are more diffuse, more fixed, more painful, increase faster and tend to infect the lymphatics of the neck.

Treatment.—A movable tumor, corresponding to the first description above given, should be excised; a malignant tumor is fixed, and can rarely be advantageously meddled with. In excising a parotid tumor, cut as much as possible in the direction of the fibers of the facial nerve, and keep the edge of the knife toward the tumor. Simple tumors can sometimes, to a great extent, be shelled out. Facial paralysis, which sometimes follows these operations, is usually incurable.

Remember the size of the vessels imbedded in the parotid. Remember, also, position of Steno's duct, a wound of which may cause salivary fistula.

C. B. KEETLEY.

PAROTITIS, IDIOPATHIC.—See MUMPS.

PATELLA,—See DISLOCATIONS; ALSO, FRACTURES.

PATELLAR REFLEX.—See REFLEX, SPINAL.

PEDICULOSIS (Phthiriasis; Lousiness).—Three kinds of lice prey upon the human skin, causing dermatitis of the regions they inhabit. The diseases thus produced are essentially confined to the neglected and uncleanly, are limited to the parts protected by clothing or by hair, and are usually proportional in severity to the number of the parasites present, although debilitated persons and those at either extremity of life are prone to suffer most severely.

Pediculus Capitis.—The insect is grayish in color, but in dark races acquires a dark, even black, hue; it is smaller than either *P. corporis* or *P. pubis*. The male presents a head, thorax, and abdomen. The head is triangular, carries a pair of jointed antennæ, minute, compound, lateral eyes, and a complicated masticatory apparatus. The body has brownish markings on the sides, the thorax is narrow, carrying three pairs of jointed legs terminating in a claw; the abdomen is long and has seven segments, the last of which is rounded off. The penis projects from the dorsal surface, on which is also situated the anal aperture. The female exists in much greater abundance than the male; the last dorsal segment is forked; the genital opening is on the ventral surface. They are oviparous, and lay from fifty to sixty eggs, from which the young emerge after six days, and in twenty-seven days become sexually mature.

The ova, or nits, are often present in abundance when the mature insect can only be detected with difficulty; they are most commonly found in the occipital region, and appear as white specks attached to one side of the hair-shaft, to which they are pretty firmly adherent by means of a chitinous cement substance which surrounds the hair like a tube, so that they can usually be moved with the finger along the hair; this serves to distinguish nits

from loose scales. Each ovum has a lid or operculum.

Pediculi capitis in healthy persons may cause no symptoms except slight and occasional itching; indeed, the discovery of their presence is often accidental. When they are very numerous, however, and occur in cachectic persons, or in children with irritable skins and a predisposition to eczema, intensely severe weeping, pustular dermatitis may be produced as the conjoint result of the parasite and of scratching. Ulceration occurs, thick crusts and scabs form, the hairs become matted together by gummy discharge entangling epithelium, dirt, lice, and *débris* constituting the condition formerly described as *plica polonica*. The corresponding cervical lymphatic glands are almost always swollen, often suppurate and may form large abscesses. The glandular affection more frequently attracts the attention of parents than the primary cause. The pus has a special tendency to acquire infective properties, impetigo supervenes, and sores appear on the face, hands, and other parts of the body.

The disease is commonest in children and in young women with abundant and knotty hair.

Treatment is promptly successful, but reinfection is, for obvious reasons, very common. In children the nits are best removed by cutting the hair very short; crusts are best removed by soaking with oil, and under white precipitate ointment (diluted, if necessary) the sores rapidly heal. In adults, the nits may be loosened by soaking the hair in turpentine or kerosene for twenty-four or thirty-six hours, the head being covered with a flannel mask, and then removed by frequent washing and assiduous use of a fine comb. In less severe cases nits may be destroyed by lotions of carbolic acid (1-40) or perchloride of mercury (grs. iij ad $\frac{3}{4}$ viij). After crusts have been removed, as already described, white precipitate ointment applied to the ulcerated surfaces will soon complete the cure.

Pediculus Corporis (*vel vestimentorum*).—Closely resembles *pediculus capitis*, but is slightly larger, and the head is more elongated; the abdomen has eight segments, and is distinctly separated from the thorax; the antennæ, legs, and claws are more developed, and its movements are much more rapid. It is grayish-white in color, and lives entirely in the clothing,

especially in the folds, only resorting to the skin for nutriment. It is possessed of a labium surrounded by a collar of hooklets which it fixes into the margin of the opening of a cutaneous—generally a sweat—gland; then it protrudes its membranous proboscis or sucking apparatus into the skin and sucks up blood, at the same time causing a minute, evanescent wheal; when the proboscis is withdrawn a little blood fills the dilated follicle and coagulates to constitute the pathognomonic “hemorrhagic speck,” which may be differentiated from excoriations produced by scratching secondary pruriginous papules by its smaller size, and by not being raised above the general level of the skin. These specks are most common about the neck, shoulders, and clavicular regions, then about the back, thighs, and abdomen, but the secondary lesions produced by scratching generally greatly predominate and comprise wheals in parallel lines, linear excoriations, torn papules with adherent blood clots, pustules, scabs, and ecthymatous sores. In old-standing cases the skin becomes harsh, deeply pigmented, hardened and thickened (*morbus erronum*, *vagabond's disease*) and the lymphatic glands enlarge. The subjective symptoms are burning, itching, and creeping sensations, always worst at night, and transferred, probably by cutaneous reflexes, to other regions than those where the real origin of the disease is located.

The disease is distinctly rare in early life, but very common in advanced life, especially in the dirty and cachectic.

Diagnosis—The distribution distinguishes it from scabies; the history, age of the patient, hemorrhagic specks, and presence of pediculi or their ova on the body or in the folds of the clothing, especially of the neck-band, diagnose it from prurigo.

Treatment must be directed chiefly toward the clothing, which ought to be subjected to a dry heat of at least 220° F. for several hours, preferably in a disinfecting oven. It is well to iron all underclothing along the seams. Stavesacre ointment, freely applied, destroys all pediculi that may remain on the skin, and subsequent pruritus may be relieved by a lotion of liquor carbonis detergens (3j ad $\frac{3}{4}$ viij). Good feeding and reconstituents, especially cod-liver oil, are of value.

Pediculus Pubis (*Phthirus Ingualis*; *Crab-louse* resembles *P. capitis*, but is

shorter, broader, and flatter; the head is rounder, and has five antennæ; the thorax and abdomen are not separated by a constriction. The two posterior pairs of legs with their claws are stronger. The female lays from ten to fifteen eggs, from which the young emerge in six days, and are sexually mature in fourteen days. The headquarters of the parasite are in the pubic hair, where they penetrate into the hair-follicles, the nits being fixed to the base of the hair-shaft. Thence they may emigrate to the hairs along the middle line of the abdomen, to the sternal region, axillæ, eyebrows, eyelashes, and beard, but almost never to the scalp. Their salivary secretion, inoculated beneath the skin, produces extensive bluish discoloration.

P. pubis causes itching, varying much in severity in different subjects, but always worst at night, and the consequent scratching produces a localized dermatitis similar to that described under *P. corporis*. The parasite, from its small size and close attachment to the skin, is often difficult of detection, but must always be carefully searched for in cases of eczematous rashes in the pubic region. The disease is by no means confined to the dirty or to the lower classes of society.

Treatment. — Free inunction of unguentum hydrargyri is always promptly effectual, but may cause dermatitis. Chloroform vapor, white precipitate, naphthol or Stavesacre ointment are almost equally efficacious and less objectionable. It is not necessary to shave or cut the hair short. Pruritus subsequent to cure is common, and may be relieved by lotions of calamine or liquor carbonis detergens (3j ad $\frac{3}{4}$ vj).

Cimex Lectularius (*Acanthia Lectularia*; *Common Bed-bug*) is oval in shape and of a brown color. The head carries a long proboscis, two jointed antennæ, and a pair of eyes; the thorax carries three pairs of three-jointed legs; the abdomen consists of eight segments. The peculiarly offensive odor of the insect is due to the secretion of a gland situated on the anterior part of the metathorax. The female deposits numerous operculated ova in the early spring; in three months a larva is produced, similar in every respect to the parent except in size; this becomes full-grown in three weeks. The bed-bug is nocturnal in its

habits, and lives in the cracks of wood, etc. It is able to undergo long periods of inanition, and possesses remarkable olfactory powers.

Cimex attacks for preference the hands, feet, and face, causing urticarial wheals with a central puncture, which, by scratching, may be converted into papules or even pustules. The irritation which they produce is attributed to the deposition of an acrid matter in the wound which excites hyperæmia and renders the blood more accessible to the parasite.

Treatment. — Washing with Eau de Cologne or a mild carbolic or naphthol lotion relieves all symptoms. Sulphur fumigations effectually destroy the insect.

Leptus Autumnalis (*Harvest Bug*) is a comprehensive term applied to a sexual parasite larvæ of different species of the family Trombidinæ, genus Arachnidæ. They are minute, oval in shape, reddish in color, and possess eight jointed legs, arms with hooklets, as well as a formidable rostrum. They frequent the fields, especially in autumn, and are also found on gooseberry and currant bushes, in granaries and barns. The animalcule implants its rostrum into the opening of a sebaceous gland at the base of a hair-shaft while the hooklets of the legs act as anchors. Intense irritation is set up, with the formation of urticarial wheals and minute papules; frequently the other phenomena due to severe scratching are developed. The legs, being nearest the ground and most accessible, are the parts most frequently attacked, but occasionally the whole body may participate, and considerable general disturbance ensue.

Treatment. — Diluted sulphur or naphthol ointment or weak corrosive sublimate lotion rapidly effects cure and destroys the parasite.

Pulex Irritans (*Common Flea*) is a temporary parasite, and only attacks man in the later stages of its development. It is of deep brown or black color, and is highly active; it possesses a head bearing antennæ, eyes, and a complicated suctorial boring apparatus, a thorax bearing three pairs of powerful legs adapted to jumping, and an abdomen with nine segments. The female is about twice as large as the male; she lays about twelve eggs in clothing, the cracks of woodwork, etc. These are

broad, flattened at each end, and present several micropyles. In about six days a white, footless, eyeless larva with thirteen segments is developed. It feeds on organic matter and the fæces of the parent, and in eleven days forms a cocoon consisting of fine fibers of a sticky material and foreign matters. From the cocoon springs a whitish-yellow larva, similar in shape to the adult; this reaches maturity in eleven days. The average development to the adult parasitic stage occupies about twenty-eight days in summer and about forty days in winter.

Pulex produces a minute circular red spot, in the center of which is a tiny speck which marks the spot where the boring apparatus has penetrated the skin. The actual "bite" of the creature is sometimes accompanied by a smarting sensation, and examination reveals the parasite in the very act. Some persons are habitually insensible of, and ignore, the bite and its consequences; others suffer severely, the irritation causing diffuse eczematous eruptions and sometimes even fever. Any part of the body may be attacked, but usually the face and hands escape. The flea is especially associated with personal and domestic uncleanness.

Treatment.—The use of weak carbolic, or calamine lotion soon relieves the itching.

Dracontiasis (*Guinea Worm Disease*) is a disease of the skin, characterized by the development of deep vesicles or abscesses, due to the presence of the fully developed nematode worm, *dracunculus medinensis*.

The female worm is cylindrical, $\frac{1}{10}$ inch in diameter and generally about 30 inches long, although occasionally much longer. The mouth is surrounded by four papillæ; it is viviparous and contains an enormous number of embryos which, escaping from man into water, lodge in a minute crustacean—cyclops—where they grow to full maturity in six weeks. They obtain entrance accidentally into the human interior, where they become impregnated, and the female passes through the tissues to lodge in the skin, generally about twelve months after they obtained entrance into the system. The characters of the male are not known; they are supposed to be excreted along with the

fæces. The idea formerly entertained that the worm enters the skin of the feet or legs during bathing is undoubtedly erroneous.

In the majority of cases the worm is single and is detected in the foot, leg, or thigh, where it can be felt like a bundle of soft string under the skin. When about to make its escape it gives rise to some itching and discomfort; then a small abscess-like swelling forms, from which clear fluid is discharged and in which the head of the worm can be detected. In some cases very severe inflammation and suppuration may occur along the whole worm-track, with fever and much constitutional disturbance. If the worm break during extraction the embryos may penetrate into the system and cause disastrous results.

Treatment must be mainly directed toward the removal of the worm entire. The abscess cavity having been opened, very gentle traction must be made on the head of the worm and as much as can be easily extracted wound round a small stick, to which a turn or two can be given daily till the whole is extracted. Abscesses must be treated on general surgical principles.

J. J. PRINGLE.

PELIOSIS RHEUMATICA (*Purpura Rheumatica*).—A condition much more closely related to erythema exudativum than to the forms of purpura, along with which it is usually classified. It resembles the former disease as regards distribution, concomitant symptoms, tendency to relapse and to hemorrhage, which latter is usually so marked a feature as to mask its truly erythematous nature.

The lesions are at first slightly elevated papules, from the size of a pin's head to a lentil, of a deep red color which does not disappear on pressure and soon becomes dark purple, subsequently undergoing the changes of tint common to all blood extravasations. They are always present on the legs and feet, often clustered around painful joints, and are also common on the hands and arms, but very rare on the trunk and face. The hemorrhagic papules may be confined to the immediate vicinity of the follicles and remain discrete, or may coalesce to form extensive, irregularly shaped patches, round the margin of which isolated

hemorrhage spots can generally be observed. Sometimes erythematous or urticarial rashes (*P. urticans*) are present on other parts of the body, and, more rarely, vesication occurs (*P. pemphigoides*).

Peliosis is commonest in persons from fifteen to thirty years of age, especially perhaps of the male sex. An outbreak is preceded by, or attended with, considerable lassitude, malaise, and feverish disturbance, which frequently subside when the rash is fully developed. Rheumatic pains, effusion into joints, especially the knees and ankles, and œdema of the feet usually accompany it, and sometimes acid sweats occur, while endocarditis may develop during its progress. In severe cases hematuria has been noted. Repeated relapses of all the symptoms of the original attack almost invariably occur, prolonging the disease over several weeks, and there is a marked tendency to recurrence at regular intervals.

The disease must be considered as closely allied to articular rheumatism. The immediate cause of the rupture of capillaries and consequent hemorrhage is unknown. The blood infiltrates the papillæ or deeper layers of the corium, especially round the glands and hair follicles.

Diagnosis.—The affection must be carefully differentiated from symptomatic and idiopathic purpura, from flea-bites, hemorrhagic syphilodermata and hemorrhagic iodide, or bromide rash.

Treatment certainly influences the course of the disease. Absolute rest must be enjoined. The diet ought at first to be chiefly liquid with slops, but in old standing cases more liberal and stimulating fare may be indicated, including fresh vegetables, meat, and wine. Salicylates are very efficacious in relieving pain and joint symptoms. Small doses of turpentine internally, and ergotin subcutaneously, control the hemorrhagic tendency, while the astringent salts of iron—especially the perchloride—arsenic, and quinine are all of value.

J. J. PRINGLE.

PELLAGRA.—An endemic disease confined to the south of France, the north of Spain, the north and center of Italy. As its effects are most marked on the skin, especially in its earlier manifestations, it may be here considered as a “skin dis-

ease,” but the central nervous and digestive systems are also profoundly affected and its fatal issue is due to their involvement.

Treatment.—No treatment is of avail unless the patient be removed from the locality and placed in good hygienic surroundings. Maize, as an article of diet, is, of course, to be interdicted. Arsenic is said to have a powerful controlling effect over the disease, and general tonic measures and drugs are to be recommended. To prevent the occurrence of the disease in pellagrous districts, the maize ought to be garnered in warm, dry, and well-ventilated granaries.

J. J. PRINGLE.

PEMPHIGUS (*Pompholyx*; *Bladder Tetter*).—A disease of indefinite duration, characterized by the development of successive crops of blebs or bullæ on the skin, and more rarely on the mucous membranes.

It is so closely allied to the group of morbid conditions described as hydroa, and through it to the vesicating forms of multiform erythema, that no absolute line of demarcation, either clinical or pathological, can be drawn between them, the same case being frequently relegated by several equally competent observers to different categories. Nevertheless, the majority present the comparatively definite characters now to be described.

Acute Pemphigus is a rare disease in adults. Its onset is preceded and accompanied by high fever and symptoms of severe nervous prostration; bullæ develop rapidly and indiscriminately over any part of the body, dry up, or burst, forming scales or crusts, and spontaneous recovery ensues in a few days, or rapid death with involvement of the mucous surfaces.

In cases of so-called **Pemphigus Solitarius**, the blebs are single or few in number, localized in distribution, and accompanied by a little constitutional disturbance. The writer has seen one case in an old man suffering from universal leucoderma with severe pruritus, in which the eruption of two large blebs on the feet—undoubtedly spontaneous—was accompanied by high fever, “typhoid” symptoms, and diarrhea, resulting in death in four days.

Acute pemphigus occurring in children

newly born (**P. Neonatorum**) is less rare; it occurs epidemically or sporadically, is always generated in unsanitary dwellings, being of undoubted septic origin; it is infectious, and may extend to adults occasionally. Children affected may be otherwise healthy; an acute eruption of blebs resembling those of pemphigus vulgaris, accompanied by severe febrile disturbance, occurs on any part of the body except the soles and palms. A certain proportion of cases recovers with careful treatment and nursing, but the large majority succumb at the end of two or three weeks. The disease must not be confounded with bullous syphiloderma, which occur at the same age, but invariably attack the palms and soles, and are associated with other evidences of congenital syphilis.

Chronic Pemphigus (*P. vulgaris*) is also a comparatively rare disease. It more frequently attacks children than adults. It is sometimes hereditary, and may affect several members of the same family.

The *eruption* may occur on any part of the body except the palms and soles, its seats of election being the abdomen, chest, and thighs, the face, ears, and neck, the genitals, and the backs of the hands and feet. The lesions are always bilateral, sometimes grouped, sometimes roughly symmetrical, but usually remarkably indiscriminate in distribution. Occasionally an antecedent polymorphous erythema of varying duration may be present; but in typical cases the erythema is either absent or of extremely short duration, and an eruption of large bullæ testifies to the onset of the disease. These bullæ are hemispherical, tense, and rapidly increase peripherically, or coalesce to form blisters the size of a marble or walnut, or even larger. They may have a surrounding areola of congestion, but its presence is atypical. Their contents are at first clear, but soon become turbid, flaky, and purulent; hemorrhage often occurs into them in the severer forms; soon they dry up, forming crusts, or burst and discharge, forming thick scabs, the separation of which—after a variable time—leaves deep purplish stains, which become brownish and ultimately slowly disappear without leaving scars. The appearance of successive crops of fresh lesions—it may be daily (*P. diutinus*)—is very characteristic, and

explains the coetaneous existence of lesions of different ages—*e. g.*, erythema, blebs, ulcerations, scabs, pigmentation. After recovery, universal desquamation generally takes place, even from areas unaffected by the disease—*e. g.*, palms, soles. The duration of the disease is indefinite; it may last weeks or months, or may run on for years with periodic aggravations. Even after apparent recovery, the tendency to relapse after varying intervals is marked.

The *constitutional symptoms* are often trivial, but in some cases, especially in old persons and children, each outbreak is preceded by rigors and fevers, sometimes with delirium. The amount of itching, burning, and tension is very variable, but occasionally these subjective symptoms are intense (*P. pruriginosus*), and in great part account for the sleeplessness, which is often one of the most troublesome complaints, and undoubtedly plays an important rôle in the production of the extreme exhaustion, which results in death.

The most rapidly fatal cases are those in which the mucous membranes are attacked; in them, as in allied diseases of mucous membranes, bleb-formation is not distinct, or is of very ephemeral existence, owing to rapid maceration and removal of the wall of the bleb; early ulceration thus occurs, and results in the production of diphtheritic-looking lesions. The mouth is generally first affected, the tongue swells, the breath is fetid, salivation is copious, and dysphagia ensues from involvement of the esophagus. The vagina is often affected in like manner. Diarrhea results from a similar condition in the large intestine, and the occurrence of pneumonia and nephritis, which may supervene, is probably due to an analogous process. In such cases a lethal termination is almost invariable, and generally after a short duration of the disease.

Pemphigus affecting the conjunctiva presents some special features; occasionally it occurs either long previously to, or independently of, skin lesions, the conjunctiva undergoing a process of so-called "essential shrinking," which results in thickening and opacity of the cornea, and finally in atrophic destruction of the eyeball.

In the extremely rare form of the disease termed **P. Vegetans**, the bullæ on

the mucous membranes precede those on the skin by days, and even weeks. They arise most frequently in the axillæ, or groins, and on the backs of the hands and feet. After rupture, they leave extensive excoriations, which have little or no tendency to heal, but ulcerate deeply and fungate, discharging offensive, viscid fluid. Recovery may occasionally take place, but multiple epitheliomatous growths are very apt to arise from the lesions, the patient dying from profound cachexia.

Pemphigus Foliaceus is another rare form, very dissimilar at first sight to *P. vulgaris*, but it has been observed to result from repeated attacks of the latter. The bullæ are small, never quite filled with fluid, and, therefore, flaccid and flat; they come in rapid crops, and so soon burst at the periphery that careful observation is often necessary to verify their existence as blebs. The resulting ulcers have little tendency to heal, and piled-up scales, crusts, and scabs—aptly compared to flaky pie-crust—are formed, which exhale a peculiarly offensive odor. There is more diffuse erythema than in *P. vulgaris*, and the whole body-surface is ultimately involved; the hair and nails fall out, the eyelids become everted, the nasal and buccal orifices dilated. Finally, the mucous membranes are involved, the constitutional disturbance is great, and the patient dies in an exhausted “typhoid” condition.

Pathology.—Very obscure. Probably the primary change is in the vasomotor centers in the spinal cord, bleb formation being common in many of its diseases, especially myelitis, spinal meningitis, tabes dorsalis, and progressive muscular atrophy. Local irritants—*e. g.*, pressure—may determine the localization of blebs, and, generally speaking, irritant lesions are more apt to produce the disease (or conditions similar to it) than paralytic ones. Evidences of inflammation and degeneration have been repeatedly demonstrated in the peripheral nerves, but the question whether these are primary or secondary is still a moot one.

The bullæ result from rapid serous effusion among the loose cells of the rete malpighii, which soon filters through them to raise the granular and horny layers of the cuticle to form the roof of the bleb. Diapedesis of leucocytes, hem-

orrhage, etc., ensue, according to the intensity of the process. In cases fatal from diarrhea, extensive and deep ulceration of the large intestine has been observed.

Diagnosis.—The differential diagnosis from other vesicating diseases may be briefly dismissed. Scabies in children, impetigo, bullous dermatosyphilis, herpes, vesicating urticaria, and self-inflicted injuries with blistering agents, may present some superficial resemblance to *P. vulgaris*, acute or chronic. The relationship to erythema multiforme has been already referred to. Dermatitis exfoliativa (pityriasis rubra) and universal lichen planus may simulate *P. foliaceus* very closely.

Treatment must be constitutional as well as local, and importance must be attached to careful nursing. Complete rest in bed is necessary. Diet must be nutritious, alcoholic stimulants—preferably wine—are often indispensable. A certain number of cases yield to arsenic freely administered, and with the usual precautions. In a large number of cases, especially where the mucous membranes are involved, opium is of signal service; to insure its full benefit, the remedy must be pushed and insomnia relieved. Iron and quinine may also be of service.

Local treatment varies with the phase of disease present. Mild forms may be simply dusted with oxide of zinc powder, salicylated starch, or lycopodium, and the parts wrapped in cotton wool. In severer cases the blebs should be pricked before these remedies are applied. Great relief is often experienced by swathing the parts in cloths soaked in carron oil, calamine liniment (calamine ℥ij, zinc oxide ʒss, lime water and olive oil, of each, ʒj), or weak carbolic oil. When the condition is subsiding the glycerole of lead subacetate (1 to 6 of water), or milk lotion (liq. plumbi subacetatis ʒj to ʒj) are clean and convenient lotions. In the later stages, when the lesions are drying, oleates of zinc or bismuth, borax, etc., in the form of ointments, have their uses.

In the severest forms no treatment is equal to that of the continuous tepid bath, which affords the greatest relief to the sufferings of the patient, and may apparently be employed for an indefinite period of time. The fetor of *P. foliaceus* and *P. vegetans* is best masked by dusting with iodol; while chlorinated soda

gargles (3 j of the liquor to water $\frac{3}{4}$ vj) are specially useful for the affections of the mouth.

J. J. PRINGLE.

Symptomatic Indications.—*Rhus tox.* is useful in recent cases; itching with burning, confluent blisters, containing a milky or watery fluid, with peeling of the skin; *phosphorus*, when the blisters are hard and painful, full to bursting, but do not itch; *thuja*, in pemphigus foliaceus, with offensive odor, and formation of scales; *arsenicum* in chronic, and the graver forms, does excellent service; *mercurius* is valuable when syphilitic; *kali iod.* in gangrenous form.

PELVIC CELLULITIS.—See PARAMETRITIS.

PELVIC HEMATOCELE.—See HÆMATOCELE, PELVIC.

PELVIC HEMATOMA.—See HEMATOMA, PELVIC.

PEPTONURIA.—See ALBUMINURIA.

PERCUSSION.—A method of physical examination in which some part of the body is struck with a view either to elicit sound or to estimate density of substance.

In the methodical examination of the chest and abdomen the act of percussion follows that of palpation. A slight difference in resonance brought out by an experienced examiner can be easily appreciated by others, but it requires long practice before the student is able to elicit the true note for himself, percussion being by far the most difficult of the arts of physical diagnosis. As an indication of the condition of the subjacent structures the degree of "resistance" experienced on percussion is only second in importance to the alteration in sound.

Method of percussing.—The use of any instrument is, now, almost a thing of the past. The best pleximeter is the finger, the middle finger of the left hand being generally used. It must be applied firmly to the part, and should be struck with one, two, or three fingers of the right hand, the fingers being flexed, the blow delivered from the wrist, and not from the elbow, and vertically to the pleximeter.

Light percussion is best when it is desired to elicit sound from the parts immediately subjacent or to map the outline of the thoracic or abdominal

viscera; also, whenever there is tenderness of the chest-wall and, speaking generally, when examining the front of the chest. Over the supra-spinous fossæ and interscapular regions, however, it is often necessary to give a firm blow in order to bring out slight differences in resonance. This is sometimes termed "deep" percussion.

The clavicles are percussed by tapping them directly with the finger. It is often possible to make out slight differences in resonance by percussion of the clavicles when no variation from the normal can be detected elsewhere; this step should, therefore, never be omitted in the examination of doubtful cases of apical phthisis.

The sounds elicited from different chests and from different parts of the chest vary; it is essential in all cases to compare the note obtained over any spot with that from the corresponding part on the opposite side; interspace must be compared with interspace, clavicle with clavicle, and rib with rib, the pleximeter finger being similarly applied and struck with equal force in each case.

In percussing the back of the chest the patient must be directed to lean forward, to fold the arms, and to "let the shoulders drop," so as to completely relax the scapular muscles.

Theory of percussion sounds.—The sound which is obtained when the healthy chest is percussed is mainly due to the vibration of the thoracic walls alone, and any condition which interferes with the vibration of the chest-walls alters the percussion note. According to another view, however, the middle-sized and largest bronchia are the seat of the vibrations which produce the normal percussion tone.

The nomenclature of percussion sounds is almost as confusing as that of auscultation. Before describing them, it is necessary to refer to some of the synonyms in ordinary use and also to describe the normal percussion signs. The term "dullness" is held to imply absence of "tone;" "tone" being the result of the regular succession of impulses which are present in a musical sound, but lacking in a mere noise.

Not only may the normal tone be lost, but "adventitious" tones may be acquired which vary much in "pitch." Of these, the highest pitched tone is that produced by percussion over a bone

(osteal); next in descending scale comes a tone resembling that produced by percussion of the trachea when the glottis is open (tubular or tracheal); the lowest pitched tone being that produced by percussion over a hollow cavity, containing air, *e. g.*, the stomach (tympanitic). The tone over healthy lung (normal percussion tone) comes in point of pitch after the tracheal tone.

Normal percussion sounds.—By long practice a physician is able to form for himself a normal standard of resonance for different regions of the chest, regard being had for the condition of the parietes and other considerations. This is of service when the percussion note of healthy lung cannot be obtained owing to the presence of disease in corresponding areas on both sides of the chest.

Taking the front of the chest from above downward, the normal condition of the percussion sounds is as follows:

Resonance commences about $1\frac{1}{2}$ inch above the clavicle; it is equal on the two sides until the sound is modified owing to the presence of the liver on the right side, and on the left of the uncovered portion of the heart.

The *liver dullness* commences at the sixth rib in the nipple line; it may be said to be bounded above by a horizontal line extending outward on a level with the base of the ensiform cartilage, and below by the costal margin in the mammary line; in the median line it extends about $1\frac{1}{2}$ inch below the base of the ensiform cartilage. On the left side the outline of the *precordial dullness* is normally roughly triangular, being bounded externally by a line drawn from the center of the sternum opposite the junction of the fourth costal cartilages to the apex beat in the fifth interspace, an inch within the mammary line, below by a horizontal line drawn from the latter point inward, internally by the mid-sternal line uniting the two.

The *splenic dullness* extends from the ninth to the eleventh rib on the left side, in the posterior axillary line; it is oval in area.

Behind, the percussion note in the supraspinous fossæ, owing to the thickness of the muscles, is less resonant; in the interscapular region it is somewhat more resonant, and in the infrascapular region the note is almost equal to that beneath the clavicles.

The lower margin of resonance on the right side is at the tenth rib, and on the left side at the eleventh rib or thereabout.

The following varieties of morbid percussion sounds are generally recognized:

Increased resonance; hyperresonance.—This sound has the quality of the exaggerated normal percussion note, combined with a trace of the tympanitic note; it is of more marked intensity than the normal note, and of lower pitch. It is elicited by percussion over emphysematous lung.

Tympanitic resonance.—A somewhat musical sound of varying pitch, heard on percussion over distended stomach or bowels, or over a pleural cavity containing air, or over a very large pulmonary cavity.

Skodaic resonance.—A clear high-pitched sound of tympanitic quality, produced on percussion over the upper part of the chest (infra-clavicular region especially) when the pleural cavity contains fluid. It is believed to be due to the relaxation of the upper part of the lung which, however, still remains in contact with the chest-wall.

Diminished resonance.—Dullness varying in degree. A sound shorter, sharper, and higher in pitch, and lacking the tone of the normal note. It may be of a quality similar to that produced by percussion over a piece of wood (wooden), or a bone (osteal). The sound usually signifies either incomplete consolidation or displacement of the lung, or the presence of some morbid condition of the pleura. With diminished resonance there is almost always increased resistance on percussion.

Absence of resonance; absolute dullness.—A high-pitched note from which all tone is absent. The sound is elicited by percussion over a pleural cavity containing fluid, or over completely consolidated lung or a solid growth within the chest, in contact with the pleura.

Amphoric resonance; tubular percussion note.—A sound similar to that obtained by percussing the trachea with the glottis open, usually produced over a large superficial cavity, with free bronchial communication, and often accompanied by the "cracked-pot sound."

Cracked-pot sound; bruit-de-pôt-fêlé.—A sound having an amphoric and

slightly metallic quality produced on percussion over a superficial cavity, with slightly yielding walls and free bronchial communication, the glottis being at the time open.

J. K. FOWLER.

PERICARDIUM, DISEASES OF.—

1. **Pericarditis.**—Inflammation of the pericardium, accompanied by an effusion of fluid within the pericardial sac, may be the result of some morbid condition of the blood, as in acute rheumatism, scarlatina, measles, smallpox, septicæmia, nephritis, etc., or it may be due to extension of disease from neighboring organs, such as the heart, pleuræ, lungs, bronchial glands, mediastinum, esophagus, vertebræ, ribs, sternum, mammary gland, or peritoneum. In the great majority of cases the pericardial inflammation is dependent on acute rheumatism, chronic nephritis being the next most common cause.

Tuberculosis is not unfrequently concerned in the production of pericarditis. In one form the pericardium is involved in common with the pleura or peritoneum without similar disease elsewhere. At other times caseous mediastinal glands, or pleural tuberculosis, occurring in the course of pulmonary phthisis, may lead to pericarditis by extension, and occasionally the pericardial affection is part of a general tuberculosis. Pericarditis may supervene in the course of acute pneumonia, either as the result of extension or of toxæmic causes. In rare cases the affection can be traced to direct injury, and at times it appears to develop without any definite cause.

Symptoms and course.—In cases where the effusion is not very extensive, there may be no definite symptoms. In individual instances pericarditis occasions severe pain in the precordial region and epigastrium. Large collections of fluid are invariably associated with a sense of oppression, or even with severe dyspnœa, and palpitation is frequently complained of. Dyspnœa is to be attributed to the small amount of blood entering the heart and passing through the lungs, diminished pulmonary circulation leading to imperfect oxidation of the blood, with dyspnœa as its necessary consequence. Anæmia of the arterial system is very apt to give rise to cerebral symptoms, drowsiness, delirium, headache. Acute pericarditis is attended by a varying degree of pyrexia,

and occasionally is ushered in by a distinct rigor. In others, the onset of the affection is very insidious, and, especially in the subjects of nephritis, pericarditis may escape detection altogether, as it commonly develops during the later stages of the disease. The existence of pericarditis can seldom be inferred from symptoms; we must depend on physical examination. In long-continued effusion, a degree of venous stasis may be induced, resembling that which occurs in affections of the mitral valve. At the same time, it must be stated that this condition is often the result of more than one cause, the effects of mechanical pressure being supplemented by the supervention of myocardial debility, which may depend on combined valvular disease and pericarditis.

Effusion into the pericardium occurring in the course of acute rheumatism is rarely fatal, though occasionally the amount of fluid may be so extensive as to endanger life from the effects of pressure upon the heart and large vessels. Absorption is usually a slow process, except when the effusion is a small one, and some degree of adhesion of the visceral and parietal surface usually results. In cases of pneumonia and renal disease, pericarditis is an ominous symptom, and generally augurs a fatal termination. Tubercular pericarditis is seldom accompanied by much effusion, and, as a rule, does not occasion marked symptoms. Purulent effusions are commonly fatal. The complications that are liable to arise are to be regarded as the effects of pressure. Thus dysphagia, aphonia, and hiccough have been attributed to compression of the esophagus, recurrent laryngeal, and phrenic nerves respectively. Large effusions exercise pressure on the left lung, and so increase the existing dyspnœa. Thrombosis of the left innominate vein has been known to result from pericardial effusion.

Patients suffering from this disease generally have a pale, ashy complexion, and some distention of the veins of the neck is often visible. The face betrays anxiety, and the respiratory movements are increased in frequency. Orthopnœa is frequently observed; but in some cases of extensive effusion the decubitus is dorsal, the object being to diminish the anæmia of the brain as far as possible.

Physical examination of the chest.—

Inspection reveals bulging of the precordia, and effacement of the intercostal spaces. At times the chest-walls are slightly œdematous. The impulse of the heart is indistinct, and may be invisible.

Palpation.—The apex beat is feeble, and the impulse is often diffused. Sometimes the apex beat appears to be situated in the fourth intercostal space, but in such cases the impulse is probably communicated from the right ventricle, the apex being separated from the chest-wall by the effused fluid. A friction fremitus may occasionally be detected when the hand is placed over the precordia.

Percussion.—The area of cardiac dullness is increased. In the early stage, when the patient is in the recumbent position, the presence of pericardial effusion is first detected at the base of the heart, the dullness reaching up to the second or third rib on the left side. As the effusion increases, the precordial dullness assumes a pyriform or roughly triangular shape, the apex pointing upward, the base downward.

Owing to the fact that the pericardial sac is more loosely disposed around the great vessels at the base of the heart than elsewhere, the fluid accumulates here in the first instance, but when the pericardium becomes further distended the effusion separates the two surfaces of the serous membrane in all directions, and the fluid gravitates toward the most dependent part. The area of dullness is greater when the patient sits up than when he lies down, inasmuch as in the latter case the fluid has a tendency to sink behind the heart. Changes in position are not uncommonly attended by a shifting of the line of dullness to the right or left.

In some instances the precordial dullness extends further to the left than the position of the apex beat, owing to the distention of the pericardial sac.

Auscultation.—When the amount of effusion is not sufficient to separate the pericardial surfaces completely, a friction sound or rub, is heard, corresponding more or less accurately in rhythm with the movements of the heart, but in some cases, and these often of a very acute character, no friction sound can be detected at any period of the disease. Pericardial friction is generally most marked toward the base of the heart,

though it may be audible over the whole cardiac region. The rubbing sound is commonly systolic, but it may be both systolic and diastolic. The distinction of pericardial friction from an endocardial murmur is generally, though not invariably, an easy matter. Pericardial friction is often less accurately coincident with the heart sounds; it is rougher, more grating or creaking in character, and seems to be closer to the ear. The localization of the sound does not always agree with the point of maximum intensity of the different endocardial murmurs; moreover, it does not show the same tendency to propagation in definite directions, and is often heard over a very limited area. The loudness of the friction sound is usually increased by pressure with the stethoscope, causing the two roughened surfaces of the pericardium to come closer together. Variations of intensity are often produced by a change of posture, friction being most distinctly audible in the upright position. As the effusion increases and separates the pericardial surfaces, the rub is no longer heard, and the heart sounds become weak and distant.

The degree of effusion cannot be determined solely by the extent of precordial dullness, a point which should be borne in mind. Cardiac dilatation, especially if it be combined with retraction of the margins of the lungs, may simulate an extensive effusion when the amount of pericardial fluid is comparatively small. Large effusions, on the other hand, sometimes give rise to very little increase of precordial dullness when they gravitate to the posterior aspect of the serous sac. Emphysema also masks the existence of pericardial effusion to a considerable extent. Depression of the diaphragm, liver, and spleen may be caused by large pericardial exudations. When the left lung is compressed, dullness to percussion, and weak breath sounds are discovered at the posterior base. In cases of large effusion the pulse is generally weak, small, and irregular, and its frequency is increased. It should, however, be remembered that the condition of the pulse is determined not merely by the amount of effusion, but also by the nutrition of the myocardium. See also EXTERNAL PERICARDITIS.

Diagnosis.—Pericardial friction is the only pathognomonic sign, but this adventi-

tious sound is sometimes wanting, when the conditions necessary for its production are present, viz., roughened surfaces without much effusion. Absence of the characteristic rub in these cases is believed to depend on weakness of the cardiac contractions. A pleuro-pericardial friction sound depending on roughening of the pleural surface in the vicinity of the heart, and commonly audible at the margins of the cardiac area, may sometimes be distinguished from true pericardial friction by observing that the sound is modified when the patient holds his breath, but at times an accurate decision is impossible.

When copious exudation has occurred and friction is no longer audible, the diagnosis can usually be made by attention to the following: The peculiar shape of the precordial dullness, enfeeblement of the impulse and sounds of the heart, and the occasional but characteristic relation of the apex beat to the left margin of the cardiac dullness. When pericarditis is complicated by effusion into the pleura, diagnosis may be impossible in the absence of a pericardial friction sound.

Prognosis.—Depends to a great extent on the nature of the primary disease. When pericarditis appears in the course of rheumatic fever, it is favorable; whereas in chronic cases and in those which are complicated by valvular disease, the chances of recovery are not so good. Pericarditis, when secondary to pneumonia or renal disease, is generally fatal.

Morbid anatomy.—The changes met with in pericarditis are similar to those that accompany inflammation of other serous membranes. The surface of the pericardium first becomes dull, slightly injected and roughened, and subsequently a fibrinous exudation occurs. The process may stop at this point, but commonly an effusion of fluid ensues. The effusion is almost always sero-fibrinous in acute rheumatism and renal disease. Purulent exudation is generally a consequence of suppuration in adjacent organs (*e.g.*, empyema, spinal, costal, or sternal abscesses), perforation of the pericardium by new growths of the esophagus, or pyæmia.

A hemorrhagic character is occasionally imparted to the effusion, when the morbid process depends on tuberculosis, or malignant disease, and in the rare instances in which pericarditis develops in the course of scurvy or purpura.

Putrefactive changes may be set up in certain cases of purulent effusion, and it has been asserted that this event is at times associated with the formation of gas in the serous cavity.

Sero-fibrinous effusions may become absorbed without leaving behind them any trace of their existence beyond a localized or diffused thickening of the serous membrane. More frequently, acute pericarditis is succeeded by a chronic stage in which the fibrinous exudation undergoes organization, and adhesion of the visceral and parietal pericardium is produced. When the adhesion is partial, effusion is apt to recur from time to time, and ultimately the two surfaces of the pericardium may become universally adherent. General or localized adhesions are not unfrequently the results of an essentially chronic pericarditis. Calcification is occasionally associated with fibrous thickening and adhesions. The milk spots or white patches, so often met with on the visceral pericardium, especially over the anterior surface of the right ventricle, may be sequelæ of acute inflammation, but more often represent a process that has been chronic from the first.

The inflammation of the serous membrane at times involves the outer fibrous laminæ of the pericardium (external pericarditis), and may thence extend to the pleuræ. In other cases, external pericarditis is secondary to pleurisy or inflammatory affection of the mediastinum, the serous surface of the pericardium being frequently unaffected.

As the result of these changes, fibrous adhesions are apt to form between the pericardium, sternum, and large vessels at the base of the heart (mediastino-pericarditis, mediastinitis fibrosa).

Inflammation of the pericardium is always to some extent propagated to the muscular walls of the heart, though the degree of myocarditis produced varies considerably. The peripheral layers of the myocardium become more or less softened, and acquire a dull yellowish appearance. At times when the pericardial thickening is very extensive, the heart seems to be enveloped in a fibrous or calcareous capsule, and in such cases the cardiac walls are thin and atrophied. Dilatation of the heart is commonly induced, as the result of concomitant

myocarditis and fatty degeneration. Hypertrophy is never a direct result of pericardial adhesion, but is due either to coexisting valvular disease or to other recognized causes of cardiac hypertrophy.

When the amount of pericardial effusion is large, the diastolic expansion of the heart is interfered with, the quantity of blood entering from the veins is curtailed, and a condition of venous stasis and arterial anæmia is produced. Extensive effusions exercise more or less pressure on the left lung, esophagus, trachea, recurrent laryngeal nerves, and other neighboring structures.

Treatment.—In most instances no direct treatment is called for beyond the application of a pad of cotton-wool or a poultice to the precordial region; an ice-bag or blisters are sometimes of service. Iodide of potassium has been recommended to promote absorption. Complete rest in bed and the avoidance of any sudden movement are of great importance. A light, nutritous diet should be ordered. When the heart's action is feeble and rapid digitalis is indicated, and alcoholic stimulants may be administered.

If great effusion and pressure effects appear, the question of paracentesis should be considered. When this operation is contemplated, an exploratory puncture should always be made as a preliminary measure, the fourth or fifth intercostal space, an inch to the left of the sternum, being the point usually selected. Aspiration has proved successful in several cases, and, when carefully performed, the operation is attended with very little danger.

Free incision has been practiced, in a few instances of purulent pericarditis, with excellent results.

2. Pericardial adhesion.—The two surfaces of the pericardium may be universally adherent without any ill effects being produced. In certain cases, however, this condition is accompanied by a marked degree of cardiac dilatation. These differences probably depend on the varying extent to which pericarditis involves the subjacent myocardium. The presence of pericardial adhesions may at times be recognized, but more often the diagnosis can only be conjectural. A general systolic retraction of the intercostal spaces over the precordia is the most trustworthy sign of an adher-

ent pericardium. If the two surfaces of the serous membrane be united and at the same time the pericardium be fixed to the sternum, this phenomenon is more likely to occur. In such cases rebound of the chest-wall and sudden collapse of the jugular veins may occasionally be observed during diastole. Systolic recession, confined to the region of the apex beat, is less uncommon and is frequently unconnected with pericardial adhesion.

The fact that the margins of the cardiac dullness are unaffected by deep inspiration, and the absence of any shifting of the apex beat, with changes in the patient's position, has also been regarded as symptoms of adherent pericardium, but neither of these signs can be relied upon.

3. External Pericarditis.—This condition may give rise to a pleuro-pericardial friction sound. When fibrous adhesions have formed between the sternum, external pericardium, and great vessels at the base of the heart, a peculiar modification of the pulse is sometimes observed. This consists in distinct intermissions of the pulse corresponding with each inspiration (*pulsus paradoxus*). This alteration of the pulse has been attributed to tightening of the adhesions around the aorta by the descent of the diaphragm and by the outward movement of the ribs and sternum which occurs during inspiration (*see PULSE*).

Rosenbach, however, found by experiment that when the intra-pericardial portion of the vena cava inferior was compressed to a certain extent, a typical "*pulsus paradoxus*" was produced. Each deep inspiration gave rise to complete constriction of the vein as it passed through the diaphragm, a fall of blood pressure and weakening of the heart sounds occurring simultaneously. These facts prove that the "*pulsus paradoxus*" may be due to insufficient entry of blood into the heart.

4. Hydropericardium.—Dropsy of the pericardium is generally the result of renal disease, valvular lesions, or chronic affections of the lungs. Pericardial friction does not develop, but with this exception the physical signs are the same as in pericarditis with effusion, and the differential diagnosis of the two affections is not always easy.

Treatment must be directed to the

primary disease, and when the amount of fluid is very great, paracentesis may be resorted to.

5. Hæmopericardium. — An effusion of blood into the pericardial cavity commonly depends on bursting of an aortic aneurism, but this accident may also be caused by rupture of the heart or of aneurisms of the coronary arteries. Rupture of the heart may be the result of myocarditis, infarction, fatty degeneration, or cardiac aneurism, or it may be due to direct injury.

Death is speedily produced from the effects of pressure upon the heart.

6. Pneumopericardium. — The presence of gas in the pericardial sac is either the result of traumatic causes or of communication between the pericardium and air-containing organs like the esophagus, stomach, or lung, or the pleura. In the latter case, perforation depends upon ulcerative or suppurative processes, almost always leads to purulent pericarditis, which terminate fatally. The physical signs of this rare condition are tympanitic resonance over the precordial region, metallic gurgling or splashing sounds, synchronous with the heart's movements, and amphoric echo of the heart sounds, endocardial murmurs, or pericardial friction. Slight dullness in the situation of the heart may sometimes be detected when the patient sits up.

PERCY KIDD.

Symptomatic Indications. — *Aconite* is the principal remedy in the early stage, with violent throbbing and extreme pain; double friction sound in rheumatic cases, laboring, heaving action; diminishes vascular excitement and relieves irritability. *Bryonia* is valuable in second stage, when exudation is present. *Digitalis*, when the heart's action is rapid and feeble, with serous effusion, cyanosis, and dropsy does excellent service. *Spigelia*, in rheumatic cases, stitch pains, is often efficacious. *Arsenicum* in cases of great debility, restlessness, anxiety, with effusion into pericardial sac is very valuable. *Cactus*, when there is feeling of constriction as though the heart was encircled by an iron band, acute pain, palpitation, and dyspnoea.

PERIHEPATITIS. — Inflammation of the serous covering of the liver.

This may occur as part of a general peritonitis, but more frequently it is second

ary to some disease of the liver, or is an extension of inflammation from neighboring parts. Acute perihepatitis, in addition to its relation to acute general peritonitis, arises from extension of inflammation in empyema of the same side, from ulceration of the stomach, and where an abscess of the liver reaches the surface. Chronic perihepatitis occurs in all forms of cirrhosis and in new formations, especially syphilis and tubercle, also as a result of pressure—*e. g.*, from tight-lacing and from the pressure of a greatly hypertrophied heart, and from other causes.

Symptoms. — The chief symptom of acute perihepatitis is acute cutting pain; there may be some degree of fever with slight jaundice, and a friction sound may be heard over the seat of the pain. In chronic perihepatitis the organ is often altered in size and shape; friction may be audible, but very often adhesions prevent the descent during deep inspiration. All these signs may, however, be absent, and frequently the condition can only be inferred during life, or is discovered after death.

Diagnosis. — Acute perihepatitis is liable to be mistaken for pleurisy.

Prognosis. — Depends upon the cause.

Morbid anatomy. — In acute perihepatitis, not being part of an acute general peritonitis, a circumscribed area of the surface of the liver presents a milky appearance, and is covered with lymph. In chronic perihepatitis the capsule is much thickened, in places forming fibrous bands and wedge-shaped layers of considerable thickness, especially where there has been loss of liver substance, as in gummatous cirrhosis and tubercle of the liver. In cardiac cirrhosis the capsule is often universally thickened, and the organ assumes a globular form from flattening of its anterior margin. Adhesions to neighboring organs often result.

In many cases of atrophic cirrhosis accompanied by ascites a fenestrated membrane can be detached from the liver, the fenestræ corresponding to the "nodules" on the surface of the organ. A similar membrane, but of more uniform texture, is generally present over the whole surface of the peritoneum, although its presence may easily be overlooked. The perihepatitis is in such cases part of a slowly progressive chronic peritonitis. A similar membrane is often present on the pleura in cases of hydrothorax

secondary to valvular disease of the heart.

Treatment.—If acute, rest and turpentine stupes, or hypodermic injections of morphia. This treatment should be combined with a dose of calomel or euonymin, followed by a saline purgative. If chronic no treatment can be of any real service.

ROBERT SAUNDBY.

Symptomatic Indications.—Acute, *aconite*; chronic, *bryonia*.

PERIMETRITIS (Pelvic Peritonitis).—Inflammation of the peritoneum about the uterus, having its origin in disease of the uterus or its appendages. It is always a secondary affection, produced by inflammation of the uterus, or of the tubes, or of the ovaries, or by noxious discharges through or from the tubes or ovaries, or by mechanical injuries. More particularly by injury in labor, intra-uterine pessaries, tents, operations upon the uterus, gonorrhea, puerperal or other endometritis, uterine cancer, uterine fibroids, ovaritis, salpingitis, and tubercular disease of the tubes. It may also arise by extension from parametritis, with which it often coexists. It is often attributed to cold.

There are three varieties: *adhesive*, *serous*, and *suppurative*. The first of these is the most common, and is often attended with symptoms so slight as scarcely to be noticed by the patient. Serous is the least common; suppurative the most serious.

Symptoms.—Commences with febrile disturbance and pain in the lower abdomen. There may be shivering, but there is not usually a well marked rigor. There is a rise of temperature, acceleration of pulse and respiration (which is less abdominal than normal), loss of appetite, and thirst. The patient lies on her back, with the knees drawn up. The pain is referred principally to the lower abdomen, and often described as worse over one ovarian region. There is tenderness on pressure, and the abdominal walls are held rigid. There is often irritability of the bladder, and there may be slight scalding pain on micturition. Defecation is often painful, the pain more especially preceding the act. These symptoms may prove to be the beginning of general peritonitis. But if the inflammation remain merely a peri-

metritis, in the course of a few days they will diminish in severity, the temperature falling, and the pain becoming less. The rapidity with which improvement begins to be apparent will depend very much upon the treatment. When the intensity of the onset has subsided, pain, tenderness, slight fever, and debility linger on for, it may be, weeks, gradually becoming less. When all symptoms have completely disappeared, a slight relapse is common, and may be followed by another, so that the date of ultimate complete freedom from all symptoms cannot be definitely stated. These symptoms are met with in all varieties of perimetritis, and, indeed, all kinds of pelvic inflammation. The diagnosis of perimetritis can only be made by physical examination.

Signs.—In the early stage of the disease, when the process has not advanced beyond injection of the peritoneum, and the exudation of a little inflammatory lymph, the only physical signs are pain on moving the uterus and fullness, that is, increased resistance to pressure around the uterus. At a later stage of the disease, the exudation of lymph becomes more abundant, and is gradually organized into fibrous tissue, which, in course of time, become increasingly hard and dense. After the first few days, there is felt as it were a hard roof to the pelvis, joining the uterus on each side, at or a little above the internal os, dipping down behind as low as the os externum or even lower; at the sides retreating out of reach of the finger, in front not felt by the finger. The uterus is fixed, and after a few weeks' duration it becomes no exaggeration to say that the exudation feels "as hard as a board."

In *adhesive* perimetritis, although on vaginal examination the induration closely simulates a tumor, yet on bimanual examination, which is difficult to make satisfactorily without anæsthesia, owing to the rigidity of the abdominal walls, it will be found that there is no tumor, but that the hardness is merely thickening of the peritoneum covering the pelvic viscera. All the parts in contact with this sheet of peritoneum—uterus, tubes, and adjoining bowel—are matted together by adhesions. In the inter-spaces of these adhesions there is often a little serous fluid, but not enough to form a distinctly outlined swelling.

In rare cases there is a large effusion of serous fluid, which becomes inclosed in a space limited by inflammatory adhesions. This is *serous* perimetritis. Such swellings are usually behind the uterus, and displace it forward. They may obstruct defecation or micturition. Being bounded by matted intestine, they are often resonant on percussion, while, from the thickness of the parts which separate them from the exploring hands, it is seldom that fluctuation can be distinctly felt.

In *suppurative* perimetritis there is a collection of pus bounded by adhesions among the bowels. Inflammation so acute as to lead to the formation of pus, is apt to spread, and an abscess may form near the uterus; or the inflammation may be merely adhesive in the neighborhood of the uterus, and suppurative at a part of the peritoneum remote from it; or there may be several abscesses at different parts. Hence perimetric abscesses are not at all regular in their position and outline, and the largest are not globular, but sinuous, irregular, and present pouches in all directions.

Diagnosis.—It is not difficult to ascertain the existence of perimetritis. The pain, the fever, the fixity of the uterus, and the induration around it, plainly indicate the disease. If the case be not seen until after the acute symptoms of the onset have subsided, we may feel in doubt whether the swelling present behind and around the uterus is the result of inflammation, or a hemothecle. An opinion can only be formed by the history of the mode of onset; it is not possible, from the character of the swelling, to tell whether Douglas' pouch is occupied by blood, pus, or serum. In perimetritis, the difficulty is to ascertain what morbid conditions underlie and coexist with it. To do so may be impossible in the acute stage of the disease, but as the perimetritic symptoms subside, the symptoms and signs of any disease which remain, such as diseased tubes, ovarian cysts, or uterine fibroids, will become clearer. Serous perimetritis may form a swelling very difficult indeed to distinguish from an ovarian cyst; if a tumor, apparently a cyst, be discovered for the first time as an attack of perimetritis is subsiding, it is well to wait a few weeks and watch its course before deciding on an operation.

Prognosis.—If the cause be not still in

operation, the tendency is to recovery. In the course of time effused serum is absorbed, adhesions stretch and become looser, and the viscera are less firmly fixed, the adhesive bands may at length become elongated, so as to in no way interfere with the functions of the organs they bind together. But if cause persists repeated attacks are likely. After many attacks, as is often the case when the tubes are diseased, there may be great fibrous thickening of the peritoneum, and extensive and dense adhesions. These generally give rise to persistent pain. If the uterus be flexed, perimetritis may lead to its being fixed in the bent position, and when so held secretions may accumulate in its cavity, and hemothecle or pyometra be the result. The prognosis, although favorable as to risk to life, should be guarded as to the patient's future good health. In suppurative perimetritis the prognosis is more unfavorable than in the other forms.

Treatment.—The patient should be kept in bed as long as either fever or much pain is present. The pain of perimetritis is seldom severe enough to require opium, and if there be severe pain it seldom lasts longer than a few days. The drug, when needed, is better given locally, in the form of morphine suppositories, or a liniment of oleate of morphine (two to four per cent.) may be painted on the abdomen, or laudanum may be sprinkled on poultices. Opium should be omitted as soon as possible, as it disturbs digestion, and by confining the bowels, favors the formation of scybala, the passage of which past the inflamed pelvic peritoneum, and the straining called for to expel them, may cause the patient a great deal of suffering. To relieve this, laxatives should be given, so as to keep the stools soft. Another reason for caution in the use of opium is that slight pain may persist long, and if the patient be accustomed to look to opium for relief, she may need increasingly large doses, and in time become unable to do without it. The best means of at once lessening the inflammation and relieving pain is the use of counter-irritation, such as poultices of linseed and mustard (mustard 1, linseed 4: mix the mustard with the water before the linseed); turpentine stupes; small blisters, one every three or four days; or lin. iodi every other day, or less often. Aconite or belladonna may be

used locally. Pessaries of aconitia (gr. $\frac{1}{5}$, gelatin mass \mathfrak{D} ij) are useful. Alcohol is better withheld, unless the pulse be so feeble as to clearly indicate its use, or it be found that small doses aid digestion. Regulation of the diet is not so important in this form of local peritonitis as in that which depends upon disease of the alimentary canal. Under treatment conducted on these lines, most cases progress slowly toward recovery although there may occasionally be a slight relapse.

It may be found within the first few days that the case, though carefully treated, is not improving, the symptoms pointing rather to the spread of the inflammation. The pain becomes worse, the tenderness more diffused, the fever higher, and the prostration greater. Acute symptoms such as these may quickly develop in a case which seemed to be going on favorably. Under such circumstances it is clearly not advisable to wait for the peritonitis to become general, or for the patient to become hopelessly exhausted. The abdomen should be opened without delay, the site of the inflammation, which will probably be the tubes or ovaries, sought for, the products of inflammation removed if possible, and the abdomen washed out and drained.

In serous, or in suppurative perimetritis pressing on the bowel or the bladder, or associated with persistence of severe febrile symptoms, Douglas' pouch may be bulged downward by the inflammatory effusion. In such a case, it will be proper to tap the swelling with an aspirator needle, and having thus ascertained beyond doubt that it is a fluid effusion, to make a free incision and let the serum or pus out. But if, although the character of the symptoms calls for interference, there are no clear indications that the effusion is so situated that it can be let out by vaginal incision, abdominal section is to be preferred.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is the main reliance in the stage of congestion, especially when the disease results from cold; high fever; hot, dry skin; much thirst; anxiety and restlessness: *apis* is valuable to stimulate absorption or exudation, and will sometimes abort suppuration. It is indicated by burning, stinging pain in the uterine and ovarian region, with great tenderness; leucorrhea

and painful urination; diminished or suppressed menses; tendency to anasarca. *Arsenicum* is valuable when the effusion is copious, the patient asthenic and greatly prostrated; burning pains. *Bryonia* is useful after aconite to promote absorption of serum; stitching, lancinating pains worse from the least motion; obstinate constipation. *Silicea*, when there is chronic pelvic abscess with fistulous opening and much thin pus. *Cinchona*, in chronic pelvic abscess, is useful to sustain the strength when the patient has become debilitated from long continued discharge of pus; fever of an intermittent or remittent type. See, also, PELVIC CELLULITIS.

PERINEPHRITIS.—Inflammation of the fibrous and fatty tissue surrounding the kidney. It may be primary, that is, independent of disease in any other parts, or secondary. A further division of secondary perinephritis may be made according as the primary disease is situated in the kidney itself, or in some other part not necessarily near the kidney.

The primary form is most frequently due to traumatism, in the shape of blows upon the lumbar region, bruises, or actual wounds penetrating to the perirenal tissue. It may also in some cases be the result of strain of the psoas and lumbar muscles, or of sudden chill of the heated body, and it arises occasionally in the course of pyæmia and the specific fevers.

Secondary perinephritis is more frequent. Its usual cause is some previous disease of the kidney itself. This may be an inflammation of the kidney or of its pelvis, which, however induced, affects the perirenal tissue by direct extension, or which, being itself suppurative in character, causes extravasation of pus into the surrounding parts.

Tumors, hydatid and other cysts, and tubercle of the kidneys may so irritate the surrounding tissue as to produce inflammation. Calculus of the kidney is a most frequent cause of perinephritis. It acts either by inducing an inflammation of the kidney tissues, which, by direct extension, or by rupture of an abscess, affects the perinephric tissue, or by causing ulceration of the pelvis of the kidney and extravasation of urine. The stone itself may come to lie actually outside the kidney. It is to be noted

also that such a renal fistula may be caused by other conditions, such as tubercle, tumor, or hydatids of the kidney. Further, disease of other parts, even far distant from the kidney, may cause perinephritis. Thus, typhilitis and perityphilitis, parametritis (pelvic cellulitis), the result of operations upon, or of inflammation of the pelvic organs, ulceration and perforation of the colon and of the gall-bladder, abscess of the lung or empyema, and abscesses in connection with caries of the vertebræ, may, by extension along the planes of connective tissue, affect the perirenal tissue, while leaving the kidney intact.

When not the result of rupture of a renal abscess, or of extravasation of urine, perinephritis is frequently non-suppurative. It then shows itself as a thickening of the perirenal tissue causing firm adhesion of the capsule of the kidney to the surrounding parts. In such a condition, the kidney is found embedded in a hardened mass, and when the organ is removed, its capsule is commonly left behind. The majority of the causes mentioned, however, produce supuration. The abscess may be of almost any size. The pus most frequently lies behind the kidney, with the organ intervening between the abscess and the peritoneum, but it may completely surround the kidney, and may in rare cases lie entirely between the kidney and the peritoneum. The pus is often fetid, even if there be no communication with the bowels. The surrounding parts are congested and often show small hemorrhages; they may in some cases contain masses of sloughy tissue.

Symptoms. — At commencement the symptoms are variable; may be acute or latent, obvious or not well pronounced, may again be masked by the symptoms of the primary disorder which causes the perinephritis. The earliest symptom is pain in the lumbar region of one side, uncertain in character, but usually dull, aching, and deep-seated, often shooting down to the inner side of the thigh, and sometimes accompanied by retraction of the testicle. The pain may be paroxysmal, may disappear for a time and afterward recur, and may be reflected even to the knee of the same side, as occurs in disease of the hip-joint. At the same time there is tenderness on deep pressure in the renal region, and a sense of resist-

ance is experienced by the examining hand. The patient, too, feels a heaviness in the same locality. The position of the patient is often characteristic. He assumes a fixedly bent position, inclining also somewhat toward the affected side, and, on lying down, the thigh on that side is maintained in the flexed position. In sitting, the weight of the body is thrown on to the opposite tuber ischii, and in walking lameness is observed from a similar tendency to throw the weight on to the opposite leg. These constrained attitudes are due to attempts to avoid the pressure or strain upon the inflamed parts in the loin which would result from the contraction of the psoas muscle. There are at the same time the constitutional symptoms of the subfebrile condition; a temperature slightly and irregularly raised, slight rigors, and coated tongue. The urine is febrile, and may contain a little albumin; it may, also, of course, present the changes characteristic of the affection causing the perinephritis; the bowels are constipated.

When pus forms, the pain and also the constitutional symptoms are increased in severity. Rigors and sweating are now pronounced features, and a more or less definite tumor appears in the loins, obscurely fluctuating and sometimes attaining a great size. The skin over the part may be œdematous, and may also be reddened. Œdema of the lower extremity is an early sign of pus formation. In the early stages, before pus has formed, the inflammation may undergo resolution and spontaneous cure.

When pus has once formed, unless it be liberated early, it will burrow in various directions. Most frequently it makes its way upward, bursting into the pleura, causing empyema, or discharging itself directly into the bronchi, or else proceeds downward in the sheath of the psoas muscle, showing itself at the groin. It may also, though more rarely, reach the cellular tissue of the iliac fossa, or of the pelvis, and may make its exit at Poupart's ligament, or at one or other of the foramina of the pelvis, or may burst into the vagina or bladder. Again, the pus sometimes finds an entrance into the large bowel, or bursts into the peritoneum; it may make its way through the kidney to the renal pelvis and the ureter, and, finally, it may open externally in the loins. By taking

the latter course, the abscess finds a communication between the interior of the kidney and the external surface, by which portions of a calculus may be discharged. The fistula so produced may remain patent for years.

Diagnosis.—The symptoms may, especially in the early stages, be mistaken for those of disease of the hip-joint. The unilateral pain sometimes shooting to the knee, the flexure of the thigh, and the bend of the body are similar in the two disorders, but in perinephritis the pain and tenderness are situated higher up. There is no pain on pressure over the trochanter or head of the femur, passive movements of the hip-joint are painless when the limb is flexed so as to relax the psoas muscle, and there is no alteration in the length of the limb. Disease of the vertebræ, too, may be closely simulated, especially if the pus formed in a case of perinephritis have burrowed in the psoas muscle. But in perinephritis the body is inclined to one side, more or less, and is not held so stiffly as in caries of the vertebræ. Also there is distinct lameness, not merely tenderness of gait, there is no prominence of the vertebral spines, no bilaterally radiating pains, and no tenderness over the vertebræ. Moreover, the pain of vertebral caries is greatly relieved by suspension.

The symptoms and even the signs of typhlitis and perityphlitis closely resemble those of perinephritis of the right side. The diagnosis may be made by remembering that pain and swelling of perinephritis are higher in situation than are those of typhlitis, although in the further course of the two disorders the distinction may disappear. Vomiting is more common, and peritonitis occurs earlier in typhlitis than in perinephritis. Tumors of the kidney, lumbago, and fecal accumulations may possibly be mistaken for perinephritis; but their diagnosis will be clear from the account of the symptoms of perinephritis already given.

Prognosis.—If no pus have formed, the prognosis is favorable; but cases are rare which go on for any length of time without suppuration. Primary perinephritis, if recognized early, and the pus liberated by free incision, admits of a favorable prognosis. In all other cases the prognosis is grave. Death takes place from exhaustive suppuration, from pressure, or from severe peritonitis,

pleurisy, or pneumonia. Much depends, however, on early diagnosis and prompt liberation of pus. Even then, as a rule, the disease pursues a long and wearisome course.

Treatment.—In the early stages the measures recommended for abscess of the kidney (*q. v.*) should be adopted. Rest in bed and light diet, warm fomentations and poultices, and cupping of leeches to the loins. The bowels should be kept open after a preliminary purgation. As soon as pus is detected it must be at once liberated by lumbar incision, and search should be made for it by the aspirator if there be even a suspicion of its presence. The further treatment should be based upon the ordinary rules of surgery.

ROBERT MAGUIRE.

PERINEPHRIC EXTRAVASATIONS.—*Air.*—Air is occasionally found in considerable quantity around the kidney after injury to that organ. The source of the air is not always traceable. In one case it appeared to have gained admission through a perineal incision which had been made on account of a rupture of the urethra, which complicated a fracture of the pelvis. Wounds of the loin, groin, and perineum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs, with injury to the lung, may be the causes of this form of extravasation. Retro-peritoneal abscess opening into the bowel may give rise to it.

Blood may be effused around the kidney from a ruptured artery or vein, or from capillaries, as a result of violence. The clots so formed may ultimately break down and lead to suppuration. Fractures of the pelvis or lumbar vertebræ, ruptures of muscles, and the bursting of an aneurism of the abdominal aorta, have been the causes of considerable circumrenal hemorrhage. The kidney may be raised so completely by the extravasated blood as to present a tumor anteriorly in the hypochondrium.

The *symptoms* vary with the cause and extent of the extravasation. When the blood occupies the cellular tissue of one loin, chiefly or entirely, it causes a tumor, sometimes difficult to diagnose from a distended kidney. If the source of the bleeding is a superficial laceration of the kidney, or a rupture of

an artery (say one of the lumbar arteries), some weeks may elapse before the effusion is sufficient to give rise to any swelling or increased dullness in the loin, and no sign of faintness is noticed at any time; then, after some time longer, the effused blood becomes more solid, and the tumor more irregular, and by degrees, perhaps, it is absorbed. On the other hand, the blood and clot may disintegrate, under which circumstances the symptoms of suppuration will arise.

Recovery may take place after very extensive traumatic hemorrhage; but retro-peritoneal hemorrhages due to ruptured aneurism are almost certainly fatal, though, it may be, tardily so.

If the hemorrhage increases, or suppuration occurs, and surgical aid is not brought to bear upon the case, death may occur from peritonitis, due to tension upon or rupture of the peritoneum; or the colon may be penetrated, and fæces and flatus enter the blood tumor, and give rise to decomposition, septic absorption, and death.

When hemorrhage is due to aneurism little or nothing in the way of treatment will avail; when due to injury, the treatment must be based upon the principles stated in dealing with injuries to the kidney.

Urine is extravasated into the loin behind the peritoneum from ruptured kidney, or from direct penetrating wound, the result of operation or accident, or as a consequence of ulceration of these parts. Ulceration of the ureter, due to injury or the pressure of a tumor, may cause urinary extravasation into the loin or iliac region. The inflammation of the cellular tissue, resulting from urinary infiltration, may run on to suppuration, giving rise to a lumbar or inguinal abscess. If the quantity of urine effused is small, the cellulitis, stopping short of suppuration, may become chronic, spreading toward the iliac fossa, and causing contraction of the ilio-psoas muscle. In some instances the effused urine becomes encapsuled within a thick-walled cyst of inflammatory origin, with the cavity of which the kidney communicates at the point of rupture or ulceration. Sometimes phosphates accumulate in the space or cavity occupied by the effusion to such an extent as to form deposits, which block the drainage-tubes used in treating this extravasation by lumbar incision.

Treatment.—When the diagnosis is uncertain, but from the fullness and dullness of the loin there is reason to think that urine is escaping behind the peritoneum, an aspirating needle should be inserted at the spot indicated. In cases where the effusion continues, and the swelling in the side again and again re-forms, a lumbar incision and drainage are needed. Suppuration must be dealt with by early free incision. If the kidney is greatly damaged nephrectomy will be requisite.

PERITONEUM, MALIGNANT DISEASE OF.—May occur as a primary affection, but it is more commonly secondary to cancer of the abdominal viscera. The primary growth is situated with greatest frequency in the stomach and ovaries, and next in the uterus and pancreas, but it may be found in the rectum, large or small intestine, the testicle, or the liver.

Symptoms.—The general symptoms are indefinite; abdominal uneasiness, nausea, diarrhea, or alternating constipation and diarrhea may first attract the patient's attention. If peritonitis occur there may be some fever. Ascites is one of the most constant symptoms, the effused fluid being generally of a brown or red color, and at times containing so much blood that coagula form. Nodules, or tracts of induration of the omentum may be made out, or the primary tumor may be discovered. In a considerable number of cases a hard nodule may be found in the skin and subcutaneous tissues immediately about the umbilicus, produced probably by extension of the growth along the obliterated umbilical vessels. In colloid cancer the dense gelatinous masses which fill up the peritoneal cavity, and which are particularly apt to develop in the pelvis and the hypogastric and iliac regions, produce very great distention of the abdomen and absolute dullness. In these cases, especially toward their termination, the temperature is often remarkably depressed, and the patient is liable to shivering attacks with great coldness of the extremities, presenting a general resemblance to rigors, but without any elevation of temperature.

Diagnosis, often extremely difficult; when a malignant tumor of the stomach, ovary, or other organ is known to exist.

the occurrence of ascites must excite the suspicion that the peritoneum has become secondarily affected, a surmise which will be strengthened, but not conclusively established, if the ascitic fluid be found to be bloodstained. The resemblance to tubercle of the peritoneum will be noticed. The age of the patient, and the absence of pyrexia, together with the nature of the primary lesion, if that can be discovered, will assist the diagnosis.

The *prognosis* is necessarily fatal, but the duration of the affection varies in different cases in relation with the rate of growth of the malignant tissue.

Pathology.—Peritoneal cancer may consist of a single tumor, or it may be limited to the pelvis. In typical cases of generalized peritoneal cancer, a large number of roundish or flattened granules or small tumors are stretched over the peritoneum, and present some resemblance in distribution to tuberculosis. The smallest of the tumors are, as a rule, not less than peas in size, and the majority are larger. As they increase in size the center undergoes degeneration, and gives to the finger a sensation of softness, so that each growth is at a late stage umbilicated. At the periphery each nodule throws out processes, as it were, which tend to contract so that the serous membrane is dragged in toward the nodule; in this way the omentum is puckered up until it forms a solid mass lying transversely below the stomach; and the mesentery is thickened, indurated, and retracted; in this way also the caliber of the intestine may be greatly diminished and obstruction produced.

This description applies to hard carcinoma; soft carcinoma also occurs, but more rarely; multiple tumors commonly exist, but in the early stage are more globular, or even pedunculated, and tend later on to form large tumors.

Colloid Cancer of the Peritoneum is a distinct clinical variety produced by colloid degeneration of a true carcinoma. In its early stage it forms gelatinous nodules irregularly distributed; these quickly involve the submucous tissue and grow with great rapidity, coalescing with other nodules until the whole, or a large part, of the peritoneal cavity is filled up, and distended by soft gelatinous growth.

Sarcoma is, in most cases, secondary to gastric sarcoma. Lymphadenoma may

spread from the retro-peritoneal glands along the mesentery, causing great thickening of the peritoneum and sub-peritoneal tissue; when the growth has completely surrounded the intestine, it does not produce contraction but converts the gut into a thick-walled rigid cylinder; the stomach may be similarly affected. The peritoneum is also liable to become the seat of papillomatous growths, secondary to rupture of papillomatous cysts originating in the parovarium or hilum of the ovary; these growths are very liable to infect the whole peritoneal cavity, exhibiting the most malignant tendencies, but in other cases they are not distinctly malignant.

Malignant disease of the peritoneum spreads in several ways: the multiple nodules probably originate by lymphatic infection, and subsequently extend by continuity of tissue. Cancer may also extend from the one to the other of two opposing surfaces of the peritoneum without the previous production of adhesions. Finally, it seems probable that portions of growth may become detached and find their way into the pelvis, or other dependent parts, and there set up the cancerous process.

Cancer of the peritoneum may be accompanied by peritonitis leading to adhesions between opposing surfaces, or to effusion of fluid which may be puriform. The ascites, however, must not always be attributed to the cause; it may be due to interference with the portal circulation by pressure of the new growths.

Ætiology.—The disease is seldom or never observed below thirty years of age, is most common between fifty and sixty, and is not uncommon later. It is most often met with in women.

Treatment can only be palliative; opium is the drug which may be given with greatest advantage, and no hesitation need be felt in administering doses sufficiently large and frequent to relieve discomfort and pain. Localized pain should be treated by fomentations, or leeches; diarrhea by ordinary astringent remedies, and constipation by a mild laxative—preferably castor oil.

DAWSON WILLIAMS.

PERINEUM, DISEASE OF THE.

—Chief affections are abscess and fistula. Hernia, and a misplaced testicle in the perineum, occur very rarely.

Perineum, Abscess in the. — Commonly caused by a slight urinary extravasation behind a stricture. At first attention is attracted by fever, perhaps rigors, and pain in the region of the bulb. A hard lump is felt; this increases and softens.

Treatment.—Open early; incise in the middle line. If a stricture coexist, it is good practice to divide it at the same time (external urethrotomy). At all events the stricture, being the cause of abscess, must be treated.

Perineal Fistula.—A result of perineal abscess. Generally closes when the original stricture of the urethra is cured. Perineal fistulæ occasionally have their origin in comparatively remote affections, *e. g.*, cancer within the pelvis. In order to cure a perineal fistula it may be necessary to (1) teach the patient to catheterize himself four times a day, or (2) to incise the fistula freely, or (3) to cauterize it; (4) it is to be remembered that the presence of a small calculus may prevent healing.—

THOMPSON.

Perineum, Injuries to.—*Causes.* — Blows received in climbing over railing, etc., or by being thrown on the pommel of the saddle. Pressure of child's head in parturition. The injuries vary in seriousness from slight bruises to injuries involving such important structures as the urethra, rectum, and bladder.

Perineum, Rigidity of the.—A condition of the perineum where its dilatation is very slow or apparently arrested.

Causes.—Old cicatrices.

Symptoms and signs.—Expulsive pains severe and painful, patient restless and anxious.

The center of the perineum bulges as if the head would come through it; its anterior edge thin, hard, and unyielding.

Prognosis.—Not unfavorable.

Treatment.—Hot bath, (belladonna) ointment. If the perineum threatens to rupture, it should be divided on either side of the central line.

HEYWOOD SMITH.

Perineum, Rupture of the. — This accident is not uncommon after first labors. The degree of laceration may vary from a slight tear of the fourchette to a rent that extends into the rectum and divides the sphincter. The slightest forms of rupture cause no trouble, and require no operative treatment. Ruptures involving the greater

part of the perineum not only give rise to a distressing sense of weakness and of loss of control over the parts, but also encourage prolapses. This most usually takes the form of *rectocele vaginalis*, a term applied to a prolapse of the posterior wall of the vagina, together with such part of the rectum as is in contact with it. Another form is the *cystocele vaginalis*, when the anterior vaginal wall with some part of the bladder is prolapsed into the vaginal orifice, or there may be in severer cases more or less prolapse of the uterus. When the sphincter has been ruptured there is, in addition to these troubles, incontinence of fæces.

In performing any operation for the restoration of the perineum, it must be borne in mind that the term perineum applies not merely to the skin between the vagina and anus, but to the whole of the rectovaginal septum. This septum appears, on median section, in the form of a triangle with its base at the integument and its apex high up between the rectum and the bladder. A mere restoration of the skin of the perineum is useless.

If the patient should be seen immediately after the rupture has occurred, steps may be taken to close the fissure at once. Such attempts will probably fail, owing to the bruising of the parts, the patient's health, and the vaginal discharge incident to parturition. They may, however, succeed, and in event of failure can do no harm. If immediate closure has not succeeded, or has not been carried out, the operation should be postponed until the patient's health is thoroughly restored, until all vaginal discharge has ceased, and, if possible, until after she has ceased to suckle the child. The rectum having been well cleared out, the patient is placed in lithotomy position, and the parts well exposed. The first step of the operation is to freshen the surface, which is done by dissecting off the mucous membrane. This dissection should extend well up along the floor of the vagina in the median line and the bared area, if measured along this line, should be from an inch to one and a half inches. The bared surfaces on either side of the median line will be of triangular outline. The bleeding having been checked, the sutures are introduced by means of a large Hagedorn's needle held in a holder. The hindmost suture is introduced first. The sutures must be passed deeply so that no part of

them is exposed upon the bared surface. They must be introduced also at least one inch from the margin of the wound. The best material is Chinese twist, and the ends may be secured after the manner known as "the quill suture," or by means of split shot, or, as some prefer, by merely tying in a knot. Three deep sutures will be sufficient, as a rule. The rest of the wound should be carefully closed by surface stitches of fine silk.

When the sphincter is involved, its divided ends must be united with care, to guard against two common evil results of imperfect closure: recto-vaginal fistula, and continued incontinence of fæces. Dr. Thomas advises that the suture that unites the sphincter should be applied as follows: Enter the needle as low down as the lower edge of the anus, pass it thence upward through the recto-vaginal septum, completely encircling the rent, and bring it out alongside the lower edge of the anus on the other side. Its action then is like that of a purse-string, puckering up the open parts and restoring the sphincter to its original ring-like outline. After the operation the bladder should be emptied by catheter only for the first five or six days. The bowels must be kept from acting, complete rest in the recumbent posture must be insisted upon, and the parts be kept very clean. The deep sutures may be removed on the sixth or seventh day, or before, if they are exciting suppuration. The surface stitches may be left in a little longer. At the end of ten days the bowels may be opened by enema, but the patient should, in any case, not leave her bed for three weeks after the operation.

PERIOSTITIS.—See BONES, DISEASES OF.

PERIPNEUMONIA CATARRHALIS.—See INFLUENZA.

PERIPNEUMONIA NOTHA.—See INFLUENZA.

PERITONEUM, DROPSY OF.—See ASCITES.

PERITONITIS.—Inflammation of the peritoneum may be acute or chronic, general or local.

Acute Peritonitis presents a complex of symptoms liable, especially in the early stage, to considerable variation, in accordance with the cause.

Symptoms.—In a case in which the

early symptoms are not masked by some concurrent malady, such as enteric fever, the first to be observed is often a sudden rigor, or there may be vomiting, or purging, or both. Abdominal pain quickly becomes the most prominent symptom; it is generally referred at first to the hypogastric region, and the patient in sitting or standing remains rigidly bent forward. Being soon compelled to take to bed, he there assumes a characteristic attitude: he lies on his back with his shoulders raised, and knees and hips flexed; this position is assumed to relieve the abdominal pain, which is aggravated by the erect or extended posture and by any movement or pressure of the abdominal muscles. For the same reason diaphragmatic respiration is abolished, breathing being mainly upper thoracic. The pain is sharp, cutting or darting, and has a burning character; there is also great tenderness, so that even the pressure of the bed-clothes is dreaded. The face is flushed, the features pinched, the eyes sunken and the expression anxious. The pulse is sharp, small, hard, wiry, and increased in frequency (100 to 150). The temperature is raised, commonly to 100° or 101° F., but it may reach 105° F. The skin is hot and dry, the tongue often furred and dry, thirst is distressing, and appetite is abolished. Vomiting is common, and it is the rule for all the food to be thus rejected. Owing to the abdominal movements, vomiting may cause great distress. Constipation is the rule, but there may be diarrhea.

On examination of the abdomen it will be found to be exquisitely tender to the lightest touch, while deep pressure is insupportable. The abdominal muscles are rigidly contracted, so that in the very earliest stage the abdomen may appear a little retracted; later, however, more or less distension occurs, due either to gas in the intestines or fluid in the peritoneal cavity, or to both causes; when extreme, it seriously increases the existing embarrassment of respiration. Occasionally peritoneal friction may, in the early stage, be detected, either by palpation or auscultation. When fluid has collected, dullness may be detectable in dependent situations, but fluid may be masked by the flatulent distension of the intestines; for the same reason the areas of hepatic and splenic dullness are diminished. Ineffectual intestinal peristalsis may be per-

ceptible to the eye or hand. The urine is scanty, high colored, and deposits abundance of urates. Where the peritonitis is mainly pelvic, frequent and painful micturition may be a troublesome symptom, and is often succeeded by retention due to paralysis of the bladder.

Peritonitis from *perforation* or rupture is one of the commonest, as it is one of the most fatal, forms of the disease. The patient may be, apparently, in good health up to the moment when he is seized with sudden intense pain in the region of the lacerated organ—most often the stomach. The pain is accompanied by extreme collapse, evidenced by coldness of the surface, cold sweats, and a small or almost imperceptible pulse. The symptoms, however, are not always so well marked, and may be entirely masked. This is especially the case in perforation of the intestine in the third or fourth week of enteric fever. In such cases it may only be possible to surmise the occurrence of perforation from the rapid fall of temperature and increased prostration, weaker pulse, cold extremities, the onset or increase of tympanites, and the presence of general abdominal tenderness. When air is present in the peritoneal cavity it tends to collect between the liver and diaphragm and abdominal wall, the result being a displacement of the liver backward, and *obliteration of the hepatic dullness*, which thus becomes an important physical sign of perforation of the stomach or intestine. It must, however, be remembered that gas is occasionally, although probably very rarely, formed within the peritoneal cavity independent of perforation of the bowel.

Course.—Acute peritonitis terminates in death, recovery, or chronic peritonitis. In favorable cases the temperature and pulse fall, the pain and tenderness diminish, the respirations become natural, and the patient slowly recovers. In unfavorable cases the distention of the abdomen increases, while persistent vomiting and hiccough contribute to exhaust the patient's strength. The tongue becomes small, irritable, red at the tip and edges or all over, and tends to become dry. Sordes form on the lips, the face gets somewhat cyanosed, the eyes sunken and haggard, and pulse and respiration still more hurried. The whole aspect of the patient as he lies doubled up in bed, with

anxious face, distended abdomen, dreading every movement, is now exceedingly characteristic. Death may ensue during this stage while the temperature is high; more commonly it is preceded by a fall of temperature, often to below the normal, and a sudden cessation of pain. The last-named phenomenon is of very bad omen; it appears to be a part of the general condition of collapse into which the patient has sunk. The pulse is so feeble, rapid and irregular as to be, perhaps, uncountable; the extremities are cold, the face pinched and blue, the respirations shallow and hurried, the voice a whisper. As a rule, the mind remains clear, but death may be preceded by coma, or by low muttering delirium.

Acute peritonitis has hitherto been considered as a general inflammation of the peritoneum, but it may be limited to any part. *Local* or *circumscribed* peritonitis is always secondary to injury or visceral disease, and the symptoms of peritonitis are often masked by those of the primary malady. Circumscribed peritonitis is most commonly met with in the pelvis in association with inflammatory diseases of the uterus, Fallopian tubes (*q.v.*), ovaries or rectum: in the right iliac fossa in association with ulceration of the appendix and cæcum (*see* PERITYPHLITIS): in the right hypochondrium in association with abscess of the liver or gastric ulcer: and in the left hypochondrium in association with disease of the spleen or with gastric ulcer. The symptoms are the same in kind as those of acute general peritonitis, but vary in severity; cases of every degree may be met with, from the fully developed attack to instances in which the occurrences of circumscribed peritoneal suppuration is only discovered after death. The physical signs are limited to the affected region; pain and tenderness are localized, and probably a firm swelling with ill-defined edges will after a short time be discoverable. When suppuration has occurred fluctuation may be obtained,

In some cases the fluid effused into the peritoneum becomes bloodstained; this may be due to a very acute form of inflammation at the onset, or, at a later stage, to rupture of newly formed vessels in the false membranes.

The symptoms of *Chronic Peritonitis* are not well defined. Tenderness with uncomfortable dragging sensations, or

pain aggravated by movement, may be referred to some part of the abdomen. Attacks of colic are common, and are especially liable to follow the taking of food. Appetite is impaired; constipation is commonly present, but may alternate with diarrhea. When not due to tuberculosis, there may be no pyrexia, and all the symptoms may easily be attributed to dyspepsia. Physical examination may reveal the presence of fluid in the abdomen, but, as this may be confined by adhesions, the dullness may not shift with position. Irregular thickenings and a peculiar doughy feeling may be discovered on palpation.

The *diagnosis* of peritonitis sometimes presents great difficulties; this is especially the case for the first few hours in perforative peritonitis, during which period, moreover, death may occur. The difficulty of diagnosing peritonitis due to perforation of a typhoid ulcer has already been mentioned. In simple colic and in lead colic the pain is intermittent or at least varies in intensity, and is relieved by pressure; the belly is generally hard and retracted, and the patient is restless. In colic complicated by hysteria the simulation of peritonitis may be closer, but the tenderness is mainly superficial, is not aggravated by deep pressure, and is not constant. Colic is said sometimes to cause a slight rise in temperature, but it would be imprudent to rely on so rare an occurrence as a guide to treatment.

The *prognosis* of acute peritonitis depends largely upon the nature of the exciting cause. Peritonitis produced by perforation of the stomach or duodenum may be fatal within two days and perforation of the intestine occurring during typhoid fever always, or almost always, causes death. Acute peritonitis is ill borne by young children, and is so serious a disease at all ages that the prognosis is always grave unless the inflammation be distinctly limited. During the progress of a case unfavorable symptoms are, change in the character of the pulse, which becomes soft, feeble, and faster, great abdominal distension; restlessness; sudden or rapid subsidence of pain without corresponding improvement in other symptoms; hiccough and the onset of collapse,

The *Pathology* of the vast majority of cases of peritonitis is simple, the inflammation being due to the direct action of

some irritant. In acute general peritonitis the primary lesion is more often situated in a hollow, than in a solid viscus, for perforation of the stomach, intestine or gall-bladder leads to extravasation of material which is not only irritant, but capable of producing sepsis. This applies also to the peritonitis which occurs as a consequence of parturition, the inflammation of the peritoneum being due to extension of suppuration from the septic cavity of the uterus. Salpingitis is another cause of purulent peritonitis, which may be in some cases septic, but is in others gonorrheal. Septic peritonitis may also be originated by decomposition occurring in a hernial sac. Peritonitis due to intestinal obstruction is at first circumscribed, but may become general. Inflammation of solid viscera is less liable to produce general peritonitis, but circumscribed peritonitis, is a common complication of hepatitis and ovaritis. General suppurative peritonitis may be due to rupture of an hepatic abscess or of a splenic abscess (due to suppurating infarct), to rupture of a psoas abscess or of an hydatid cyst, or to suppurative nephritis. Pyæmic peritonitis probably always arises by secondary extension from local mischief. Peritonitis, generally suppurative, is a not very infrequent complication of chronic Bright's disease, occurring with the variety of kidney known as the "large white." Instances in which acute peritonitis was apparently due to sewer gas have been reported, and many believe that the disease may be produced by exposure to cold; to such cases the term idiopathic peritonitis is applied. The peritoneum may also become inflamed by extension from the pleura and pericardium; this is especially liable to occur in children, and the inflammation is commonly suppurative. Children appear to be specially liable to sub-acute general peritonitis accompanied by more or less effusion. Some of these cases are undoubtedly tubercular, but the pathology of others is obscure, the patients recovering without surgical interference. Severe blows, even if no organ be ruptured, may determine peritonitis. The collapse and cardiac disturbance are reflex, being produced by the irritation of the peritoneum, and the hurried respiration may be in part due to the same cause.

Chronic peritonitis appears to be most

commonly the result of one or more attacks of acute peritonitis; it may be limited to, and associated with, chronic disease of the liver, spleen or other viscera. It is a frequent accompaniment of tubercle and less often of cancer. In some cases it appears to arise spontaneously, the first symptom to attract attention to the belly being its increased dimensions, which are found to be due to ascites. Limited chronic plastic peritonitis appears generally to follow tapping for ascites due to cirrhosis of the liver.

The *morbid anatomy* of all cases of peritonitis is fundamentally the same, but the appearances vary greatly with the intensity and character of the inflammation. The earliest changes are dilatation of the small vessels, infiltration of the sub-serous tissue, and epithelial proliferation. Inflammatory redness is apt to be limited to two narrow longitudinal bands, parallel with, and about equidistant from, the mesenteric attachment. Exudation now takes place at the surface. This exudation may be (*a*) plastic, leading to the formation of a grayish lamina consisting of fibrinous material enclosing cells; or (*b*) fluid, containing more or less numerous pus cells. Peritonitis produced by blows, and circumscribed and chronic peritonitis tend to plastic exudation, and in this way a small collection of pus may be shut off from the general cavity of the peritoneum. Even in cases where perforation of a typhoid ulcer has occurred it is not unusual to find only a small area of suppurative peritonitis, limited in all directions by plastic adhesions between the intestinal coils. In general peritonitis of the plastic type the false membranes may become enormously thickened. If the acute process subside early, organization of the false membrane occurs, and adjoining organs become firmly adherent; in this way a large part or the whole of the peritoneal cavity may be obliterated. If the exudation be fluid, the peritoneal surface, instead of becoming dull and lustreless, owing to the layer of lymph, remains glossy and becomes greasy to the touch; the fluid may be of any degree of corpuscular richness.

Every gradation between well-marked plastic and well-marked suppurative peritonitis may be met with, but, as a general rule, when the fluid is distinctly purulent, the plastic effusion is limited.

In circumscribed peritonitis a collection of pus may be contained within a cavity lined and formed by organizing lymph.

Adhesions the result of acute peritonitis, if limited in extent, may become gradually lengthened, forming bands under which gut may pass and become strangulated; or a coil of intestine may be so fixed that a kink is produced, which may eventually determine an attack of obstruction. Chronic peritonitis when not due to tubercle is generally plastic, with but little effusion, and that serous. When the intestines are involved, their coils may be almost universally adherent to each other, and retracted into a single mass against the spine; or the peritonitis may chiefly affect the mesentery, diminishing its area in every direction, so that the intestine is much shortened and moored down to the vertebral column, although, the coils may not be adherent to each other.

Treatment of Acute Peritonitis.—The first indication is to procure general and local rest. The patient should be put to bed and propped in the attitude which is found most comfortable. The only drug of any proved value is opium; it should be given at once in full doses. Two grains of opium, or its equivalent in laudanum, should be given every two or three hours, and the patient carefully watched, relief of pain being taken as an indication to diminish, but not to stop, the opium; its administration should be continued even after danger has apparently passed. The existence of constipation or of intestinal obstruction is not a contra-indication; on the contrary, its effect in acute obstruction has led to the paradoxical statement that “opium is a purgative.” Morphine may be administered hypodermically. Purgatives should not be given under any circumstances. No solid food must be allowed, and, if vomiting be troublesome, nothing beyond a little ice should be taken by the mouth. Nutrient enemata or suppositories may be used if thought necessary. Local depletion by leeches (ten to thirty) is strongly recommended by some in the early stage of acute peritonitis in robust individuals. Warm local applications are most generally used, but flannels dipped in ice-water are said to allay pain and anxiety and to limit inflammation. Depression is to be combated by diffusible stimulants, of which the best

are good brandy, champagne, ether, or ammonia and quinine. Stimulants should not be given as a part of routine treatment. Flatulent distension is not easily relieved; turpentine stupes may be tried, or small turpentine clysters, or the cautious introduction of the long rectal tube. If the distension be seriously interfering with respiration, and other means of relief fail, puncture of the intestines with a fine trocar may give relief. Hiccough, if not checked by opium, may be relieved by ether, by the combination of camphor with opium, by sinapisms to the epigastrium, by small blister in the same situation, the resulting sore being dressed with morphine. Strong coffee, combined with a large dose of bromide of ammonium, may succeed, but the symptom is sometimes so intractable and causes so much pain and distress that it is necessary to resort to the inhalation of chloroform.

If the peritonitis be due to perforation of a gastric ulcer, the injunction to allow nothing, whether food or drug, by the mouth need hardly be given. In such cases, and in suppurative peritonitis due to disease of the pelvic organs, or to the rupture of a hydatid cyst or abscess, the question of performing abdominal section may be raised. At present the cases in which primary laparotomy has been performed with the object of treating perforative peritonitis are too few to allow of a definite opinion being here expressed.

In *chronic peritonitis* a flannel roller carefully applied favors absorption and preserves from cold. Careful manipulation of the abdomen (massage) is believed to favor absorption of fluid and to relieve constipation. Ascites is better treated by the Turkish bath, or even by tapping, than by purgation; repeated tapping may end by greatly improving the patient's condition owing to obliteration of the cavity in which the fluid accumulated. Where local tenderness can be made out, counter-irritants, such as iodine, should be used.

DAWSON WILLIAMS.

Symptomatic Indications.—*Aconite*. is of very great value in the early stage of acute peritonitis, with febrile symptoms; after *aconite bryonia* is generally useful when the fever relaxes and effusion threatens; burning, stitching pains, worse on motion. *Mercurius cor.* is useful when the disease is due to mechanical injury, especially in scrofulous cases.

When inflammation extends from the abdominal viscera, *colocynth* will render excellent service; colicky pains, diarrhea and tenesmus especially indicate this remedy: *apis mel.* is frequently useful when there are sudden paroxysms of stinging pains, with great prostration; *belladonna* when a general congestive condition is present, with headache, flushed face, throbbing pain; pain radiating from one spot. *Erigeron* or *cocculus Indicus* are efficacious for the tympanites occurring in this disease.

PERITONITIS, TUBERCULAR.—

There are distinct clinical forms of this affection. (1) The peritoneum may share in a general acute miliary tuberculosis affecting the meninges, the lungs and the abdominal viscera, and, it is often almost an accident whether a case should be regarded during life as one of tubercular meningitis, or tubercular peritonitis, or of miliary tuberculosis of the lungs. (2) The peritoneum is sometimes affected by tuberculosis which is limited to the serous membranes of the pleura, pericardium and peritoneum. (3) The peritoneum may be secondarily infected by direct continuity from tubercular ulcers of the intestine (*q.v.*), over areas which are, at first at least, limited. (4) The tubercular process may apparently originate in the peritoneum, and being accompanied by inflammation, gives rise to the condition known as tubercular peritonitis.

Tubercular peritonitis is a term commonly reserved for cases in which the affection of the peritoneum is well marked. Such cases present features which entitle them to be placed in a special clinical class. The ætiology of the condition is obscure; as observed in the dead-house it is often accompanied by intestinal tubercle, but whether as cause or effect is not clear. The lungs are affected in seven cases out of nine, probably secondarily. The Fallopian tubes are frequently affected, sometimes perhaps primarily. It is more frequently observed in children than adults, though not rare in the latter.

Symptoms.—The onset is insidious; abdominal fullness, pain and tenderness, with slight evening pyrexia, wasting and general impairment of health and activity are early symptoms. Pain and tenderness may be absent, and there is not often evidence of ascites, the fullness being due

to gaseous distension of the intestines. Later the pain becomes greater, and occurs in paroxysms; constipation and diarrhea alternate; fluid may be detectable in the abdomen, and the thickened omentum, or the cords of lymph which fix the intestines together and lie in the grooves between them, may be felt. Tension of the parietes is, however, often considerable and interferes with palpation. Emaciation progresses rapidly in the later stages, the child becomes confined to bed, the face is pinched and anxious, abdominal pain is severe; tenderness is extreme and the legs are drawn up; the pyrexial excursions become higher (104° F.), the pulse rapid, the tongue dry, red and tremulous, and the lips covered with sordes. Death may be due to exhaustion, hastened often by intercurrent pulmonary disease. In children meningitis is very common.

Not infrequently the disease appears to become arrested and this arrest may be permanent even after symptoms have existed for many months or even years; more frequently relapse occurs: arrest, partial recovery and relapse may recur several times and the patient finally recover. Frequently inflammation extends along the track of the obliterated umbilical vessels leading to an erysipelatous redness about the umbilicus which may end in an abscess which discharges externally; occasionally a fistulous communication is established with the peritoneal cavity, which is thus emptied. Where the distension is very great the umbilicus may give way without previous inflammation.

Course.—Though usually a chronic malady, it occasionally runs an acute course lasting only four weeks.

Diagnosis in the early stage is extremely difficult; abdominal pain and distension, with diarrhea and wasting, may be due to imperfect digestion, but if to these symptoms be added distinct abdominal tenderness evidenced especially by the care which the patient takes to avoid a blow, or even a slight jar, the case will be looked on with suspicion and systematic observation may reveal slight nocturnal rise of temperature. Later this dread of any sudden movement or jar gives the patient a characteristic aspect.

Acute cases, and to a lesser degree chronic cases during periods of exacerbation, are liable to be confounded with enteric fever. The absence of rash and of enlargement of the spleen, and the more

irregular character of the pyrexia will be of use in distinguishing the acute cases from enteric fever. In more chronic cases the history of the case, especially the duration of the illness, will assist the diagnosis. The discovery of fluid in the pleura will also be confirmatory as it points to tubercular pleurisy. In women amenorrhœa is a suspicious symptoms as it may be due to tubercular salpingitis; the same may be said of chronic epididymitis and orchitis in men.

Erysipelatous redness about the umbilicus, sometimes ending in abscess, is a characteristic occurrence due to extension of inflammation along the obliterated umbilical vessels. The discovery of the thickened omentum, which must not be confounded with the edge of the liver, or of bands or nodules of lymph, will leave little room for doubt in the later stages.

Morbid anatomy.—The extent of surface affected varies greatly; sometimes the under surface of the diaphragm and the flanks are most affected, but in the most typical cases the intestinal serous membrane is thickly set with tubercles, and the several coils of intestine are glued together by lymph. Fluid may be contained only in small pockets or there may be a large quantity of fluid in the peritoneal cavity, the intestines being matted together and packed back against the posterior wall of the abdomen. The fluid may be serous or purulent, and is sometimes blood-stained. The omentum is generally affected, forming a thick, and often very large, flattened mass; thick layers of lymph may overlay the intestines and other abdominal organs, or the solid effusion may be chiefly collected in the grooves formed by the adjacent coils of adherent intestine.

Treatment.—Rest in bed, regulated diet, opium to control pain, combined with bismuth if diarrhea be present, are among the most important measures. Counter-irritation is recommended by many. Hensch advises the daily use of tincture of iodine to one quarter of the abdominal surface; the application may be continued for weeks; Alonzo Clark recommends a solution of iodine in olive oil (gr. viij or x or even xxx to $\frac{3}{4}$ j) rubbed in twice a day and covered with oil silk. Mercurial applications are reported to cure "the great majority of cases" admitted into Guy's Hospital; Dr. Fagge recommended linimentum hydrargyri spread freely over the

surface of a flannel belt stitched tightly round the abdomen; Dr. Goodhart prefers to have the abdomen painted with oleate of mercury, or the following: \mathcal{R} Ung. hydrarg. 3j, ext. bellad. 3j, glycerin \mathfrak{z} j, ol. olivæ ad \mathfrak{z} ij. The application of belladonna and glycerin (equal parts) is useful in relieving pain. In the early stage or during remissions, a residence at the seaside, and the administration of codliver oil are important measures in treatment. The syrup of the iodide of iron is supposed to be specially useful, and may be given when cod-liver oil cannot be digested.

Laparotomy and washing out of the peritoneal cavity have been followed by recovery, which was apparently complete and permanent; in future therefore the desirability of resorting to this heroic treatment must be considered in every case. It is said that cases in which spontaneous evacuation at the umbilicus occurs yield a large percentage of recoveries.

DAWSON WILLIAMS.

Symptomatic Indications.—*Arsenicum, calcarea carb.*

PERITYPHLITIS AND TYPHLITIS (Inflammation of the appendix *Cæci*).—By the former is to be understood inflammation around or outside of the cæcum; by the latter, inflammation of the cæcum itself. The two conditions, generally coexist and cannot be separated from each other clinically.

Symptoms and diagnosis.—The disease is generally ushered in by an attack of constipation, alternating, it may be, with diarrhea; and followed by pain in the right iliac fossa, and often by vomiting. Not a few cases occur in which the symptoms are practically those of intestinal obstruction. On examining the seat of pain there is found an elongated swelling, commencing in the right iliac region and extending for some distance up the colon. This swelling gives a dull note on percussion, and is very tender to the touch. There is also a class of cases, and those the worst, in which no tumor may be felt, and the symptoms are those of acute peritonitis. The right thigh is flexed as the patient lies in bed, so as to diminish the tension of the abdominal wall; and in cases which have commenced acutely the temperature is raised to the extent of two or three degrees, or perhaps more. There is loss of appetite also, and the tongue is

coated, of a brownish tint down the center, and dry. Thirst is often complained of, and the urine is small in quantity, high colored, and often contains indican.

In typical cases the diagnosis presents no difficulty. From cancer of the cæcum the chronicity of the complaint, the age of the patient, the history of the symptoms, and the emaciation will help to establish the differential diagnosis. Enteric fever, by the pain and tenderness in the right iliac fossa, the appearance of the tongue, and tumidity of the abdomen may suggest typhlitis; but a careful inquiry into the history, the range of temperature, and the absence of swelling will serve to make the distinction. Intussusception will be negatived by the less urgent nature of the symptoms and by the absence of the passage of mucus and blood characteristic of that affection. Simple impaction of fæces, which occurs mostly in old people, may present the sausage-shaped swelling of typhlitis, but the general condition and the absence of pain and tenderness exclude the latter disease.

The graver class of cases in which the symptoms are those of a general peritonitis, presents more difficulty, and here the diagnosis is established more by excluding other causes of peritonitis than by any positive physical signs. Whenever a sudden peritonitis becomes developed in a young person, and we can exclude injury and tubercle, mischief in the vermiform appendix may be fairly suspected.

Prognosis.—Favorable in cases in which the iliac tumor is marked and the development of the disease is gradual. In more severe cases, characterized by rapid onset and peritonitis, prognosis is grave. If the peritonitis be only local, good hope may be entertained of a favorable result with prompt surgical treatment; but where the original mischief is not hemmed in by adhesions, and rapidly spreading peritonitis occurs, the case is likely to end in death at no long interval. And even where recovery occurs relapses are very common.

Ætiology.—Perityphlitis and typhlitis occur most frequently in the young, and generally in the male sex. In the great majority of cases, if not, indeed, in all, the starting-point of the disease is to be found in the vermiform appendix. The anatomical condition of the appendix renders it especially prone to become a focus of disease. The feebleness of its muscular

coat invites accumulation of fæcal matter, and disables it from expelling such accumulation. This gradually becomes inspissated and acts as a foreign body, setting up an ulcerative process which may in time end in perforation. Short of this, however, inflammation may spread from the mucous to the serous coat of the appendix and to the cæcum itself, and this is probably the history of the frequently relapsing form of the disease. The appendix is also sometimes found bent at an acute angle and greatly distended with mucus, and in this condition it presents a source of irritation which may at any time light up an attack of typhlitis. It should be noted, also, that the appendix is sometimes the seat of tubercular, and sometimes of typhoid, ulceration. Foreign bodies, too, have been found in it, although by no means so frequently as used to be thought, the inspissated concretions of fæcal matter before referred to being, no doubt, often mistaken for date- or cherry stones. It is doubtful whether simple fæcal accumulation in the cæcum ever leads to typhlitis; it is more probable that the accumulation is a result of the inflammatory process, which, at first beginning in the appendix, affects by extension the walls of the cæcum, inducing paralysis of the muscular coat.

Pathology and Morbid Anatomy.—Even before perforation of the appendix has taken place, and all the more after that event, peritonitis is set up. This may be local in the first place, and may continue so, or it may rapidly become general. In the former case adhesions take place by which the pus which is formed is hemmed in, where it may remain for an indefinite time. In the latter, besides the ulcerated appendix, intense inflammation will be found in the cæcal region, with formation of pus and a general involvement of the whole peritoneal membrane. Or an abscess, at first localized, may be found to have burst into the general peritoneal cavity, or into the bladder, colon, rectum, or elsewhere in the abdomen. It may also burst through the abdominal parietes. A fæcal concretion is, in the great majority of cases, found in the appendix or in the pus around it. Death is usually due to peritonitis, but in exceptional cases to long-continued suppuration, inducing, it may be, albuminoid disease, or to septicæmia.

Treatment.—In cases in which a well-

marked tender swelling is found in the cæcal region the vermiform appendix is probably but little affected; treatment is strict rest in bed, liquid diet and hot poultices or fomentations to the right iliac region. Under the hot application, apply equal parts of extract of belladonna and glycerine on lint; or, if the pain be very severe, two or three leeches before poulticing. As regards drugs, opium is the sheet-anchor, on account of its power of alleviating pain and checking the peristaltic action of the bowels. It may be given in the form of pill ($\frac{1}{4}$ to 1 grain of the extract) every four or six hours, according to the age of the patient and the amount of pain; or the tincture may be substituted if preferred. If vomiting forbid medication by the mouth, the subcutaneous injection of morphine may be practised instead. Purgative medicines must on no account be employed. Many a patient has been done to death by purgatives.

When the temperature has become normal and the pain and tenderness have passed off, the bowels should be moved by simple enemata. As regards diet, only soups etc., should be allowed, and great caution is necessary during convalescence and for a long time after, as relapses are apt to occur after the slightest indiscretion. The patient should be restricted to soups, milk, panadas, and the like, for so long a period as possible. Treated thus, the disease almost uniformly ends favorably in resolution. If, however, in spite of treatment, the symptoms become aggravated and point to suppuration, an incision must be made and the pus evacuated, the parts being irrigated with a warm antiseptic solution and drained.

Where the presence of pus is suspected, exploration with a needle is advocated. But this proceeding is attended with considerable risk, and it is safer and better to make an exploratory incision at once. The needle may get into adhesions and fail to reveal pus when it is really present.

In the more alarming class of cases where a sudden onset of severe pain with collapse and peritonitis indicates that perforation of the appendix has taken place, opium must be freely given, but prompt surgical intervention also is necessary to give the patient a chance for his life.

DAVID W. FINLAY.

Symptomatic Indications.—*Veratrum viride*, or *aconite* in the first stage, with sthenic symptoms; *belladonna* when congestive condition is present, with high fever, nausea, and vomiting; *arsenicum* is useful in chronic cases with much prostration; *mercurius* in perityphlitis.

PHANTOM TUMOR.—A localized swelling in the abdomen, peculiar to women. The swelling is tympanitic and tumid and unconnected with disease of any of the abdominal viscera. It is usually situated in the middle line below the umbilicus, and may vary much in size. It disappears completely under chloroform, to return even before the effect of the anæsthetic has entirely passed off. The cause of it is obscure, but it must be regarded as a manifestation of hysteria and treated accordingly.

PHARYNGITIS, ACUTE (Acute Pharyngeal Catarrh).—An acute inflammatory affection of the pharynx and adjacent parts.

Symptoms.—The patient usually complains of a frequent desire to swallow, but has at first discomfort in so doing, soon passing on to pain. If the uvula be markedly enlarged there will be the sensation of a foreign body in the throat and probably a hacking cough, especially on lying down, from the uvula coming into contact with the back of the tongue or epiglottis. Extension of the inflammation downward into the larynx will cause hoarseness, its extension upward and forward will lead to interference with nasal respiration and will give a nasal twang to the voice. The eustachian tubes may be occluded, giving rise to a feeling of fullness in the ears and temporary deafness. There is usually some amount of stiffness and discomfort about the neck. As regards general symptoms, the attack is ushered in with a feeling of malaise, and chilliness sometimes amounting to rigors, and after a short time a rise in temperature occurs. The tongue is furred, there is loss of appetite, constipation, and febrile urine. On inspection, the soft palate, uvula, tonsils, and pharynx will be seen to be swollen and the surface covered with viscid mucus. The uvula at times attains the size of the thumb and may be œdematous—to this condition the term *uvulitis* has been applied (*see* UVULA).

Diagnosis.—A careful examination of the back of the throat should suffice.

Prognosis.—Simple catarrhal pharyngitis is usually an affair of a few days; it is only when the inflammation is of an erysipelatous type that danger need be apprehended.

Pathology.—There is at first hyperæmia and swelling of the mucous membrane, with arrest of secretion, and then a viscid, muco-purulent fluid is poured out.

Ætiology.—A chill, especially in persons of the rheumatic diathesis, errors in diet, a sedentary life and a strumous inheritance predispose to pharyngitis, as they do to inflammatory affections of other mucous surfaces.

Treatment.—At the commencement 3 grains of calomel, followed by a saline aperient, are useful. If the temperature range high, minim doses of tincture of aconite every half-hour for two or three doses, and then at less frequent intervals, will have a good effect. Guaiacum has long been a favorite remedy in pharyngeal inflammation; it may be given in 5-grain doses mixed with jam every two or three hours, or the trochisci guaiaci of the Pharmacopœia. If the patient be at all below par, carbonate of ammonium in 10-grain doses with 15 grains of bicarbonate of sodium, given with 17 grains of citric acid while effervescing, will act as a stimulant. In cases of rheumatic origin, 10 or 15 grains of salicylate of sodium may be added to the mixture. Later on quinine is well borne. Locally, ice, both externally and internally, is to be preferred to warmth. Spraying the throat with a 10 per cent. solution of cocaine will facilitate deglutition if this be very painful.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Aconite* is useful in the acute stage, with febrile symptoms, particularly when the disease results from cold: *belladonna* when the throat is bright red and ulcerated, with much pain on swallowing: *argentum nit.* in ulcerated throat of low type, with fetid breath and foul mucus, and in cachetic persons; *phytolacca* when there is much hoarseness and aphonia, with great dryness, feeling of lump in the throat; *arnica* when from excessive use of the voice.

PHARYNGITIS, CHRONIC (Chronic Pharyngeal Catarrh).—Chronic inflammation of the pharynx and adjacent parts.

The *symptoms* are those enumerated under the head of ACUTE PHARYNGITIS, but they are less severe. One of the most troublesome is the hawking and clearing of the throat necessitated by the presence of viscid mucus at the back of the pharynx; this may give rise to vomiting.

Diagnosis.—The relaxed condition of dilated venules and sticky mucus at the back of the throat are the characteristics of the disease.

Prognosis.—The affection is very troublesome and obstinate, but free from danger to life.

Pathology.—Briefly, the changes present are chronic hyperæmia of the mucous membrane of the pharynx, with cell proliferation and dilatation of the small vessels of the part.

Ætiology.—It may be the sequel of an acute attack, but the disease more commonly comes on gradually in persons leading sedentary lives in an unhealthy atmosphere, especially if there be excess in smoking and drinking. The strumous, rheumatic, and gouty diatheses predispose to the disease. Of late, attention has been directed to the dependence of chronic pharyngeal affections on obstructed or disordered nasal respiration. Atrophic rhinitis, for example, is almost invariably attended with a dry, glistening condition of the pharynx, to which the term *pharyngitis sicca* has been applied.

Treatment.—The essential points in the treatment of chronic pharyngeal catarrh are to combat, as far as possible, the constitutional causes which underlie it and to treat any nasal trouble which may exist. A tepid or cold sponge bath, with vigorous friction of the skin, wearing flannel next the skin, exercise in the open air, great moderation in the use of stimulants, leaving off smoking, avoidance of pepper, mustard, curry and other pungent articles of diet, will be of service. A gorged state of the pharynx is often found associated with piles; in these cases saline aperients will be found to act beneficially on both conditions. As regards local treatment, painting the throat with glycerin of tannin, or with an application composed of equal parts of tincture of iodine, tincture of catechu and glycerin, may be tried. The medicated throat pastiles will be found a convenient mode of applying local remedies. Among the most valuable may be mentioned those of chlorate of potash and borax, rhatany and chloride of ammo-

nium. If there be much irritation, rhatany, the compound rhatany pastiles, which contain $\frac{1}{10}$ grain of hydrochlorate of cocaine, may be ordered. Gargles are of little use, sprays being more efficacious; any of the sprays mentioned for use in the treatment of chronic laryngitis may be employed with advantage in chronic pharyngitis. If the pharyngeal irritation be kept up by the presence of an elongated uvula, this must be removed.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Mercurius iod.* is the most generally useful remedy; the throat is swollen, with copious saliva; swollen gums and tongue; shooting pain on swallowing; ulcers on the mouth; profuse perspirations; *kali bichrom.*, when there is tough, stringy mucus; chronic ulceration: *calcium sulphide* in scrofulous persons.

PHARYNGITIS, GRANULAR (Clergyman's Sore Throat).—A chronic form of pharyngitis characterized by the presence of granular bodies on the mucous membrane of the pharynx.

Symptoms.—The amount of discomfort the patient suffers is out of all proportion to the objective condition. A feeling of irritation is complained of, as though a foreign body were in the throat; there is also cough, but usually without expectoration. The voice is not at first affected, but sooner or later the individual finds that he must clear the throat before beginning to speak, and in course of time he finds that he cannot talk for long without clearing the throat, and eventually the voice becomes much impaired in consequence of the strain thrown on the larynx by the constant hawking. The mental effect must also be borne in mind, as patients are apt to imagine that they have some grave disorder of the throat, such as cancer or consumption, and are consequently subject to great depression.

The objective symptoms consist in the presence of roundish or oval prominences on the mucous membrane of the pharynx. They are of red color and usually rather darker than the neighboring mucous membrane; they vary in size from a pin's head to a pea, but by coalescence larger masses may be formed. The vessels of the pharynx are enlarged and a stellate arrangement is not uncommon.

Diagnosis.—The irregular granular condition of the pharynx and the chronic-

ity of the symptoms are diagnostic of the disease.

Prognosis.—No danger is to be apprehended to life, but the disease is apt to be very chronic, and, until recently, treatment was not very successful.

Pathology.—The granules are due to a circumscribed proliferation of lymphatic tissue around the efferent ducts of the mucous glands; the pavement epithelium of the mucous membrane extends over the granular, though it is thinned, and may be absent over the top of it. In some instances the inflammatory process is limited to the lateral walls of the pharynx. To this condition the term *pharyngitis lateralis hypertrophica* has been applied. In such cases a round or flat swelling may be seen immediately behind the posterior pillar of the fauces. The swelling consists of a conglomeration of granulations, with more or less hypertrophy of the salpingo-pharyngeal fold.

Ætiology.—The causes which have been mentioned as producing chronic pharyngitis are also concerned in the production of granular pharyngitis, but the most powerful of all causes is undoubtedly over-use of the voice, especially under unfavorable circumstances, as, for instance, when the individual is suffering from catarrh, or in an impure atmosphere, or in the open air.

Treatment.—Though relief may be obtained by carrying out the measures suggested under CHRONIC PHARYNGITIS, the only hope of curing the patient consists in the destruction of these granules. For this purpose the galvano-cantery is by far the best form of caustic. Each granule must be touched with the galvano-caustic point or blade at a dull red heat; four or five applications can be made at a sitting. Any prominent vessels may be divided by applying the blade at right angles to them. If the throat be unusually irritable, it may be sprayed with a ten per cent. solution of cocaine, but, as a rule, so little pain is experienced that this is unnecessary. The feeling of sore throat which follows is best relieved by effervescing lozenges containing chlorate of potash and cocaine, or by the compound rhatany pastiles already mentioned. Only in very exceptional cases does the amount of inflammatory reaction require the use of ice pills. The sittings should be at intervals of a week to ten days, and usually four or five suffice for the cauterization

of all the granules. If this be thoroughly carried out, the result is most satisfactory, and there is but little tendency to relapse.

If the reflex irritability be excessive, bromide of potassium with a bitter infusion is indicated, but, as a rule, improvement results from the administration of iron and arsenic.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Arnica* is the principal remedy when there is much hoarseness from preaching or public speaking; *arum triph.* when there is constant hawking; profuse secretion from posterior nares and fauces; hoarseness, worse from talking. *Phosphorus*, throat very dry; hoarseness, worse from talking, reading aloud, or laughing. *Causticum* burning in the throat, hoarseness worse from singing; *kali bichrom.*, secretion of thick, tough mucus from posterior nares and fauces; *natrum carb.*, continual sensation of rawness and scraping; diminished secretion with constant desire to hawk and hem.

PHARYNX, ULCERATION OF.—

May be a result of syphilis, tuberculosis, lupus and malignant disease.

Syphilitic Ulceration.—This is so much the most common that the possibility of the disease being due to syphilis should be excluded before any other diagnosis is arrived at. Syphilitic ulceration is generally due to the breaking down of a gumma, so that the ulcer is usually round or oval in shape and is most often situated in the center of the posterior wall of the pharynx, but in severe cases it may spread in all directions. After the ulcers heal, white cicatrices are left which give rise to contraction of the neighboring parts. There is very little pain attending syphilitic ulceration.

Treatment.—As for syphilis generally. Locally, after the surface has been cleaned by a detergent spray, iodoform may be insufflated, or a solution of sulphate of copper (20 grains to the ounce) applied.

Tubercular Ulceration.—Tubercular ulcers of the pharynx are lenticular in shape, with no apparent excavation; the base is pale yellow, the edges are irregular and ill defined, and the surface covered with thin, unhealthy pus. The presence of the tubercle bacillus will establish the diagnosis. Pain, which is almost absent in syphilitic ulceration, is a prominent symptom in the tubercular affection,

and radiates to one or other ear; there is also great pain on deglutition. The remaining symptoms are those usually met with in tubercular disease of the larynx and lungs, with which the pharyngeal affection is almost invariably accompanied.

Treatment as for laryngeal tuberculosis.

Lupus of the Pharynx is usually met with as an extension from lupus of the nose and of the pharynx. For diagnosis and treatment, see LARYNX, LUPUS OF.

Cancer of the Pharynx is generally of the scirrhus variety. It begins as a hard, irregular mass, which subsequently softens and ulcerates. The marked induration of the edges and the fungous-looking surface will usually suffice to distinguish it from tertiary syphilitic ulceration. If there be any doubt, iodide of potassium in full doses will soon set it at rest.

F. DE HAVILLAND HALL.

PHLEBITIS.—See VEINS, INFLAMMATION OF.

PHLEBOLITHES.—Some veins may contain loose calculi or phlebolithes, generally round or oval, and sometimes attached by a narrow pedicle to the inner wall. They are found most frequently in the veins of the pelvis about the bladder and prostate, especially when the latter is enlarged. No inconvenience results from their presence. Their origin is questioned. Bichat thought that they occurred in veins exposed to slow circulation of their contents. Hasse found them connected with varices. Hedgson held that they were probably formed in surrounding parts, and made their way into the veins by absorption. Cruveilhier that they were developed in the center of a clot of blood. It is most probable that they are clots which have thus dried up and become transformed. Having protruded from some small branches, they receive additions to their surface, and, eventually separating from the pedicle which held them to their original vessels, shift their situation, and are perhaps rolled along for some distance by the blood-stream before being finally arrested.

They are formed of concentric layers, which consist, according to Frankland, of protein matters and phosphate of lime. The former, constituting about twenty per cent. of the calculi, are nearly all al-

buminous or fibrinous; the latter, though mainly phosphate of lime, is mingled with a little sulphate of potash and sulphate of lime. That is to say, the phlebolithes consist of the coagulated protein constituents and the less soluble salts of the blood.

GEO. W. CALLENDER.

PHLEGMASIA DOLENS.—A disease occurring chiefly in the puerperal state. Its main characters are denoted by its name, "phlegmasia alba dolens"—"painful white œdema." It is due to obstruction the veins and lymphatics of the part affected.

Clinical History.—The affection usually comes on toward the end of the second week after delivery, but the date of onset varies. It begins with pain and fever, the pain being generally in the groin and upper part of the thigh of the affected side. Then comes swelling, which extends down over the whole limb and the corresponding labium. This rapidly increases, so that in a day or two the limb may be twice the size of the other. The pain may extend over the back and lower abdomen, and the whole of the affected limb. The pain and swelling in some cases begin in the foot and thence extend upward. For the first two to four days the limb is tender, and the swelling pits. Then the swelling acquires the solid character that has been mentioned, and does not pit on pressure, nor when pricked does serum ooze out. The œdema is not altered by position; and there is more loss of power over the limb than is usual in ordinary œdema. This condition lasts from three to eight days. Then the swelling begins to get less hard, and to again pit on pressure, and about this time the pain, tenderness, and febrile symptoms diminish. The swelling takes, as a rule, from three to five weeks to subside, but some amount of enlargement of the limb persists long after this date, and, if not treated, may be permanent. During the height of the pain and swelling there is some degree of numbness in the limb. The pain is often so severe as to prevent the patient from sleeping. There are seldom any signs of inflammation about the limb. The plugged veins may sometimes be felt as hard cords.

As a rule, phlegmasia dolens ends in recovery. The chief danger lies in the

possible detachment of a clot, and its being carried into the heart, and thence into the pulmonary artery, thus causing pulmonary embolism (*see* PULMONARY ARTERY, EMBOLISM AND THROMBOSIS OF). This does not occur until a sufficient time after the formation of the clot to admit of its having softened and become friable, which is seldom until at least three weeks after delivery.

In rare cases the thrombosis extends up to the vena cava and thence to the heart, and in that way kills the patient.

Pathology.—The statement that the veins are obstructed rests upon the fact that in every case in which the parts have been dissected the veins have been found plugged. That there is also obstruction to the return of lymph from the limb is inferred from the fact that the œdema, during the few days in which the disease is at its height, is of a peculiar solid, non-pitting character, such as is never seen from simple venous obstruction, but is seen in inflammation of the lymphatics, and in elephantiasis, a disease known to depend upon plugging of lymphatic vessels. In elephantiasis the change is more marked because the obstruction is permanent, while in phlegmasia dolens it is temporary. We do not know what is the cause of the venous thrombosis and lymphatic obstruction in phlegmasia dolens. There are very seldom signs of inflammation in the limb.

Ætiology.—The disease has been ascribed to a blood poison; but nothing is known about the poison, if there be one. It is most common in the puerperal state. It is seen occasionally in the terminal stages of phthisis and cancer, and still more rarely in other conditions of anæmia and debility. As a puerperal disease it is most apt to occur after labors that have been accompanied with hemorrhage. Its frequency in the lying-in period is attributed to the combination at this time of slowness of the circulation with a varicose condition of the veins and an excess of fibrin in the blood. It is generally in one leg, and that more often the left, probably because the veins of the left side are more often varicose than those of the right. It may affect both legs or even the arms.

Treatment consist in absolute recumbency so long as the pitting œdema is present. During the febrile symptoms diet must be regulated according to the

patient's digestive powers. For the relief of pain local applications not of an irritating character, and not involving friction. Lint smeared with ext. bellad. and glycerin, p. æq., laid on the limb, is useful. If pain be severe, a four per cent. solution of oleate of morphine in olive oil may be painted on the limb. The limb should be slightly raised to favor the return of blood from it, the pressure of the bed-clothes taken off by a cradle, and, unless the weather be warm, the limb wrapped in cotton-wool. After the sixth week, if œdema be slow in subsiding, the limb may be bandaged from the toes upward with a Martin's perforated india-rubber bandage, put on before the patient arises from bed. The patient and her friends should be most strictly cautioned against friction or kneading of the limb—measures which they are very likely to think useful.

G. E. HERMAN.

Symptomatic Indications.—The most generally indicated remedy is *belladonna*, especially when there is much fever, burning thirst, hyperæsthesia of the senses, tearing pains in the limbs. *Aconite* is frequently useful when marked inflammatory symptoms are present; *pulsatilla* when the disease has extended from the uterine veins; *hamamelis* when a varicose condition is present. *Arnica* in early stage, after severe and protracted labors, feels bruised and sore, frequently gives good results; arsenicum in later stage, with restlessness and anguish, exhaustion, burning pain, swelling pale and œdematous.

PHOSPHATURIA.—A condition in which an excess of phosphate is passed in the urine. This must not be confused with a mere deposition of phosphates from the urine. Such a phenomenon is merely sign of alkalescence of the urine, and may take place when a normal, or even a less than normal, quantity of phosphates is present. Nevertheless, it was this latter condition which was believed by Prout to constitute a distinct disease, and which he termed the "phosphatic diathesis." True phosphaturia can only be diagnosed after a quantitative analysis of the urine for phosphates by the uranium method (*see* URINE, EXAMINATION OF).

The clinical relations of an excessive discharge of phosphates are not yet clearly understood. In great activity of

the brain, as when delirium is present, Dr. Bence Jones showed that phosphates were passed in excess; and observed an excessive phosphatic discharge in association with emaciation, thirst, polyuria, and other symptoms of diabetes mellitus, terming the disease "phosphatic diabetes." With these exceptions, the clinical interest of the phosphates of the urine attaches entirely to their deposition in the urinary passage as a result of loss of acidity of the urine.

ROBERT MAGUIRE.

PHOSPHORUS, POISONING BY.—

Phosphorus is met with either in the common yellow soluble form or in the allotropic form; of these the former only is poisonous, the latter being quite inert. Cases of phosphorus poisoning most commonly arise from children sucking the heads of lucifer matches or from the taking of "phosphorus paste" or "rat paste." The symptoms may appear in either an *acute* or *chronic* form; the subjects of the latter affection are usually workers in lucifer-match factories.

Symptoms.—**Acute Poisoning.**—The symptoms commence with the taste and smell of garlic. There is also intense pain in the mouth extending down to the stomach, with nausea and vomiting; the vomit may be blood-stained and luminous in the dark. Purging is also present. In severe cases delirium and fatal coma may come on in a few hours; otherwise, about the third day, jaundice and retention of urine, albuminuria, numbness and cramps in the limbs, fainting, somnolence, and convulsions become the most prominent symptoms. In cases less speedily fatal there may be subcutaneous, intestinal and other hemorrhage, leading to the patient's death from exhaustion; recovery may, however, follow such symptoms. Acute yellow atrophy of the liver present some features in common with phosphorus poisoning, but jaundice makes its appearance earlier in that disease, and nervous symptoms are present almost from the first. The speedy diminution of liver dullness would be a valuable sign of the disease as against poisoning. Acute yellow atrophy runs an even more rapid course than the poisoning, and is almost inevitably fatal.

Post-mortem Appearance.—The skin may be jaundiced, and, as well as the viscera, may show ecchymoses; the con-

tents of the stomach and intestine smell of garlic, and may be luminous in the dark; the liver is enlarged, yellow, pale, and mottled. Microscopically, the mucous membrane of the stomach is swollen, owing to the blocking of the tubular glands with degenerated and fatty epithelium, and the hepatic cells are found to have lost their outline and to be filled with oil globules. Fatty degeneration is present in the renal epithelium and throughout the muscular system generally.

Treatment.—Emetics should be given, and subsequently mucilaginous drinks; oil of turpentine (in 10-minim doses administered at short intervals) is the chemical antidote. The rest of the treatment would be symptomatic.

Chronic Poisoning commences with pain in a tooth. After extraction of the painful tooth the wound in the gum does not heal; gradually the alveolus becomes exposed, the gums grow spongy, and the teeth fall out. The disease of the jaw progresses, and large pieces of bone are removed. The patient may then recover, or sink slowly from exhaustion consequent upon the long-continued drain upon his system. Now that matches are made with allotropic phosphorus, cases of chronic poisoning by phosphorus are becoming very rare.

PHRENIC NERVE, PARALYSIS OF.—This is rarely due to disease or injury of the nerve trunk, but commonly to disease of the anterior gray matter of the spinal cord at the level of the third and fourth cervical nerves. It occurs in acute or chronic spinal myo-atrophy, and is not rare after diphtheria. Paralysis of the diaphragm has also been observed in lead palsy. In a few cases the loss of function has been attributed to rheumatic neuritis of the nerve trunk, and cases are recorded in which it was due to compression in the neck.

Symptoms.—The evidence of paralysis of the phrenic is inaction of the diaphragm. After experimental section of the phrenics, the two most constant phenomena observed are increased scope of the thoracic excursions and a distinct reversal of the abdominal movements in respiration. Clinically these symptoms are present in most cases, but in varying degree. In ordinary quiet breathing they may be almost imperceptible, but

become clearly marked on the quickening of respiration which attends exertion. The extent and character of the abnormal movements also vary according as one or both nerves are paralyzed.

In bilateral paralysis, such as is met with after diphtheria, there is nearly always excessive action of the lower ribs, and the abdominal movements are reversed, the wall receding instead of coming forward during inspiration and bulging out during expiration. The precise nature of the modifications of the normal movements will depend to some extent on the integrity or otherwise of the abdominal and intercostal muscles and on the degree of affection of the phrenics. When the paralysis is gradual in onset, the altered movements become established imperceptibly. But if paralysis be suddenly developed, there is always dyspnœa and lividity, of temporary duration. Accidents of this nature have sometimes been erroneously attributed to sudden heart failure. All spasmodic respiratory actions—sneezing, coughing—are performed with less energy. In post-diphtheritic cases the non-explosive character of the cough is very striking and constant. Paralysis of the diaphragm *per se* gives rise to but few symptoms, but the supervention of bronchitis places the patient in a position of great danger.

Diagnosis.—This is not always easy. The symptoms should be looked for during quiet breathing, for in voluntary deep breathing the extra action takes place chiefly in the upper part of the chest. In women breathing is less diaphragmatic than in men, and in them also conscious attention to the act of breathing is apt to arrest the action of the diaphragm. Further, immobility of the diaphragm may result from causes other than paralysis. Such are diaphragmatic pleurisy, injury, ruptured fibres, etc., and the diminished movements observed in cases of extreme emphysema of the lungs.

Again, in cases where the diaphragm is really paralyzed there may be some doubt as to whether it moves or not. In patients with collapsed abdomen the expansion of the lower ribs is apt to lift forward the lax parietes so as to simulate a descent of the diaphragm. In others cases a sudden contraction (expiratory) of the abdominal muscles, more especially the recti, occurring almost

before the end of inspiration, and tending to fill up the epigastrium, may be mistaken for a late inspiratory effort. In post-diphtheritic cases the lungs sometimes furnish confirmatory evidence. The writer has met with weak breathing and, more rarely, relative dullness, and moist râles of the bases, in several cases, and is inclined to attribute these physical signs to the presence of collapse and œdema of the pulmonary bases, occurring as a direct effect of the diaphragmatic paralysis on the lungs.

Prognosis.—Favorable in the rare instances due to cold; rather less so in lead poisoning. Unfavorable when the paralysis is part of a progressive spina myo-atrophy. When due to acute cornual myelitis, it will depend on the evidence afforded by other symptoms of the extent of the damage to the region of the cord from which the nerves arise.

After diphtheria, the occurrence of diaphragmatic paralysis materially increases the gravity of the general prognosis. It varies too with the degree of paralysis, not only of the diaphragm, but of the limbs and trunk, for in these cases the former is always part of a more general multiple paralysis.

If the view put forward above prove correct, the presence of signs of consolidation (collapse) at the bases, with evidence of œdema, will possess a grave significance not only as probably indicating a marked enfeeblement of the diaphragm, but also a condition of lung which must materially increase the work thrown on the right side of the heart, which in many instances is already showing signs of weakness. The development of broncho-pneumonia, with rise of temperature, is of the gravest import, and frequently ushers in a fatal result.

Treatment.—In all cases causal indications must be met. Counter-irritation over tender spots, if they exist, is called for in cases due to cold, while systematic faradization may be of value if the irritability of the nerve be not altogether lost. One rheophore should be applied in the neck just above the scaleni and the other over the diaphragm. A strong current is necessary.

In post-diphtheritic cases the treatment is largely that of the general disease, but owing to the tendency toward recovery which characterizes this form of paralysis, no effort should be spared to help the

patient to tide over the critical period. To counteract to some extent the occurrence of pulmonary collapse and œdema, the writer has practised artificial respiration at regular intervals (three or four times a day) for ten or fifteen minutes at a time. This method of treatment has appeared to be decidedly beneficial in some cases, more particularly where the onset of the paralysis has been accompanied by distress of breathing and lividity. The results obtained, although far from uniformly satisfactory, have been sufficiently encouraging to warrant a more extended trial of this mode of treatment.

W. PASTEUR.

Symptomatic Indications.—When the result of cold *aconite*; after diphtheria, *gelsemium*.

PHTHISIS.—A tubercular disease of the lungs, characterized by the occurrence of lesions, partly specific and in part inflammatory, which tend either to caseate and soften or to become fibrous.

This definition emphasizes the view, now held by most pathologists, that pulmonary phthisis is a single disease, and that it is invariably attended by the appearance in the lungs of the pathological product known as tubercle.

The doctrine of the unity of the disease and its dependence on a specific virus received important support from the publication by Koch in 1882 of his discovery of a bacillus in tubercular diseases of man and animals. At the present time the discovery of tubercle bacilli in the sputa of a patient suffering from some affection of the lungs is held to be conclusive evidence of the tubercular nature of the disease.

The want of uniformity in the clinical features and morbid appearances of the disease is probably due to the varying degree of resisting power of the tissues of different individuals to the action of the virus, leading in the one case to death in the course of a few weeks or months, and in another allowing life to be prolonged for many years.

Mode of Onset.—This varies much, but the following clinical types may be recognized:

Insidious Onset.—This is the most common form in which the disease appears. The patient either is unable to fix definitely the time when his health became

affected, or perhaps dates the attack from a cold of no unusual severity. There is a history of gradual failure of strength, with cough, some expectoration and emaciation. Sweating may have been present at night, and, on exertion, the breath is probably noticed to be short. Loss of appetite and dyspeptic troubles often form a prominent feature in the history of such a case. The patient is usually anæmic and emaciated. The tongue may be furred, with prominent red papillæ. If the temperature be taken in the afternoon or evening, it will probably be found to be from one to two degrees above the normal.

Bronchitic Onset.—These cases are scarcely less numerous than the last. There is usually a history of repeated attacks of bronchial catarrh or of acute bronchitis; cough may have been present in the winter for some years, and there may have been attacks of dyspnœa, with wheezing. Expectoration has possibly been profuse, and perhaps occasionally tinged with blood. The onset of the tubercular disease may be ill-defined or marked by emaciation, loss of strength, an alteration in the character of the cough, and often by the occurrence of night-sweats.

Pleuritic Onset.—The appearance of the disease has been preceded by one or more attacks of acute basic pleurisy, either dry or with effusion; if the latter, the fluid may have been completely absorbed. In some cases there is a history of pleurisy, with effusion, affecting first one side of the chest and then the other, and in both complete absorption of the fluid may have taken place, the pleural surfaces probably becoming adherent. The immediate onset is generally marked by cough, emaciation, pyrexia, and night-sweats. There is often a history of tubercular disease in the parents or in other members of the family.

Hemoptoic Onset.—In a certain proportion of cases of phthisis the health is apparently but little affected prior to the occurrence of an attack of hemoptysis. This attack may be immediately followed by the ordinary symptoms and signs of phthisis, or, as not uncommonly happens, the attack is quickly recovered from, and on examination of the chest shortly afterward, few, if any, definite signs of disease may be detected. In such a case there may be a considerable interval

before another attack of hemorrhage occurs, but, after a time, the ordinary symptoms and signs of the disease appear. It is almost certain that in many cases of this kind there is an old tubercular lesion in the lung, and that the attack of hemoptysis, apparently marking the onset of pulmonary tuberculosis, has really been preceded by symptoms and signs which have escaped either notice or memory. Such cases are not uncommon in men beyond middle age in whose family there is no history of tubercular disease.

Acute or Pneumonic Onset.—This is probably the rarest mode of onset. There are two forms.

The Lobar Pneumonic Type, in which the attack somewhat simulates one of acute lobar pneumonia of the apex, being marked by rigors, high temperature, quickened pulse and respiration, and expectoration, which may be more than simply "rusty," slight hemoptysis being sometimes present. The case is very likely to be regarded as one of ordinary croupous pneumonia until the unusual degree of emaciation, or the absence of a crisis suggests an examination of the sputa, when the discovery of tubercle bacilli shows its real nature.

The Broncho-pneumonic Type.—This is the most serious and rapidly fatal form of phthisis, and has been termed "galloping consumption." The lesions are not localized to the apex or a single lobe, but spread rapidly through both lungs; caseation quickly follows consolidation, and is in its turn soon succeeded by softening. The patient is usually of a markedly "tubercular type," the face is flushed, the eyes are bright, there is high fever, with rapid emaciation and severe cough, hectic sweating, and purulent or blood-stained sputa.

Acute Miliary Tuberculosis.—It is usual to describe this form as a separate disease, and its widely different clinical and pathological characteristics to some extent warrant the distinction, but according to the view above stated both are manifestations of the tubercular process, and the fact only serves to illustrate how various may be the appearances assumed by tubercular lesions of the lungs, and also how widely different may be the symptoms which accompany the condition. It is not suggested that a case of acute miliary tuberculosis of the lungs should be described as one of phthisis,

but there is a possibility that when the view of the essentially tubercular nature of that disease is completely accepted the term pulmonary tuberculosis may displace phthisis in its nomenclature (*see TUBERCULOSIS, ACUTE MILIARY*).

It is important to recognize that one of the greatest dangers to which phthisical subjects are liable, and one of the modes in which the disease often proves fatal, is an outbreak of acute tuberculosis, in which miliary granulations are rapidly formed throughout portions of the lungs hitherto free from infiltration. On the other hand, in a certain proportion of cases of acute miliary tuberculosis, the lungs are not the primary source of the general affection.

Symptoms.—*Cough* is perhaps the most prominent, and is the symptom which most attracts the patient's attention. It is usually present in the earliest stage of the disease, and is rarely absent for any lengthened period throughout its course. At first "hacking," it becomes in the advanced stages loud and hollow; it is especially common on lying down at night and on rising in the morning, when, if severe, it may cause retching or vomiting, and leave the patient much exhausted. It is often especially troublesome after taking food or after exertion.

Expectoration.—This in the early stages is frothy and viscid, small in quantity, and may occasionally be blood-streaked. When softening is in progress, it is profuse, purulent and "numulated"; the latter appearance is, however, not characteristic of excavation, as it may be observed in the sputa of chronic bronchitis. For methods of examining the sputa for bacilli and elastic tissue see EXPECTORATION.

Fever.—The course of the temperature is subject to much variation. It is generally considerably raised during those periods of the disease when active changes are in progress in the lungs, but cases are recorded in which, although extensive lesions occurred, the temperature did not rise above 99 F. The rise, as a rule, begins in the early part of the afternoon and attains its maximum between 8 and 10 P. M.; the temperature then falls, so that during the after-part of the night and in the early morning it may be sub-normal. When softening and cavity formation are in active progress, the temperature often assumes a

hectic type, rising to 103° or 104° F. in the evening, and falling to the normal, or below that point, during the night.

It is noteworthy that the pyrexia of phthisis is not generally accompanied, as in other diseases, by thirst, loss of appetite, and other evidence of constitutional disturbance, so that patients may continue at their work although in a state of high fever. When pyrexia gives place to a normal temperature at all periods, a favorable change has almost certainly occurred at the site of disease in the lung. For the significance of the rise of temperature, which often occurs after an attack of hemoptysis, see HEMOPTYSIS.

Emaciation is one of the most prominent symptoms, and its degree is usually a trustworthy indication of the severity of the case. In such as present the "acute" or "pneumonic" mode of onset, the loss of weight is often extremely rapid.

Hemoptysis (q.v.).—The idea that phthisis may originate from an attack of hemoptysis is no longer entertained; that the hemoptysis is the consequence, and not the cause, of the pulmonary changes, is made evident by the fact that, in cases of so-called primary hemoptysis, an examination of the blood ejected may demonstrate the presence of tubercle bacilli, sometimes in considerable numbers. It is, however, true that in many cases, after a profuse hemorrhage, there are no distinct signs discoverable on examination of the chest; but, unfortunately, it is not generally recognized that the "absence of physical signs" and the "absence of disease" are not one and the same thing.

Dyspnœa.—Although the patients generally admit to some shortness of breath on exertion, there is rarely any obvious dyspnœa until the lungs have become extensively involved. The anæmia which is almost invariably present reduces the requirements of the system, and so enables the diminished pulmonary area to supply the blood with sufficient oxygen.

Pain is often present even in the early stages; it is generally referred to the pectoral regions, and may be associated with tenderness. It is probably due to the condition of the underlying pleura, where possibly adhesions may be either forming or present, or it may be evidence that intra-pulmonary changes are approaching the surface.

Night-sweating is often present from the onset, and is one of the most distress-

ing symptoms; if the patient fall asleep during the day, sweating may also occur. The perspiration is at times so profuse as to necessitate a change of linen more than once during the night. Patients usually feel much exhausted after the sweating.

Pulse.—There is, as a rule, some increase in the pulse rate, associated with a low state of the arterial tension.

Digestive Disorders are of frequent occurrence, loss of appetite, especially for fatty food, nausea and vomiting being among the most common symptoms. Vomiting is occasionally present in the early stages; later, it often follows the violent attack of coughing which so many patients experience in the early morning.

Diarrhea is usually a phenomenon of the advanced stages of the disease, and is then; as a rule, due to the presence of tubercular ulceration of the bowel combined with catarrh of the mucous membrane of intervening areas. Albuminoid disease is another not infrequent cause of diarrhea.

The so-called Stages of Phthisis.—It is customary to describe three stages: the first, or stage of consolidation; the second, of softening; and the third, or cavity stage. These stages mark the advance of a pathological process, but have no relation whatever to the disease as a whole, or any clinical value as guides to prognosis, a patient with a well-marked cavity being often in a far more satisfactory condition than one in whom the disease has not advanced beyond the stage of consolidation. It is also in great part owing to the general use of these terms that the tendency of tubercle to undergo fibrous transformation has received comparatively little attention.

Physical Signs—Inspection.—Although phthisis may affect persons of any physiognomy build, two types of chest are specially liable to attack—a long narrow chest with wide intercostal spaces, a small antero-posterior diameter and projecting scapulæ; the other, a broader chest, which is very flat in front, the sternum sometimes being actually curved backward instead of forward.

The chief points to which attention should be directed on inspection are the supra and infra-clavicular regions, where signs of flattening may be observed. The movement of the point of the shoulder should be watched during inspiration for any slight differences in the degree of ex-

pansion of the upper part of the chest. A considerable defect of the whole of one side is readily observed when the chest is viewed from the front, the patient being seated in a good light, but slight changes are more obvious when the observer stands behind the patient and looks over his shoulders.

Palpation.—When the hands are placed upon the chest defective expansion at one apex often becomes more evident than it was on inspection. Changes in the vocal fremitus are of great importance in determining the presence of early disease of the upper lobes (*see FREMITUS*). It may, however, be stated here that when in consequence of the retraction of a cavity at one apex the overlying pleura has undergone considerable thickening the vocal fremitus may (as is usually the case with thickened pleura) be less distinctly conducted there than beneath the other clavicle.

Percussion.—In the early stages a slight difference in the percussion note may sometimes be elicited on tapping the clavicles, when elsewhere the difference is unappreciable. It may also be found that the resonance does not extend so high above the clavicle on one side as on the other, and, again, a slight difference on the two sides may be noted when the breath is held after a deep inspiration, owing to less air entering the affected lung. Firm percussion in the supra-spinous fossæ will often elicit a dull note when the evidence obtained from the front of the chest is doubtful. The note may also obtain a slightly tympanitic quality, and at a later stage varying degrees of dullness up to wooden percussion note may be elicited. When a large cavity is present at the apex, a cracked-pot sound may be present (*see PERCUSSION*).

Auscultation.—The earliest sign in cases with insidious onset is usually weak inspiration with prolongation of the expiratory sound. The inspiratory sound at a latter period becomes harsh, and is often “wavy.” At a still later period it is bronchial in quality. In cases of the “pneumonic” type there may be well marked tubular breathing below the clavicle and in the supra-spinous fossa, but the tubular (whiffing bronchial) quality of breath sound is not commonly present in phthisis unless some area of lung be completely consolidated as the result of an accompanying pneumonia.

When a cavity has formed, the signs of that condition will be observed beneath the clavicle or in the supra-spinous fossa (*see AUSCULTATION*).

It is important to note that the breathing over the unaffected apex is usually exaggerated (harsh), with a prolonged expiratory sound, a compensatory change; and that, when one apex is certainly diseased, the absence of this change at the other may be an indication of early disease there also.

The only adventitious sounds in the early stage of a case with insidious onset are, as a rule, a few fine crackling râles on inspiration or after cough. At a later period, when softening is in progress, moist crackling râles and clicking sounds appear, and are replaced by gurgling râles when a cavity has formed, if it contain secretion.

In the pneumonic type, tubular breathing and crepitation may be present over a considerable area.

It frequently happens that the physical signs are more marked in the supra-spinous fossa than above or beneath the clavicle, probably owing to the fact that the lesion is often situated nearest to the posterior surface of the lung (*see PHTHISIS, LOCALIZATION OF LESIONS*).

The changes in the vocal resonance are described under *AUSCULTATION OF THE VOICE (q.v.)*.

Diagnosis.—The diagnosis of phthisis has become a much simpler matter since the discovery of the bacillus tuberculosis. In all cases in which there are definite physical signs of disease of the lungs it is now customary to examine the sputa; if bacilli be present, the case is regarded as one of pulmonary tuberculosis, their absence after repeated examination tells very strongly against such a diagnosis. In cases with a pneumonic onset it may be necessary to wait until the period at which a crisis should occur is past before pronouncing an opinion.

In cases of anæmia, in which the presence of phthisis is often suspected, the discovery of the various hæmic murmurs is generally sufficient to exclude the presence of phthisis, as the two conditions are rarely, if ever, associated. A caution must, however, be given against mistaking the sound which can nearly always be produced by the pressure of the stethoscope on the jugular vein for the true *bruit de diable*, with which a thrill is nearly

always associated. The stethoscope should be placed upon the sternal end of the clavicle where it cannot compress the vein. It is also important not to mistake the false murmur in the second left interspace, which is so commonly present with disease of the left upper lobe, for a pulmonary hæmic murmur (*see* AUSCULTATION OF THE HEART). The occurrence of slightly blood-stained expectoration in the early morning often leads to a suspicion of phthisis, but in such cases the blood generally comes from the gums, and disease of the lungs is rarely present.

Emphysema may mask the presence of a tubercular lesion; hence it is always desirable to examine the sputa in cases of emphysema and bronchitis occurring in spare individuals.

Course; Duration; Prognosis.—While the discovery of lesions indicating arrest of pulmonary tuberculosis is one of the most common occurrences of the post-mortem room, the complete arrest of cases of phthisis clinically recognized is an event much less frequently met with. It may occur during the stage of consolidation, a caseous mass remaining, which shrivels and becomes encapsuled, the surrounding lung becoming emphysematous, or after a cavity has formed. In the latter case the cavity contracts, and the overlying pleura surfaces are separated, the intervening space being filled by the effusion of fluid from the vessels of the neighboring adhesions; this fluid subsequently assumes a gelatinous consistence, and afterward undergoes changes ending in fibrillation, the resulting tissue being in time of almost cartilaginous density.

The most rapidly fatal cases are marked by an acute onset of the "broncho-pneumonic type." Death may occur in a few weeks or months, but, as a rule, no matter how acute the symptoms at the onset, some amelioration in the patient's condition takes place after a time. In the lobar pneumonic type, a tendency to arrest is often noted after the expulsion of the softened caseous material and the formation of a cavity. The cases with an insidious onset are generally slowly progressive, with occasional periods of quiescence. The average duration of such cases has been variously given as two years and a half to eight years, but such statements are of but little value, owing to the great variety of circum-

stances which have to be taken into consideration in estimating the probable course and duration of any case. The greatest dangers which beset the subject of chronic phthisis are the formation and rupture of a pulmonary aneurism and the occurrence of acute pulmonary tuberculosis from the sudden infection of the blood or lymph vessels with the virus of the disease. A caseous nodule may remain quiescent and encapsuled in the apex of a lung for many years, giving, perhaps, little or no sign of its presence, when from some cause its capsule gives way, a communication with a bronchus or vessel is established, and acute tuberculosis is set up.

The duration of cases of the hemorrhagic type is often prolonged, and in those characterized by the bronchitic mode of onset the course is generally chronic. The prognosis in cases of the pleuritic type is, as a rule, unfavorable, there being a distinct liability to the occurrence of acute tuberculosis.

Complete arrest of the disease is occasionally observed under the most unfavorable circumstances, such cases falsifying every rule of prognosis.

Complications.—The complications of phthisis are for the most part the effects of the transference of the specific virus from the lungs and its arrest in other parts of the body, the result being the formation of tubercles, which generally either undergo softening or set up inflammation; on the other hand the tubercle bacillus may have been present in the body before it attacked the lungs. As the greater number of such affections are described under their appropriate headings, the mere enumeration of them will be here sufficient.

The complications connected with the serous membranes are described in the articles on PERITONITIS, TUBERCULAR; PLEURISY, TUBERCULAR; PNEUMOTHORAX, and MENINGITIS, TUBERCULAR.

Those of the mucous membranes in the articles on INTESTINES, TUBERCULAR DISEASES OF; LARYNX, TUBERCULOSIS OF; PHARYNX AND TONGUE, TUBERCULAR ULCERATION OF.

Those of the lymphatic glands in the articles on LYMPHATIC GLANDS, DISEASES OF, and TUBERCULOSIS (including SCROFULA).

The tubercular affections of the large

viscera, all of which may occur as complications of pulmonary tuberculosis, are treated of in articles on ADDISON'S DISEASE (tubercular disease of the supra-renal capsules); BRAIN, TUMORS OF (tubercular); KIDNEY, TUBERCLE OF; LIVER, CIRRHOSIS OF (tubercular).

Albuminoid disease (*q. v.*) is a frequent complication.

The affections of bone and joints are mentioned under TUBERCULOSIS.

Disease of the middle ear occasionally occurs as a complication of phthisis.

Enlargement of the male breasts has been noted as a comparatively rare event in the course of the disease.

Fistula in Ano is believed to be due to the occurrence of a tubercular ulcer of the bowel, which perforates the wall of the intestine and subsequently forms an external opening by the side of the anus, but the invariable existence of the ulcer has not been clearly demonstrated.

Treatment. — The condition rarely gives rise to very troublesome symptoms and may safely be left alone, the old idea being that it is dangerous to resort to operative measures in such cases as the existence of the discharge has a beneficial effect upon the lung. Whether this be so or no it is certain that the presence of another morbid process in the body has a distinct influence upon the tubercular process; witness the extreme frequency with which evidence of arrested tubercular disease is found in the bodies of those dying from cancer. If an operation be performed, the diseased tissues must be completely removed.

Pathology. — According to the view here adopted, phthisis is a local tuberculosis of the lungs accompanied by inflammatory changes, the resulting morbid products tending either to caseation and softening or to fibrosis.

Initial Lesion. — The first effect of the presence of the bacillus in the air passages is to set up changes in the finer bronchi, which extend either into the alveoli or into the surrounding connective tissue; in the one case the initial lesion is intra-alveolar, in the other inter-alveolar.

Tubercles are continuously formed throughout the progress of the disease, and according as the alveolar or connective tissues are affected, rather tend to undergo, on the one hand caseation and softening, on the other, fibrosis; soften-

ing, however, may occur in either extra or intra-alveolar lesions.

In the *caseous form of the initial lesion* it appears to the naked eye as a small rounded nodule of consolidation, having a somewhat lobular appearance. In the center the color is either whitish or yellow, and opaque; toward the periphery it is of a grayish tint. A large area of consolidation is formed by the coalescence of a number of such small nodules.

The initial lesion in the intra-alveolar form is seen microscopically to center around a minute bronchus, which is plugged with an inflammatory exudation composed of round cells and desquamated epithelium; the neighboring alveoli are also stuffed with large catarrhal cells, derived from the alveolar epithelium; the epithelial cells are often enlarged, and may be desquamating. The wall of the bronchiole is generally considerably infiltrated with round cells.

These constitute the appearances in that part of the lungs where the process has most recently commenced. Where it has been in operation for some time large caseous areas may be found; in parts where the process is of still older date, cavities of various sizes and irregular shape and outline will have formed. The larger cavities, like the large areas of consolidation, are formed by the coalescence of smaller ones (*see* VOMICA).

Caseation often begins within the bronchus and extends to the alveolus; softening commences in the central parts of the caseous masses, often in the neighborhood of a bronchiole.

The process of caseation consists essentially in the death of the cell elements, followed by their fatty degeneration. The evidence of the specific nature of the changes here described is furnished by the discovery of the bacillus, chiefly within and around the giant cells of the tubercles.

In the *fibroid form of the initial lesion* hard pigmented tubercles of varying size are found, with well-defined outline presenting the typical appearances of the miliary tubercle. The microscopical appearances differ, in that the changes are chiefly inter-alveolar, being mainly in the wall of the bronchiole and in the surrounding connective tissue; the intra-alveolar changes are much less marked,

and the evidence of inflammation there is but slight.

In this form there is far less tendency to caseation and softening than in the other; if cavities form they tend to contract, and progress is slow, the general course of the disease being chronic. Pleural thickening may be extreme. These cases constitute one of the forms of so-called *Fibroid Phthisis*, which is only phthisis of which the history has been forgotten, owing to its very chronic course. In such cases the upper lobe of the lung often presents the most typical picture of "fibroid" phthisis, while, in the lower lobe, the changes characteristic of ordinary chronic phthisis are seen in progress.

In some cases large areas are found infiltrated with tubercle of a dense fibroid consistence, often forming deeply pigmented, rounded masses having a racemose arrangement. These are seen to be spreading slowly at their margins, and undergoing fibrous changes in the central portion, but they show but little tendency to break down.

Ætiology.—The condition of the lungs which affords a favorable soil for the multiplication of the bacillus tuberculosis may be inherited or acquired. There is apparently a deficient resisting power in the tissues of the subjects of inherited phthisis, so that they are unable to resist the attack of the bacillus. In them the onset of the disease usually occurs at an earlier period of life than in those who have no such family history. When there is a history of phthisis in both parents, the disease is likely to appear at a still earlier age.

Everything which tends to lower the state of the bodily health also tends to favor the development of phthisis; and, conversely, everything which increases the resisting power of the body to disease diminishes the tendency to pulmonary tuberculosis.

The question of diathesis is a difficult one. All those who have seen a very large number of cases of phthisis have probably formed some mental picture of the type of individual whom they consider specially liable to the disease. The tendency at the present time is to regard what used to be called scrofula as the manifestation of a tendency to tuberculosis, if such a condition exist; scrofulous and tuberculous lesions being practically iden-

tical, and alike due to the action of the specific bacillus.

The breathing of impure air, the want of good and sufficient food, excess in alcohol, and residence on a damp clay soil are all important factors in lowering the resisting power of the individual to the specific virus of the disease.

Frequent pregnancies and prolonged lactation are potent in producing the tendency, although, while the mother is carrying the child, the tuberculous process generally undergoes temporary arrest. The rapid extension of the disease which often occurs after delivery has been attributed to the wide inhalation of the specific virus during the deep inspirations which accompany parturition.

The subjects of diabetes are specially likely to develop consumption, and syphilis is also a factor in the ætiology of the disease. Workers in various trades in which dust is given off from the materials employed are frequently subjects; such as coal-miners, iron-workers, stone-masons, knife and fork grinders, needle-makers, and potters. Exposure to cold and wet, by lowering the general health, and locally by diminishing the resisting power of the pulmonary tissues, predisposes to the disease. The entrance of a foreign body into the lung may be the starting-point.

Phthisis may occur at any period of life; it is generally believed to attack young adults (aged from twenty to twenty-five years) in greatest numbers.

Treatment.—As the children of phthisical parents are certainly more prone than others to acquire the disease, prophylaxis is naturally of very great importance. Every care should be taken to maintain the general health and nutrition of the child. This is to be effected by careful attention to diet, clothing, and place of residence, a dry and bracing air being preferable. Special attention should be paid to all the ailments of childhood, and especially to those, such as measles and whooping-cough, which tend to be complicated by catarrh of the pulmonary mucous membrane. Cod-liver oil and syrup of the iodide or phosphate of iron are of especial value at this period. It is undesirable that a phthisical mother should suckle her own child.

The occurrence of glandular enlargements in the children of phthisical parents should be considered a serious indication of the presence of the inherited tendency.

In youth and early manhood precautions are still more necessary, and at that period residence in California, New Mexico, Florida, or other sections where the disease is less prevalent, coupled with the adoption of a healthy out-of-doors life, may prevent the appearance of the disease.

If the onset be of the acute or pneumonic type, rest in bed is essential during the continuance of the pyrexia. Antipyrin, antifebrin, or hydrobromate of quinine may be given with a view of lowering the temperature, but they have no specific effect upon the course of the disease. An effervescing mixture with aconite is sometimes useful, and at a later period, when the most acute symptoms have passed off, small doses of iodide of potassium in a bitter infusion are of use. When there is a distinct remission of the acute symptoms, a mixture of hypophosphite of lime, grs. v, syrup of the phosphate of iron and glycerin, aa 3 j, in an ounce of water, may be given two or three times daily.

For treatment of hemorrhage from the lung see HEMOPTYSIS. Cough is an important symptom, and the patient is always urgent for its relief. If sedatives be given it should only be to check an ineffective cough or one which prevents the patient from obtaining rest; such a linctus as the following—*Liq. morphinæ acetatis*, m. viij; *sp. chloroformi*, m. iij; *succilimonis*, m. xv; *mucilaginem acaciæ*, ad 3 j—is often efficacious under such circumstances. Or a linctus containing honey (m. xxv) and dilute sulphuric acid (m. v) ad 3 j may be tried. Lozenges, such as the *tr. morph. et ipecac.* of the British Pharmacopœia, or a lozenge containing liquorice, are often of service. An inhalation of oil of peppermint (m. xv) on the sponge of a perforated zinc inhaler is very efficacious in checking cough. Menthol may also be used for the same purpose. If the digestive powers be impaired, and there be loss of appetite and a furred tongue, an alkali with hydrocyanic acid and compound infusion of gentian is preferable. Counter-irritants, such as a blister the size of half a dollar or equal parts of the tincture and liniment of iodine, applied to the affected apex, are also of use. The iodine should always be applied in the morning, as, owing to the irritation produced being sometimes in excess of that desired, it is liable to keep

the patient awake if applied at bedtime.

Cod-liver oil is generally best taken either after meals or at bedtime; at first one or two teaspoonfuls may be given twice daily, the quantity being gradually increased; if it cannot be borne, maltine or cream may be substituted.

Night-sweating is best treated by regular bedtime doses of sulphate of atropine, from $\frac{1}{100}$ to $\frac{1}{50}$ grain, in the form of a pill. The majority of cases obtain relief by this means, but in some the atropia has no effect whatever, while in others it produces the dry throat and dilated pupil to such an extent as to prevent its regular use. Oxide of zinc, in 5-grain pills, should then be tried, or failing success by them, picrotoxin, in doses of $\frac{1}{60}$ grain. A trial may be given to strychnine, if these fail. Sponging the chest with toilet vinegar at bedtime is often of service in checking the sweating. The exhausting effect of continual sweating is very great.

In ordinary cases the first attack subsides under this form of treatment, and the patient is left with a slight cough and more or less mental and bodily depression. Advantage must be taken of this pause in the progress of the disease to restore and build up the strength by nourishing food and tonic treatment on the one hand, and by guarding against exposure to risks of fresh cold, on the other. It must always be remembered that the disease shows a marked tendency to extend at irregular periods, and with each of these attacks a similar line of treatment requires to be followed out to that suggested for the initial stages. It must, however, be frequently modified according to the progress which the disease has made. Each successive attack will leave behind it some trace in the shape of a further area of lung tissue rendered unfit for service. In the more advanced stages, and when the periods of febrile disturbance are longer, and the patient has become inured to them, it is less necessary to confine him to the house; but in cases where there is a definite tendency to recurrent attacks of bronchial catarrh, the best results are obtained when the patient is kept in a warm and equable temperature, and not allowed to expose himself to the frequent changes of temperature which are inseparable from an outdoor existence in this country in the winter.

The treatment of cases, during the

periods of comparative quiescence of the disease, must of necessity vary with the patient's social position. If he be independent of the necessity for work, he should at once be placed in the best climatic surroundings suitable to his particular case. Warm and transpirable clothing, to the limbs, as well as to the trunk, is essential for all patients, whether they be at home or abroad.

For those less fortunately situated, who must perforce remain at their own homes, close supervision is necessary to guard against the risks of catching cold. The prevention of draughts of cold air within the patient's own house is often a most important factor in the prophylactic treatment. Avoidance of chill, and strict rules as to the changing of damp wearing apparel, are of the utmost importance, and it is equally essential to insist upon the patient's remaining within doors after dusk. As regards remaining in the open air, it may be said that the longer the patient can remain out of doors the better, always provided that the temperature be above 55° F., and that he be not exposed to winds, damp air, or actual wet. Quiet corners can often be arranged, even in the smallest town gardens, in which a phthisical patient can spend the greater part of the day, during the summer months, in fresh air, without risk of exposure. He should endeavor to sit as much as possible in the sun. Nourishing food is an essential, but care is required in regulating the diet for individual cases, as there is very frequently a tendency to dyspepsia, even when the lung symptoms have become quiescent. Milk is the most important article of diet, and the richer and more creamy it is the better it suits the phthisical habit, provided that it can be borne at all, for, like cod-liver oil, it is sometimes repugnant to the stomach. Although it is always an advantage to maintain a large proportion of fatty matter in the diet, it is not advisable to give large quantities of milk or cream in association with cod-liver oil. Maltine after meals, or light bitter ale with the chief meat meal, will generally be of service, but moderation is necessary in the use of alcoholic liquors generally. Hot milk, with a little rum in it, is a favorite prescription for the early morning hunger which so commonly follows the attack of coughing with which the patient may wake. Strychnine, phosphoric acid, and

the hypophosphites of lime and soda are largely used in this stage, but not with uniform success.

The diarrhea which sometimes complicates the later stages of tubercular phthisis, if it be due to ulceration, is best treated by a pill of sulphate of copper (gr. $\frac{1}{4}$), powdered opium (gr. $\frac{1}{2}$), ext. gent. (gr. 1j), of which one or two may be given for a dose, or by frequent doses of aromatic sulphuric acid and tincture of opium, or opium enemata, with occasional saline purges given in the early morning. A close watch must be kept over the diet, which must be plain and non-stimulating. Diarrhea, the result of amyloid degeneration of the intestinal wall, is most intractable and can rarely be checked altogether. Strong astringents are, on the whole, the most successful. Complete rest directly after taking food, and support to the abdomen by means of a broad flannel binder, should be insisted upon.

Since the demonstration of the presence of the bacillus in tubercular tissues, a variety of efforts have been made to discover some method whereby the active vitality of the micro-organism may be checked and its reproduction prevented, after it has established itself within the pulmonary tissues. The inhalation of antiseptic vapors, the subcutaneous or intra-pulmonary injection of antiseptic fluids, and the injection of large volumes of sulphuretted hydrogen or carbonic oxide gas into the rectum, in the hope of the rapid absorption through the portal system and conveyance hence to the lungs, have each in turn been suggested and tried by competent observers. The results, however, are not such as to warrant the adoption of any one of them as regular modes of treatment. By thus deluging the whole body with the antiseptic fluids or gases some effect has undoubtedly been produced in the lowering of the body temperature for the time, and in some instances an improvement of the general condition with respect to appetite and gain of weight has ensued, but on the other hand it has not been shown that any marked diminution in the number or reproductive activity of the bacilli has been effected, nor have the good results been maintained for long after the discontinuance of the treatment, while the treatment itself is in each case, either unpleasant, painful, or positively nauseat-

ing and repugnant, and hence by no means popular with patients. This line of treatment has been most successful in the later stages when cavities have formed, and when active suppuration is in progress, and the patient is suffering from the effects of septicæmia.

Attempts have often been made to check septic influence in the lungs by keeping the patient for many hours in a room in which the atmosphere is continually charged with antiseptic vapor. Favorable cases have been recorded, but against these must be set a long array of patients in whom headache, nausea, and complete loss of appetite have been the only results achieved.

Inhalation of air medicated with creosote, pinol, iodoform, eucalyptol, or other antiseptic and sedative substances is at times comforting to individual patients, and may have a marked effect in allaying cough. The simple oro-nasal inhaler is sufficient for this purpose. Where there is much laryngeal irritation the steam draught inhaler medicated with carbolic acid or tincture of benzoin may be employed (*see* INHALATION). Spray inhalations are useless.

The all-important object being to maintain general nutrition, it is obvious that no line of treatment which may be liable to interfere with appetite or digestion should be attempted, even though it may promise relief to some particular symptom; caution should therefore be exercised in prescribing for phthisical persons to put the requisite drugs into a palatable form. Phthisical patients as a rule suffer from the consumption of too much physic, as the hopefulness which is characteristic in some types of the disease leads the sufferers to try every new nostrum that may be offered. It is never advisable to prescribe physic to a phthisical patient as a mere *placebo*; the temporary good that may be obtained by the faith that the physic may inspire is not commensurate with the disadvantages in the way of disturbed digestion or appetite that are at all times liable to be induced from very slight causes.

Climatic Treatment.—The climate of this country during the cold months of the year is, with a few local exceptions, unsuitable to phthisical persons. In selecting a residence for phthisical patients during the winter season, one or two cardinal points require to be con-

sidered both by patient and physician. First, it must be clearly understood that a partial climatic treatment is not worth attempting. Patients seeking to benefit by it must follow it out to its conclusion, forego all thoughts of business matters, and give themselves up entirely to the mode of life prescribed for them. Secondly, hopes should not be held out that one or more winter's absence will cure the disease. Climatic treatment is only curative in so far as it guards against recurrence of inflammatory attacks affecting the air passages, and enables the patient to live a healthy out-of-door life without fear of exposure to risks of "catching fresh cold." The natural tendency of the diseased tissues to return to a state of health is then allowed free play, and nature alone can complete the cure. Thirdly, the patient's own habits and surroundings must be carefully taken into consideration. Some are only happy in a whirl of gayety, others derive the most enjoyment from solitary life in the mountains, etc. Such considerations as these are of real importance in selecting a climate or health resort for each variety of temperament.

The most favorable climate for the arrest of phthisical inflammation is one which shall be free from all impurities, organic or inorganic; of high temperature, subject to regular variation in the evening and not liable to sudden changes; abundant in sunshine and free from cold winds. The relative moisture or dryness of the air cannot be so positively defined for all cases, as some require a more humid atmosphere than others. It is necessary that the hygienic conditions of the locality should be satisfactory, and the accommodations and the food supply sufficient. All these advantages can hardly be found combined in any one locality, but the greater number of them may be met with in many health resorts, and on long sea voyages.

The treatment by residence at high altitudes requires separate consideration. Besides the advantages of purity, equality and stillness of the climate, the rarefaction of the air places the respiratory organs under new and unaccustomed conditions. The muscular movements of respiration are increased, and the chemical interchange of gases goes on more freely. The common result of this extra activity thrown upon the lung is the production

of more or less emphysema, which is often most marked about the diseased area and may, by masking the abnormal physical signs, lead to the erroneous idea that local disease has disappeared. No cases of well-marked laryngeal tuberculosis should be sent to high altitudes, or such as are in a febrile state, nor should any be allowed to go who do not possess a sufficient area of healthy lung to enable them to breathe without discomfort in the rarefied atmosphere. Cases of dilated or enfeebled heart are specially unsuitable for mountain residence. With these provisos the following list will indicate approximately the appropriate climatic treatment for various stages of phthisis.

Patients with a family predisposition, and any threatening of actual phthisis, should not spend the cold months at home if they are in a position to avoid it.

In cases where disease, whether inherited or not, has definitely declared itself, and has begun with hemorrhage, the patient should, if possible, be removed from an unfavorable climate as soon as the first part of the autumn is over, but not until the constitutional disturbance brought about by the hemorrhage has quieted down. The selection of a suitable climate must depend upon the temperament of the individual. Excitable persons, who are liable to febrile disturbances, do best at sea, provided that they can afford all the luxuries obtainable on board ship, and that they are able to withstand the first effects of seasickness. The phlegmatic temperament, on the other hand, is more likely to benefit by a residence at one of the health resorts at a high altitude. It is only permissible to send a patient for the first time to the altitudes before the onset of winter, and if time allows, it is better that pauses should be made at a lower level station before finally settling down for the winter at the highest level. In the same way, the return in the late spring should be made gradually. Patients should be guided, as to their mode of life at the altitudes, by local medical advice.

It has been claimed for the mountain health resorts, that the purity of their atmosphere has an antiseptic effect, but this idea is disproved by the well-ascertained fact that the number of bacilli in the sputa does not decrease in proportion to the improvement in the general health.

For cases which begin insidiously with

catarrh, wasting, and anæmia, and varying degrees of fever, and for the class of cases in which the disease has already produced well-marked structure changes in the lungs and in which there is a tendency to pneumonic consolidation, or where bronchitis is apt to occur with some rise of temperature, there are few climates better than the coast of California; and the districts around Santa Barbara and Los Angeles are also suitable to these cases, provided that a good part of the time be spent on the higher grounds.

Cases of advanced chronic disease, where the respiratory surface has been much reduced, must never be sent to elevated health resorts, but will be most benefited by equable, warm, and fairly moist climates. The results of climatic treatment may be roughly summed up thus: That the early cases, if they be not attended with much pyrexia, do best at the altitudes; that cases of an excitable and irritable kind are more fitted either for sea voyages or for the warm and moist climates; that established disease is best treated by residence in equable climates where prolonged periods of sunshine can be enjoyed and where as few irritating elements as possible are present, such as dust, insects, or cold winds.

E. CLIFFORD BEALE.

J. K. FOWLER.

Success in the treatment of phthisis lies more in the prevention of the development of the disease than in the attempt to arrest its career when once begun; although the cure of even advanced cases does occasionally occur. Whether the bacilli theory of the origin of the disease be accepted as proven or not, there can be no question that phthisis is a disease of debility, arising from defective vitality. It is, as a rule, inherited, but may be induced; a general, not a local condition, and the manifestation of tubercles in the lungs is but a link in the chain of morbid changes. A decided factor in its production is an impoverished condition of the blood. It was shown by Andral and Magendie nearly fifty years ago that consumption was a disease incompatible with normally developed blood, and that when the blood was in its normal condition, that is, when it contained twelve and a half per cent. of red globules, neither consumption nor any other disease of debility could arise, but when the proportion of red globules

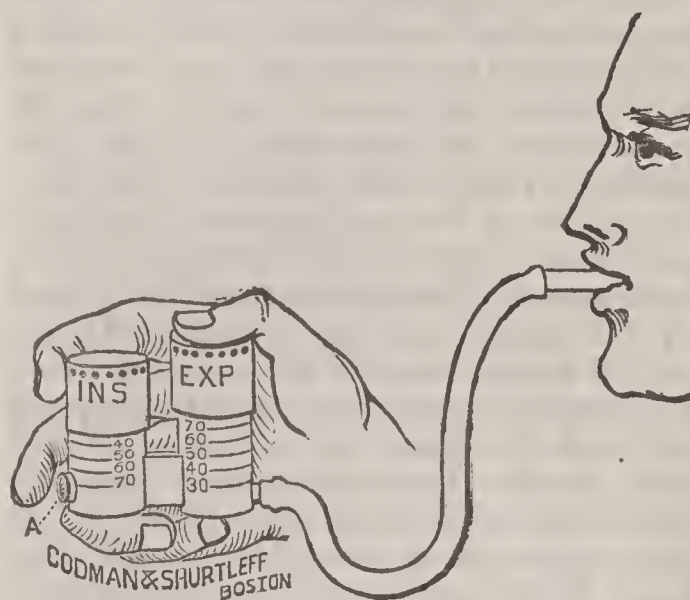
had diminished twenty, thirty, or forty per cent., a state of declining vitality existed, in which disease necessarily arose, and under favorable conditions tuberculosis was inevitable. This being true, and clinical observation extending over centuries has proven consumption to be a disease of inheritance descending from generation to generation, it is evident that when the vitality is maintained at the proper standard the disease cannot develop. The first indication, therefore, in the treatment of phthisis, is the maintenance, in those predisposed to the disease, of the normal standard of health. As the great majority of those so predisposed are not in a condition to avail themselves of the advantages to be derived from a residence in a favorable climate, the hygienic and remedial treatment must be adapted to the locality in which they, perforce, reside.

The most important of these, are : *a.* An abundance of pure, fresh air. *b.* The avoidance of over-exertion, either mental or physical. *c.* Respiratory gymnastics, including the use of compressed and rarefied air. *d.* Strict, systematic dietetic regulation. *e.* Personal hygiene. Upon the importance of the first of these, abundance of pure, fresh air, in the prevention as well as in the cure of the disease, it is unnecessary to dwell. Life in the open air has cured the disease even in advanced stages. Upon this point the great anatomist Langenbeck, after exhaustive study of the causation of the disease, said : "If I should go into practice, and undertake the cure of a consumptive, I should begin by driving him out, and prevent him from entering a house for a year or two."

The second, the avoidance of over-work, requires no comment. Almost equal in importance to these is the methodical use of such exercise as tends to the development of the respiratory muscles, and the thorough inflation of the lungs. For this purpose the chest weight, such as those of Prof. D. L. Dowds of New York, are a very convenient and valuable apparatus. The thorough inflation of the lungs may be greatly assisted by inhalation of compressed air, either by means of the pneumatic cabinet, or by an air compressing apparatus, or more readily by means of the pneumatic resistant valves [Codman and Shurtleff, Boston], by

which the inhalation of compressed or rarefied air may be accurately effected.

The object of these valves is to impede either inspiration or expiration, or both, thus prolonging the act and necessitating an increase of muscular exertion. At the same time, the pressure of air upon the pulmonary surface is differentiated from that upon the general periphery ; negatively during inspiration ; positively during expiration. The effects upon respiration and circulation, then, are



those of rarefied air during inspiration and of compressed air during expiration.

The figures 30, 40, 50, 60, 70 indicate respectively one-thirtieth, one-fortieth, etc., of an atmosphere, and, therefore, that respiration is opposed by a pressure of that amount.

Either valve may be arranged to operate at any degree of the scale by turning its cover until the lower edge corresponds with the line.

Regarding diet, only general rules can be indicated, as with the selection of the remedy for the treatment of the disease each case must be strictly individualized, and the diet which is found best adapted to the case adopted. Whatever the dietary decided upon, sufficient time should be given to each meal to insure its thorough mastication and therefore more perfect digestion. A small amount of food thoroughly masticated is far preferable to a large amount taken hurriedly. The heaviest meal of the day should be taken at such time as will permit of a more or less prolonged period of rest thereafter. The Saulsbury's Meat Diet, under which extremely favorable results

have been obtained, may be outlined as follows:

The person taking this treatment should drink from half a pint to a pint of hot water from one to two hours before each meal and on retiring at night with the object of washing out and purifying the stomach before eating and sleeping. A cup of clear tea, coffee, or beef tea may be sipped slowly toward the end of a meal. If thirsty, hot water or beef tea may be taken from one hour before to one or two hours after eating. In the beginning of treatment the patient is limited as to food to lean beef, concerning which the author says: "Eat the muscle pulp of lean beef, chopped fine, made into cakes and broiled. This pulp should be as free as possible from connective or glue tissue, fat, cartilage, fascia, tendon, etc. Steaks cut from the center of the round are the richest and best; and the beef should be procured from well fattened animals from four to six years old, and the pulp should not be pressed too firmly together before broiling. Make the cakes from half an inch to an inch thick. Broil slowly over a fire free from flame and smoke, and season to taste. Celery may be used as a relish. No other meats allowed until the stomach becomes clean, the urine clear—three pints or more daily—with a sp. gr. of 1015 or 1020, and the cough and expectoration cease to be troublesome. Then broiled lamb, mutton, game, chicken, oysters, and codfish broiled or baked, and a soft boiled egg at breakfast, if it does not color the urine, may be allowed.

"*Bread*.—Toast, boiled rice or cracked wheat may be eaten in proportion of one part, by bulk, to from four to six parts of meat. Bread should be made from gluten, white, or Graham flour, raised with yeast and free from sugar."

Personal hygiene includes bathing, which should not be too frequent. Saalsbury recommends a soap and hot water bath twice a week, afterward rubbing the body well with glycerine and water; sponging off the body with a little hot water every morning, followed by a thorough rubbing with a dry towel. The use of cold water should be avoided except in rare cases where it proves more beneficial. The clothing should be light and warm, wearing flannel next to the skin. The clothing worn during the day should be removed at night and

thoroughly aired before putting on the next day. The underclothing should be changed every day or so. Exercise, which should be taken systematically in the open air when possible, avoiding fatigue. When this is not possible, massage is frequently valuable.

Symptomatic Indications.—The most generally useful remedy is *phosphorus*, which is peculiarly adapted to the tubercular diathesis, and is equally serviceable in advanced cases and when the disease seems to be threatening in those predisposed. It is indicated by a short, dry cough, worse from lying on the affected side; pain, soreness, or oppression in the chest; burning between the shoulders; dyspnœa; prostration; emaciation; hoarseness, or aphonia; night sweats, occurring during sleep; hemoptysis or rust colored sputum; indigestion. Next in value to phosphorus, particularly in the chronic form, is *arsenicum*, which, like phosphorus, should not be too frequently repeated. It is especially indicated by great prostration, lassitude, weakness, extreme exhaustion from the least exertion, the result of the great sinking of the life forces. There is rapid emaciation; dyspnœa, and cough, especially when lying down. For the diarrhea often present it is unequaled by any other remedy. *Calcareo carbonica* is valuable when phthisis threatens, particularly in young girls with too frequent and too profuse menstruation, or in scrofulous children, with weak digestion and poor assimilation. It is indicated, when the disease has set in, by a short, hacking cough in the evening and at night, with copious, yellow, offensive expectoration, dyspnœa, and fatigue from descending any height; indigestion, with repugnance to fatty foods; acid eructation. *Iodine* is a valuable remedy when emaciation is the first symptom of the disease; swollen glands; cough from constant tickling in the windpipe and under the sternum; expectoration of transparent mucus; morbid hunger. *Ferrum* is sometimes useful, when there is much anæmia; emaciation, hemoptysis, and painless diarrhea; pale face, which becomes much flushed on least exertion; cough dry at night, but with copious expectoration in the morning. *Cinchona* is valuable for copious perspirations whenever the patient falls asleep, day or night; hectic fever; prostration after hemor-

rhage; disease induced by exhaustion from loss of vital fluids, as over-lactation. *Drosera* is very serviceable for the relief of cough; paroxysmal cough; the paroxysms come on every two or three hours and last a longer or shorter time, frequently ending with the vomiting of mucus or food; profuse, disagreeable expectoration at the end of the cough.

The inhalation of the vapor of hydrastis has been used, it is claimed, with excellent results in the treatment of phthisis (see INHALATION). The volume of the vapor inhaled should be moderate at first, and gradually increased as the patient becomes accustomed to its use, deep inspirations being taken to insure the vapor penetrating to the distal air cells. The inhalation may be given once or twice a day until improvement sets in, when the frequency may be regulated according to the exigencies of the case.

PHTHISIS, LOCALIZATION OF LESIONS OF.—While almost every writer has an explanation to offer for the apex-site of the primary lesion, and all recognize that in the early stages of phthisis the base is but rarely affected, scarcely any mention is made of the mode in which the disease progresses between these two points, or of the order in which the various parts of each lobe are affected.

Walshe thus describes the anatomical characters of phthisis. Yellow tubercle, whether preceded or not by the semi-transparent gray granulation, and whether accumulated in isolated or grouped masses, or infiltrating the pulmonary stroma, affects a special preference for the apex and upper lobe—either spreading thence downward uniformly, or leaving islets of parenchyma of various sizes unoccupied in its transit toward the base. Exceptions to this topographical mode of progress (on which the diagnosis of the disease so often turns) are infinitely rare in chronic tuberculization, the base of the lung proving the primary seat of the process, not oftener, it has been calculated, than once in sixty or eighty instances.

The softening process, like that of original deposition, commences at the apex of the lung and spreads downward.

Ewart was the first to draw attention to the remarkable proneness to disease of the dorso-axillary region, and of its

greater proneness to excavation. In 304 lungs he found cavities in this area in 227 cases. He states: "I doubt whether clinical observations have hitherto led to so high an estimate of the frequency of this lesion. A knowledge of this pathological fact cannot fail to stimulate a more searching clinical exploration of a region so liable to disease, and to strengthen the conclusions which our diagnosis may derive from physical methods of examination."

Dr. Ewart adopts the areas of the chest-wall as the basis for his classification of cavities according to their situation; in this article the lesions are described as they affect the different lobes of the lungs.

The following extract is from the work of Dr. Hilton Fagge:

"I must insist on a point which has long been known both to physicians and pathologists, namely, that the upper parts of the lungs are almost invariably affected with phthisis, in whatever form, before the lower parts; and that in all but the most exceptional instances the disease spreads downward from the apex to base, often with almost perfect regularity. The rate of proclivity of the apex is liable to some other exceptions. In certain cases the tubercles appear a little lower down, leaving one or two cubic inches at the extreme summit of the upper lobe free from them. But sometimes the middle of the organ is first affected, or even the lower lobe, the upper angle of which is indeed very often the seat of a vomica, in ordinary instances of phthisis.

"But I believe it never happens that the tubercular process spreads upward from the base of a lung into and through the upper lobe. And it is certain that what has sometimes been called 'basal phthisis' is a distinct affection, which has been described under the name of chronic pneumonia."

It may be fairly said that, until quite recent times, our knowledge of the progress of pulmonary phthisis has been limited to the fact that "the softening process, like that of original deposition, commences at the apex and spreads downward."

The writer has not anywhere met with the statement that the disease, in its onward progress through the lungs, in the majority of cases, follows a distinct route, from which it is only turned aside by the introduction of some disturbing element.

Now, this fact, if fact it be, is of great importance in that it tends to give increased definiteness and certainty to information which we may gain from an examination of the chest. If we are prepared to find lesions anywhere and (the apex excepted) attach no particular importance to their being situated in one place rather than another, our knowledge of the conditions present and our ability to forecast the future progress of the case may be very different from what it would have been had we begun the examination with a clear idea, not only that the disease, as a rule, followed a definite line of march, but also of the actual route likely to be taken. We should then first have searched the apex in various sites of election of primary lesions; finding evidence of disease there, we should have followed it along its usual course in the upper lobe and have estimated its extent by noting its furthest limits. Then, turning to the lower lobe, with a knowledge of the point most likely to be first attacked and of the lines along which the disease progresses in that part of the lung, we should have determined the presence and amount of infiltration; and our examination completed, the mental picture of the extent of lung involved might have been almost as clear as though the organs had been exposed to our view.

On the other hand, we might discover that the disease had not followed its ordinary course, and that, while the total area of lung involved was still very small, a part, usually affected at a late period only, already showed signs of infiltration. This would start us on a search for some disturbing factor, such as a previous attack of pleurisy, which, by diminishing the resisting power of a portion of the lung, had allowed such an inversion of the natural sequence of events to take place; or, more important still, it might inform us that the disease was not of that subacute or chronic type in which the progressive development of lesions about to be described is usually found. Or again, it might be a question whether or no the disease was of a tuberculous nature; now the probability of such being the case is much increased if the lesions are found in situations most affected by tubercle.

This is no fanciful statement of the exact knowledge to be obtained from

physical examination of the chest in phthisis, if the assertion of the existence of a definite "line of march" of the disease should prove correct. Extensive lesions may of course be present of which there may be no evidence: but that fact tells for nothing, as we are only concerned with cases in which physical signs are to be found.

These conclusions are based on considerable experience in the post-mortem room; but, as the particular distribution of lesions here described is likely to be overlooked unless sought for in a certain way, it is necessary to describe first the mode of examining the lungs adopted. The sections should always be in the same lines, the first exposing the largest possible surface, and all others in the same lobe parallel with it; the organ after the examination presenting an appearance similar to the leaves of a book. The left lung is placed on the table with the root downward and the *base* toward the examiner. If there be no interlobar adhesions, or only such as can be easily broken down, holding the blade parallel with the table, make a section through the upper lobe at the level of half the depth of the interlobar sulcus, commencing just below the apex and extending thence along the posterior border and the sulcus. The section must stop before the part is entirely severed. This "leaf" should then be turned over, and the whole of the upper lobe will be displayed.

The first section through the lower lobe is made along the prominence of the posterior border, through the base, and then toward the sulcus again, stopping before the part is completely separated.

If the interlobar adhesions cannot be separated without injury to the lung, a single long section should be made from apex to base along the posterior border, and carried through the lung toward its anterior margin.

The right lung is placed on the table with the root downward and the *apex* toward the examiner.

Any easily separable interlobar adhesions having been dealt with as already directed, the point of the blade is inserted at the lower and anterior extremity of the upper lobe, and an incision is made at the level previously mentioned, upward and outward toward its apex and anterior margin. The middle lobe is

separately incised from below upward. The incision in the lower lobe, starting from the anterior margin of the base, is continued through this part and along the prominent posterior border, stopping short of the sulcus, so that the section may not be complete.

If the interlobar adhesions cannot be easily broken down, a single section is made as in the left lung, but from base to apex instead of *vice versa*.

If it be made a rule to examine the lungs after this method, there is no difficulty in appreciating the arrangement of lesions about to be described; if, however, a number of irregular incisions be made, and no definite plan adopted in the examination of each lobe separately, all traces of the progressive march of the disease may easily be lost.

As it is rare to find anyone who, without having had reason to study the subject specially, is acquainted with the exact relations of the different lobes of the lungs to the chest-wall, and as such knowledge is obviously necessary in order to follow the spread of the lesions from one point to another, it is necessary to introduce here a few anatomical details.

The apex of each lung rises about one inch and a half above the clavicle. On the left side almost the whole of the front of the chest is occupied by the upper lobe, only the anterior extremity of the lower lobe being visible. On the right side the front of the chest above the fourth interspace is occupied by the upper lobe, below that by the middle lobe, only the point of the lower lobe coming in, as on the opposite side. Behind, the fact which is chiefly to be noted is that the lower lobes reach as high as the third dorsal spine, and the right, being, however, usually rather lower than the left, thus occupy almost the whole of the posterior surface of the chest, except that part which roughly corresponds to the supra-spinous fossæ. The septum between the left upper and lower lobes, starting from the third dorsal spine posteriorly, extends obliquely downward and forward, crossing the fourth and fifth interspaces, passing behind the scapula and sixth rib, in the axilla, to the upper border of that rib in the mammary line.

On the right side the line of the septum terminates at the eighth rib just outside the nipple line; a second sep-

tum, starting behind the scapula, just external to the posterior fold of the axilla, runs transversely forward along the fourth interspace to the middle line, thus forming the middle lobe. The above statements are approximately true in the majority of cases, but the exact relations of the various lobes and septa vary somewhat in different subjects. The limits of the bases of the lungs are not now of importance.

The erroneous views most commonly held with regard to the relation of the lobes to the chest-wall are, first, that a considerable portion of the front of the chest is in relation with the lower lobes; secondly, that the right middle lobe is situated much further back than is actually the case; and thirdly, that the lower lobes occupy far less of the posterior surface than they really do.

In the diagrams, for the sake of greater clearness, the outlines of the lobes are completed, and in Fig. 1 the upper lobes are separated more widely beneath the sternum than is actually the case.

The exact situations occupied by the primary and secondary lesions in the different lobes of the lungs will now be described in detail.

Sites of Lesions in the Upper Lobes.—The extreme apex of the lung is not often the site of the primary lesion; this usually occupies one of the two situations marked on the accompanying diagrams (Figs. 3 and 4). Of the two the former is by far the more common; it is situated from an inch to an inch and a half below the summit of the lung, and rather nearer to the posterior and external borders. Lesions in this situation tend to spread in the first instance backward, possibly from inhalation of the virus while the patient is lying down. This line of extension explains the fact that an examination of the supraspinous fossa will often give certain evidence of the presence of disease when the physical signs in front of the chest have left us in doubt, proving that the changes, as is generally the case, are more advanced there than toward the front of the chest. The investigation, therefore, of this part of the lung is so important that it should never be omitted.

From this primary focus, which in front corresponds either to the supra-clavicular fossa or to a spot immediately

below the center of the clavicle, the lesions often first spread downward along the anterior aspect of the upper lobe, about three-fourths of an inch

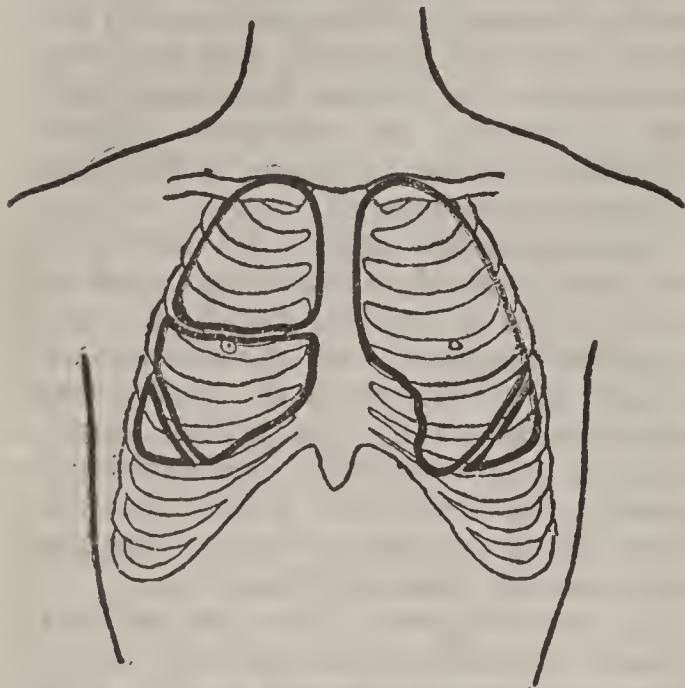


FIG. 1.—Showing the relation of the lobes of the lungs to the front wall of the chest.

within its margin, frequently occurring in scattered nodules, separated perhaps by an inch or more of healthy tissue. If, therefore, the disease appear to be limited to the upper lobe, a careful examination should be made along a line running about an inch and a half from the inner ends of the first, second, and third interspaces. It is not unusual to find in these scattered nodules the only evidence of disease on the anterior aspect of the lung, when, posteriorly, excavation has advanced to such a degree that little more than the two layers of the pleura, united by adhesions, remain. This is an additional reason for making a careful examination of the supraspinous fossa.

The second and less usual site of the primary affection of the apex is seen in Fig. 4. This corresponds on the chest-wall with the first and second interspaces below the outer third of the clavicle. The lines of extension are usually downward, so that after a time an oval area of lung is involved, occupying the outer part of the upper lobe in the situations just mentioned. It has seemed to the writer that the spread of the disease is more rapid when the primary lesion occupies this site. The lesions in the advanced stages—cavities—are of course formed by the coalescence and

extension of these primary foci. The scattered nodules of consolidation on the anterior surface of the lung often unite and break down, forming a long, sinuous cavity which may extend almost to the lower anterior margin of the upper lobe; posteriorly, where, as already stated, the signs of excavation are usually most distinct, the further progress of the disease is generally arrested at the pleural reflexion in the interlobar septum. This was found by Dr. Ewart to be destroyed, and the cavities in the upper and lower lobes united, in only five out of 152 consecutive cases of phthisis examined post mortem.

In rare cases the whole of a lung may undergo destruction, a large sac, bounded by the pleura, being formed.

Site of Lesions of the Middle Lobe.—The middle lobe of the right lung is rarely the site of a primary tuberculous lesion. It is, almost invariably, affected after the upper lobe of the same side and usually at a rather late period of the disease, while not uncommonly it escapes altogether. The lesion most commonly found there is a coarsely granular tuber-

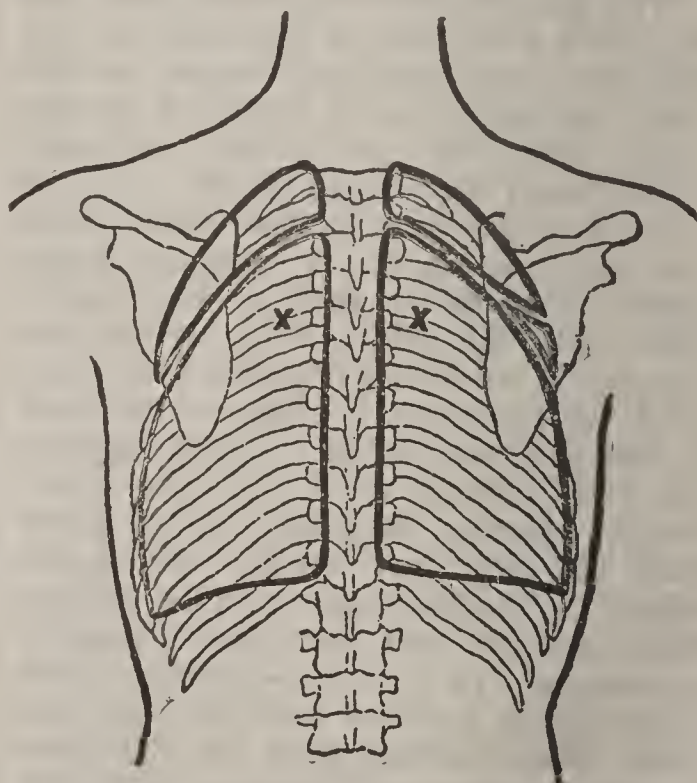


FIG. 2.—Showing the relations of the lobes to the wall of the chest posteriorly. The X marks the usual site of early infiltration of the lower lobes.

N. B.—The apex of the right lower lobe should have been slightly lower than the left.

culo-pneumonic nodule, often of large size, in process of caseation at its margin, with an area of softening in the center.

Extension of the Lower Lobe.—The lower lobe of the lung primarily diseased is usually affected at a very early period of the disease, often long before any extensive infiltration or destruction of the upper lobe has taken place, and as a rule before the apex of the opposite lung.

The site of the secondary infiltration of the lower lobe is indicated in Figs. 2 and 3. It is situated about an inch to an inch and a half below the upper and posterior extremity of the apex of the lower lobe, and about the same distance from its posterior border, although in some cases it may be found nearer to and even at the apex of this lobe. This situation nearly corresponds on the chest-wall to a spot opposite the fifth dorsal spine (See Fig. 2), midway between the border of the scapula and the spinous processes.

The infiltration of the lower lobe at this site in the early stage of phthisis is one of the most constant features in the pathological anatomy of the disease, and its recognition is a point of the greatest clinical importance, as the existence of a lesion in the lower lobe at this spot coincident with physical signs at the apex, even though the latter be in themselves of doubtful import, is strongly suggestive

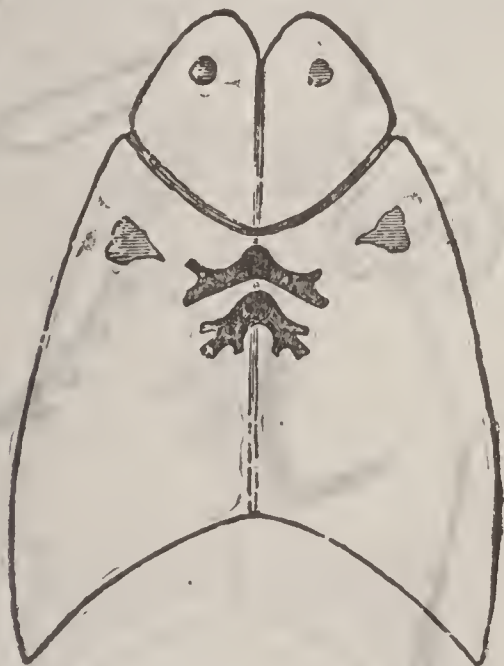


FIG. 3.—Diagram of a vertical median section of the lung, from back to front, showing one of the sites of the primary infiltration in phthisis; also the site of early infiltration of the lower lobe.

of the presence of pulmonary tuberculosis.

At what an early period this infiltration of the lower lobe takes place may be gathered from the fact that, from a careful observation extending over several

years, it may be stated that in the great majority of cases, when the physical signs of disease at the apex are sufficiently definite to allow of the diagnosis of phthisis being made, the lower lobe is already affected.

It would therefore appear that the upper and posterior part of the lower



FIG. 4.—Diagram of the left lung, viewed from its outer border, showing a less usual site of primary disease of the apex.

lobes is a spot in the lungs only second in point of vulnerability to the apex itself.

The absence of any sign of infiltration there is not, however, proof of the non-tuberculous nature of an apex lesion, as it is quite possible in some cases, from the physical signs alone, to arrive at a diagnosis of phthisis before the lower lobe is affected. The importance of the examination of the sputa has been already referred to.

On one point it is possible to speak positively, viz., that no report of the condition of the lungs in a case of apical disease is complete without a distinct statement as to the condition of the "posterior apex" (for brevity's sake so-called) of the lower lobe. If careful attention be given to this point less will be heard of cases of "catarrh of the apex," which are often assumed to have been non-tubercular from the subsequent disappearance of the physical signs; such cases must often be examples of arrest of the disease in the first stage, and help to explain the very frequent discovery of that condition post mortem.

In the description of the result of climatic or medicinal treatment in the early stage of phthisis it is commonly

stated that the disease was limited to the apex of one or both lungs. In a recent account of the climatic treatment of twenty cases of phthisis, in thirteen of these the disease is said to have been



FIG. 5.—Showing the line of extension of a lesion of the lower lobe along the interlobar septum.

limited to one apex, while in four both apices were affected, and in no case is there any mention of the condition of the lower lobes except when the whole of a lung is stated to have been affected.

Cases in which the lesions are confined to both apices, no other portion of either lung being affected, are not frequent. It is common enough to find arrest of pulmonary tuberculosis when one apex and its corresponding lower lobe have been affected, but it rarely happens that arrest occurs at both apices without infiltration of either lower lobe. The early stage of the disease at which the lower lobe is implicated is well illustrated in lungs presenting apex lesions which have undergone arrest. The area of disease may not be larger than a cherry or an olive, but if the process was tuberculous a nodule will almost invariably be found in the lower lobe. This arrangement of lesions thus becomes an important rough post-mortem test of the presence of tubercle, and is strong evidence in favor of the existence of a "line of march" of the disease.

In a few of the cases observed, post-mortem lesions not presenting a trace of tubercle were present at the apex—*e.g.*, collapse followed by bronchiectasis, or changes resulting from old pleurisy the lower lobes were quite free from disease.

This lesion once established tends to

spread backward toward the posterior border of the lung, and at the same time laterally along the line of the interlobar septum (Fig. 5), forming a doubly wedge-shaped area of infiltration gradually narrowing as it extends outward. It follows from this that even in the early stages of the disease, in order to ascertain the extent of lung affected, we must examine the lower lobe, not only opposite the fifth dorsal spine, but also along the line of the interlobar septum. This line is roughly marked by the vertebral border of the scapula, when with the hand upon the spine of the opposite scapula the elbow is raised above the level of the shoulder (Fig. 6).

The mode of extension toward the base of the lung is not usually by an advancing line of consolidation, but by scattered nodules of infiltration often arranged in a racemose manner (Fig 7). Even at the termination of a chronic case some healthy, or at least uninfiltrated, tissue will generally be found at the base, even of the lung primarily affected. This freedom of the bases from phthisical lesions is another very marked feature in the pathological anatomy of the disease. In estimating the probability of any basic

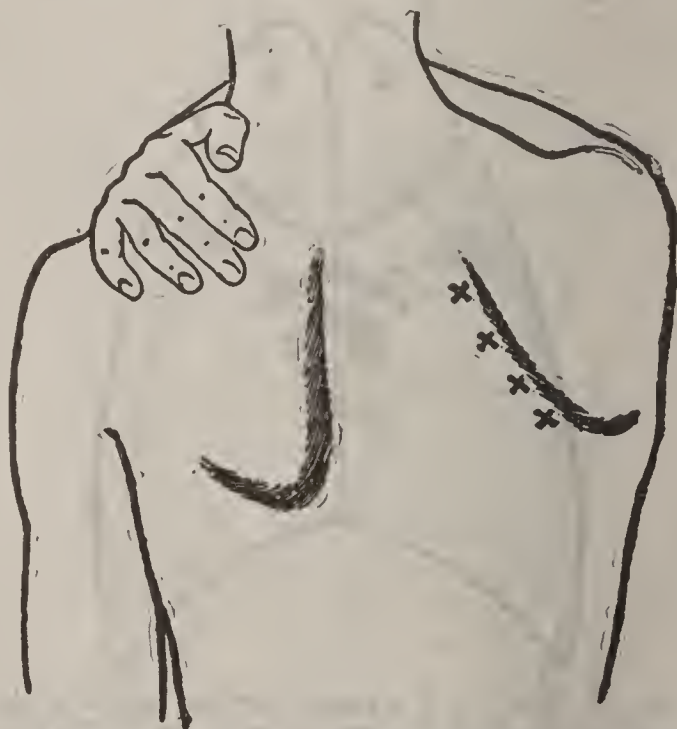


FIG. 6.—Showing the position of the arm when the vertebral border of the scapula indicates (roughly) the usual line of extension of lesions along the interlobar septum.

lesion being tuberculous in origin, it is important to observe whether the physical signs of disease in the lower lobe are continuous from its apex posteriorly, downward to its base; if so, the lesion is

probably tuberculous. If the base be affected, but the apex of the lower lobe be free from disease (see Fig. 8), the basic lesion is either non-tuberculous—*e. g.*, due to œdema and collapse, followed by



FIG. 7.—Showing the usual mode of extension of the disease toward the base of the lung.

bronchiectasis, catarrhal pneumonia, or pleurisy, etc.; or if tuberculous, the resisting power of the base has been diminished by some previous affection—for example, an attack of pleurisy followed by partial collapse; but the presumption is strongly in favor of a non-tuberculous lesion.



FIG. 8.—Typical arrangement of lesions in a case of apical phthisis with non-tuberculous disease of the lower lobe.

In enumerating the exceptions to the usual arrangement of the lesions, the varieties of chronic disease which may be met with at the bases of the lungs have been tabulated.

Mode of Extension to the Opposite Upper Lobe.—Tuberculous infiltration in the upper lobe of the lung not primarily affected often occurs at an early period, but not usually until after the disease has attacked the lower lobe of the lung first affected.

The lesions may be found in either of the common situations indicated in Figs. 3 and 4, and are therefore symmetrical in site, but in different stages on the two sides. There is, however, a third site for the secondary infection of the opposite upper lobe, which is figured in the accompanying diagram (Fig. 9). It is situated close to the interlobar septum, about midway between its upper and lower extremities, and corresponds on the

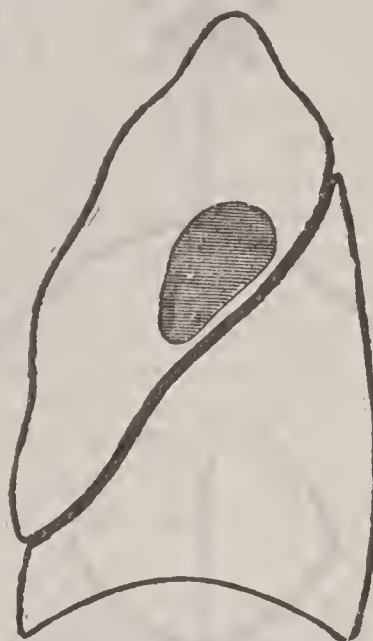


FIG. 9.—Showing an occasional site of lesion in the lung not primarily affected.

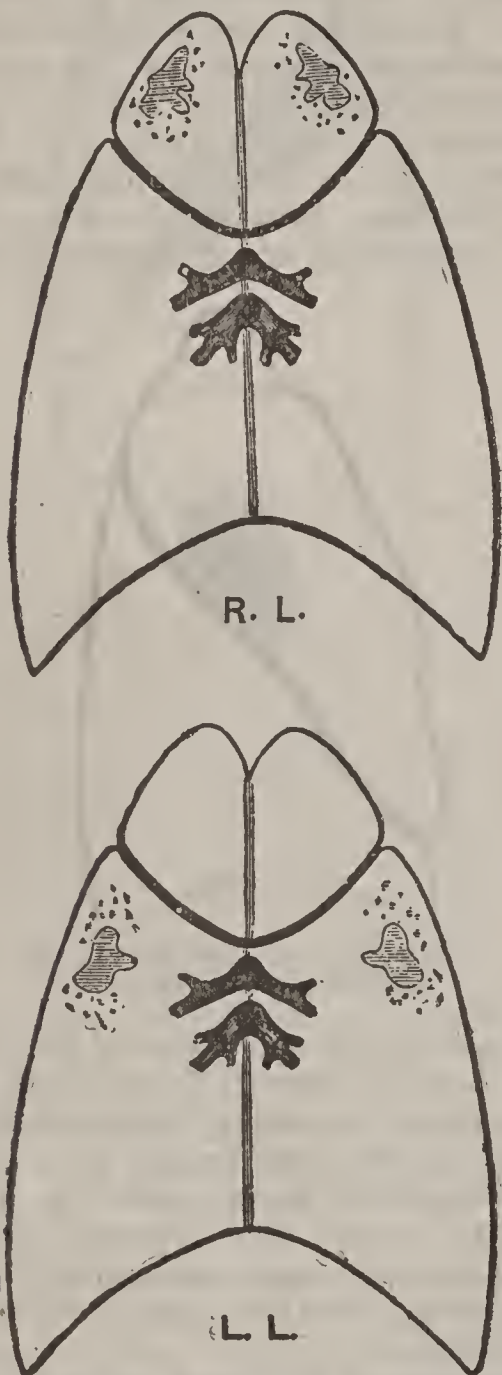
chest-wall to the upper part of the axilla. Small areas of consolidation form here and coalesce, but rarely break down into a cavity of any considerable size. Once established, this lesion tends to spread laterally, inward and upward, and is often found to occupy a considerable area of the lung when the apex is quite free from disease.

Infiltration of this area, when present, generally follows that of the lower lobe of the lung first affected. It follows from this that, in addition to the apex, the upper part of axilla must be carefully examined before the other lung can be pronounced to be free from disease in a case of phthisis apparently limited to one apex.

Extension to the Lower Lobe.—The distribution of the lesions in the lower lobe of the lung secondarily diseased is

usually similar to its fellow on the opposite side and presents no peculiarities. The first infiltration is situated below the posterior apex, and this extends along the interlobar septum and ultimately downward toward the base, but it is rare for the lower margin to be reached before death takes place.

Crossed Lesion of the Lower Lobe.—The writer has met with a considerable



FIGS. 10 and 11.—Illustrating a "crossed lesion," i. e., from right apex to left lower lobe.

number of examples post mortem, and has been able to recognize a few clinically of what may be termed a crossed lesion of the lower lobe (Figs. 10 and 11). The usual mode of extension to the lower lobe is, as just stated, from (say) the left apex to the left lower tube, but occasionally the lower lobe of the lung primarily affected escapes infiltration, and

the disease crosses over to the right lower lobe. In such a case, the site of secondary infiltration is the usual one near the posterior apex. In all cases, therefore, of apex disease it is necessary to examine both lower lobes before deciding that the disease is limited to that spot.

Exceptional Arrangement of Lesions.—As already stated, the line of march here laid down, although covering the great majority of cases, is subject to certain exceptions. Speaking generally, this arrangement of lesions is seen in its most typical form when the progress of the disease is slow, and is less distinctive of cases marked by acute symptoms and rapid extension from lobe to lobe and from one lung to another. Time is necessary for the temporary localizations of the disease which such a mode of progress as is here described requires, but there is rarely any inversion of the natural order. The disease spreads in each lobe from above downward, hardly ever from below upward, but in the lower lobe the onward march may be so rapid that one does not find that limitation of the affection for a time to the posterior apex and extension along the interlobar septum which are such marked features in the pathological anatomy of cases which run a subacute or chronic course.

Upper Lobe.—In an example lately observed, a lesion which had gone on to the stage of cavity appeared to be placed almost midway between the two sites of primary lesions indicated in Figs. 3 and 4. In this case the posterior part of the upper lobe and the apex of the lower lobe were apparently not affected, as there was a complete absence of physical signs in the supraspinous fossa and also opposite the fifth dorsal spine. It is possible that further observations may show that the disease tends to run a different course when the primary lesion occupies this site.

When the usual sites of infiltration in the upper and lower lobes are already occupied by arrested lesions, and a second tubercular infection of the lung occurs at some later and perhaps distant date, the more recent lesion in the upper lobe usually occupies a position close to the interlobar septum, while that in the lower tube is situated along the posterior border, and extends almost to the base (Fig. 12).

This observation is of importance in so far as it helps to explain the occurrence in some cases of basic disease, and will be referred to again in the description of le-

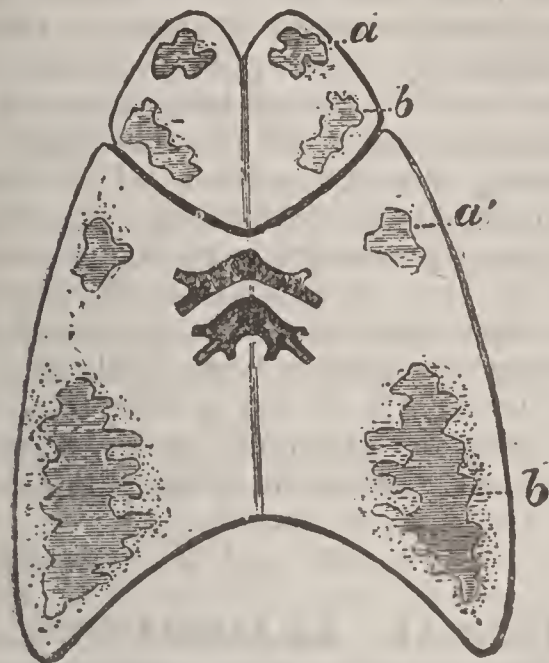


FIG. 12.—Illustrating the situation of lesions in secondary infection of a lung the seat of arrested phthisis; *a*, *a'*, arrested lesions; *b*, *b'*, recent lesions.

sions of the lower lobes occupying exceptional situations.

Lower Lobe.—The accompanying diagram (Fig 13) illustrates an unusual lesion, of which the writer has met with several examples.

A second cavity, almost equal in size to that at the posterior apex, is seen in the lower lobe about midway between that spot and the base, and close to the posterior border, the intervening area being almost free from disease and the base quite unaffected. In no case observed has this cavity been present while the usual area of disease in the lower lobe remained uninfiltated.

Basic Lesions.—Reference has already been made to the comparative freedom of the bases of the lungs from tuberculous disease; whenever, therefore, a lesion is found in this situation a most careful survey should be made, both of the history of the case and of the physical signs present, before coming to the conclusion that the basic disease is tuberculous.

The most common varieties of chronic disease affecting the bases of the lungs may be classified thus:

(a) *Non-Tuberculous Basic Disease:*

1. Collapse of the lower lobe caused by pleural effusion; followed by absorption of the fluid and falling

in of the lower part of the chest on the affected side.

2. Collapse from the same cause, followed by cirrhosis of the lung and bronchiectasis.
3. Empyema opening into the lung.
4. Hepatic abscess, or hydatid cysts of the liver, communicating with the lung.
5. Collapse of the lower lobe from pressure on the main bronchus by a growth or enlarged and infiltrated mediastinal glands, followed by bronchiectasis.
6. Diffuse gangrene of the lower lobe resulting from a communication between the bronchi and the esophagus, either directly or through the medium of a softened bronchial gland.
7. Chronic pneumonia and bronchiectasis following on the impaction of a foreign body in one of the bronchi of the lower lobe.
8. Unresolved and chronic pneumonia of the lower lobe.
9. Bronchiectasis secondary to catarrhal pneumonia and collapse. This lesion is rarely found except in children.

(b) *Non-Tuberculous Basic Disease complicated by subsequent Tuberculosis.*



FIG. 13.—Illustrating an unusual arrangement of lesions in the lower lobe.

Cases presenting basic lesions are occasionally met with in which the disease, originally non-tubercular, has had the tuberculous process engrafted on to it at some later period; the lower lobe being infected, either directly or, which

is perhaps more common, subsequently to the apex of the same lung. This complication is very likely to occur where bronchiectasis forms a part of the original lesion, but may also be found in cases of chronic pneumonia, and in other forms of non-tuberculous basic disease enumerated above.

(c) *Basic Phthisis.*

1. Phthisis with physical signs most marked at the base, but the oldest lesions at the apex.
2. Phthisis with arrested lesions at the apex and at the posterior apex of the lower lobe, more recent lesions in the upper lobe and also at the base (see Fig. 12).
3. Primary basic phthisis.

The mere enumeration of the many varieties of disease affecting the bases of the lungs is sufficient to show what caution is necessary before arriving at a diagnosis of primary basic tuberculosis. Dr. Kidd saw two such cases, being the only instances met with in 412 consecutive cases of phthisis examined post mortem.

When the lower lobe is shown on post-mortem examination to have been the site of primary tubercular infection it will usually be found that its resisting power and functional activity have been diminished by previous disease either of the lung or pleura. In both of Dr. Kidd's cases firm pleuritic adhesions were found at the base. In nearly all cases presenting lesions in unusual situations, it is possible by careful inquiry and examination to determine the cause of the departure from the normal course.

In such cases as show the arrangement here described most typically, it is probable that the disease spreads chiefly by inhalation of the virus from one point to another through the medium of the bronchi. Where, however, the blood or lymph vessels form the chief channels of dissemination, as, for example, in acute pulmonary tuberculosis, and probably also in the more acute forms of phthisis, it is difficult to recognize, either during life or on the post-mortem table, that the lines of extension of the disease are such as are here indicated. This does not, however, diminish the value of these observations, provided they are sound; for the mere fact that no definite line of march can be made out is often in itself of the greatest importance in the prognosis of

the case, as it may indicate that the disease will run a rapid course. One of the chief dangers which beset the subject of chronic or arrested phthisis is the liability at any time to an outbreak of acute pulmonary tuberculosis. In such a case it is constantly seen, post mortem, that while the older lesions have followed the course here described, the remaining and previously healthy portions of the lungs have been rapidly infiltrated with miliary granulations arranged in no definite order. That in the interpretation of physical signs their exact site is a matter of importance has always been held with respect to lesions at the apices; this doctrine may be extended to all signs of disease, no matter in what part of the lungs they may be found.

J. K. FOWLER.

PHYSICAL EXAMINATION.—In accordance with the plan adopted throughout this work, such terms as are in common use and likely to be sought for independently (PALPATION, PERCUSSION, AUSCULTATION, MENSURATION) have been described under their proper headings. It is therefore only necessary here to indicate the order and method in which a physical examination should be conducted, and to describe the appearances observed on INSPECTION.

The presence of any given disease is determined by the existence of *signs*, which are either obvious to, or discoverable by, the observer, and of *symptoms*, which are subjective sensations appreciable by the patient alone. The word *sign* is generally qualified by the adjective *physical*, and the present tendency is to limit that term to such signs as are present in diseases of the lungs and heart.

A patient, for example, may complain of certain symptoms, and may present such signs as a flushed face, a high temperature, quickened pulse and respiration, but if, on examination of the chest, nothing definite be discovered, it is nevertheless common to state that there are no "physical signs."

Regions of the Chest.—For convenience of description, it is best to indicate the position of any physical sign by reference to certain vertical lines and a given rib or interspace. The vertical lines are: (1) The mid-sternal line, (2) the nipple line, (3) the anterior, mid, and posterior axillary lines, (4), the posterior scapular

line (vertebral border of the scapula, (5) the vertebræ. The normal position of the cardiac apex is thus described: "In the fifth interspace one inch within the nipple line."

The following regions are commonly spoken of without their boundaries being accurately defined:

Anteriorly.—The supra-clavicular, the infra- or sub-clavicular, the mammary, and infra- or sub-mammary regions.

The suprasternal notch, the upper and lower sternal regions.

Laterally.—The axillary and infra-axillary regions, or upper and lower axillary.

Posteriorly.—The supraspinous fossa, the infraspinous fossa, the interscapular region, and the base.

Regions of the Abdomen.—The abdomen is divided into nine regions by the intersection of vertical and horizontal lines, the former drawn from the eighth rib to the center of Poupart's ligament, the latter on a level with the lowest point of the costal arch and uniting the anterior superior iliac spines. The central regions are from above downward, the epigastrium, the umbilical region, and the hypogastrium; on either side are the hypochondrium, the lumbar region, and the iliac region.

The examination of the lungs, heart, and abdomen is conducted in the following order: (1) inspection, (2) palpation, (3) percussion, (4) auscultation, (5) mensuration. No matter how experienced the examiner, it is rarely advisable to depart from this order, as so doing may entail the necessity of recommencing the examination when half finished.

Inspection.—This step, although much neglected by students, is certainly in importance equal to, if not greater than, any other part of the examination. So much is there to be learnt from inspection, that it is often possible in a case of phthisis, and even in some valvular affections of the heart, by simply looking at the chest to make a near approach to an accurate diagnosis.

Of the Chest.—The patient should be placed in a good light and the observer should stand opposite to him. Attention should be directed to the various points in methodical order.

The condition of the integuments and of the superficial vessels must be noted. The *shape* of the chest is of importance.

The normal chest is well proportioned in the various diameters, the sternum has a slight curve forward, the angle of Ludovici (junction of second cartilages with the sternum) is fairly marked.

In phthisis, on the other hand, the chest may be long and narrow, the upper interspaces wide, and the antero-posterior and lateral diameters diminished; or it may be fairly broad, but flat in front. The point of the shoulder may be lower and the supraclavicular fossa may be deeper on one side than the other, and there may be a depression beneath one clavicle, indicative of shrinking of the corresponding lung. In pleurisy with effusion a bulging of the affected side may be observed.

In emphysema the chest tends to assume a rounded outline, the "barrel-shaped chest," the antero-posterior diameter is much increased, and the sternum arched forward. In rickets there is often a depression running obliquely downward and outward from the mammary regions to the costal margin, giving the transverse section of the chest the shape of a fiddle; with this the sternum may present the typical "pigeon breast." Again, the local bulging, due to an aneurism of the aorta, may arrest attention on inspection.

Shoemakers often have a depression of the lower part of the sternum, due to the manner of holding the boot when at work.

Behind.—Notice the position of the scapulæ, as any retraction of the upper part of the chest usually manifests itself by a drooping of the shoulder and lowering of the angle of the scapula, which is also seen to be nearer to the vertebral column. The long narrow chest is sometimes termed "alar," from the projecting wing-like position of the shoulder-blades, due to the drooping of the shoulders.

Movement.—The expansion of the normal chest is equal on the two sides, and causes an increase in all the diameters. In disease it may, from various causes, be unequal, or absent, the enlargement being effected by the descent of the diaphragm, the chest only moving upward "*en masse*."

If there be obstruction to the entrance of air, the intercostal spaces will be observed to sink in during inspiration; generally, if the obstruction be in the larynx or trachea; locally, if the obstruction be local.

Of the Heart.—The site of the apex beat will first be observed. The impulse may be diffused, and in emphysema is often most obvious in the epigastrium. The precordial region may be bulged in consequence of hypertrophy; this is not uncommonly seen in the case of children with valvular disease. Systolic recession of the interspaces or epigastrium, or even of the ensiform cartilage, may be present. The value of these signs in the diagnosis of pericardial adhesion is discussed under that heading. The heart may be uncovered by the retraction of the left upper lobe, and the apex may be obviously displaced from a variety of causes.

Of the Abdomen.—The condition of the superficial vessels will be noted, and the state of the abdomen as regards distention or retraction. Distention may be general or local. Peristalsis may be observed, and is sometimes indicative of gastric or intestinal obstruction. The attitude of the patient is of importance.

J. K. FOWLER.

PHYSOMETRA.—Distention of the uterus by air or gas may occur during labor, or in the puerperal state, or with atresia or blocking of the cervical canal, independent of pregnancy. It is rare, and cases apart from labor are very rare. It results from decomposition of a dead fetus, of the liquor amnii, or placenta, or of retained secretions. It is said to occur "in hysterical women." This means that hysterical women have sometimes passed wind from the rectum, and said it came from the vagina. Retention of air in the vagina, and its subsequent expulsion, sometimes with noise, is commoner, and has been mistaken for physometra, which is identified by the resonance on percussion of the distended uterus, and the escape of gas when the cervical canal is opened up.

Treatment is that of the condition on which physometra depends.

PITYRIASIS.—A term formerly attached to various pathologically dissociated diseases of the skin, the most striking clinical feature of which is the presence of fine, branny desquamation or scurf. Thus pityriasis simplex capitis is now known to be a seborrhea sicca; pityriasis versicolor is due to a vegetable parasitic micro-organism, and is therefore now called tinea versicolor (*q. v.*). The

word is still in general use to designate two diseases.

Pityriasis Rosea (*vel Maculata et Circinata, Erythema Furfuracea, Roseola Circinata*).—A trivial and comparatively rare affection. There are sometimes slight febrile and gastric prodromata to the rash.

Eruption.—This is patchy, and consists of bright pink macules and slightly raised papules, roughly circular or oval in form, which vary from $\frac{1}{16}$ to $\frac{1}{2}$ inch in diameter, and are covered with more or less fine greasy yellow or white scale. They invariably appear first upon the chest, abdomen, or neck. Many remain discrete while increasing peripherically, whereas others coalesce to form irregular, gyrate areas, the center of which is always slightly depressed as compared with the scaly, spreading edge, which is also more vivid in color, the center becoming a dull yellowish brown. The disease often wanders from the chest and back over the lower part of the neck, abdomen (if not originally in these situations), and down the limbs as far as the wrists and ankles, but exposed parts, *e. g.*, face and limbs, are hardly ever attacked. The various stages of the disease are usually present at the same time, and considerable patchy discoloration is apt to persist for an indefinite period after its subsidence. Generally, very little inconvenience is caused by it, but sometimes it may itch considerably.

The disease occurs in small epidemics, especially in spring and autumn, although not demonstrably contagious. Chiefly effects children or young persons, but has been seen in a patient aged seventy. It undergoes spontaneous arrest in a period varying from a fortnight to two months, its wanderings being apparently little influenced by treatment. Much in the character of the rash suggests its origin from a micro-organism, but none to which it can with certainty be specifically attributed has as yet been identified.

Diagnosis.—The most important point about the disease is its similarity to papulo-squamous dermatosyphilis, for which it is often mistaken owing to the circinate configuration of the patches, the absence of itching and the subsequent pigmentation. It may also be confounded with seborrhea corporis (lichen circum-

scriptus), tinea versicolor, psoriasis gyrata, or tinea circinata, to the separate description of which attention is directed.

Treatment.—Calamine and weak tar lotions (liq. carbonis deterg. 3 j ad ℥ viij) are useful to allay itching. A condition of secondary exfoliative dermatitis may result from its treatment by strong irritants.

J. J. PRINGLE.

Pityriasis Rubra.—A name usually employed to designate a large group of dermatoses to which the term "dermatitis exfoliativa" is more generally applied abroad.

The group includes various conditions of skin other than those produced by the exanthemata (especially scarlatina, erysipelas, measles, and röteln) or by drugs (*e.g.*, chloral, belladonna, quinine, copaiba), whether primary or secondary to other cutaneous affections, in which universal or almost universal dermatitis is present, with severe congestion and redness, but with little or no discharge, with slight or considerable infiltration and with profuse and continuous desquamation, either of fine, branny epithelium, or of extensive scales or sheets of epidermis.

It is obvious that the term exfoliative dermatitis is a very wide one, but the disease being thus conceived as an "entity," the following general observations may be made. It occurs most frequently between the ages of forty and sixty years, but has been observed in early childhood and at the age of ninety years; it shows a striking predilection for the male sex; is not hereditary. Arthritic affections—gout and especially rheumatism—strongly predispose to its occurrence, either spontaneously or as an epiphenomenon of other diseases; renal disease and chronic alcoholism do so to a less marked degree. It may supervene upon an eczema or a psoriasis, and may also arise from a lichen, an erysipelas, a seborrhea, an erythema multiforme, a pityriasis rosea, or even a dermatitis medicamentosa. The amount of infiltration of skin varies within wide limits, as does the resulting hardness and the occasional subsequent atrophy or sclerosis of the skin. The amount of sweat secreted also varies considerably in different cases, although frequently it is surprisingly profuse. The characters of the desquamation generally depend upon its locality, that from the face being fine and branny, that from the scalp matted together—

owing to admixture with sebum—that from the chest and abdomen in large thin scales and flakes, that from the hands and feet in thick sheets or molds. As the greatest variety also obtains with regard to (1) the implication of the dermal appendages—hair and nails, (2) the amount of fever, the complications and general constitutional disturbance, and (3) the duration, course and prognosis of the malady, recent writings of Dr. Brocq of Paris, which analyze and subdivide this extensive and inchoate group of diseases into various constituent "types," have their full justification, and these types, therefore, receive separate description.

(1) **The relapsing, desquamative scarlatiniform erythema** of Fereol is the mildest form. It is commoner in children and young adults than the others. Its onset is brusque, with high temperature (102°–104° F.), marked general febrile symptoms, an intense, universal, scarlatina-like redness of the skin without any infiltration, thickening, or induration, and frequently even with sore throat. In the course of a day or two the febrile symptoms subside, all redness disappears, and copious general desquamation sets in; at the end of a week or a fortnight recovery is complete. Recrudescences repeating the characters of the primary attack often, however, occur, prolonging the duration of the disease over a month or more. The diagnosis of a first attack from scarlatina is generally difficult, if not impossible, but the subsequent course of the affection decides the point, as relapses invariably occur, often at regular seasonal intervals, especially in spring, when they are usually referable to exposure to cold, or in summer, when attributed to insolation. Sometimes a drug taken internally (especially mercurials) or an irritating external application may determine a first attack, which may be afterward reproduced in the manner described. The disease never occurs in epidemics, is never infectious, and is never attended with albuminuria. The hair is never affected, but in most cases each attack leaves its mark on the nails in the form of a transverse groove upon them. In a small number of the severest cases the nails fall, constituting a connecting link with

(2) **The universal exfoliative der-**

matitis of Erasmus Wilson, is a more frequent and much more serious condition. It is a disease of temperate climates, occurring chiefly in warm weather and attacking healthy adult males in the majority of cases. Although usually primary, it may be secondary to psoriasis, eczema, or lichen. Its onset is acute, febrile, the temperature rising to 102° F. or higher. The *eruption* first manifests itself as erythematous patches, with some scaling, usually situated on the trunk and discrete, but rapidly extending and coalescing to cover the entire surface of the body in a week. The skin is then intensely and vividly red: it is infiltrated from the first, and large, white, imbricated flakes and sheets of epidermis are shed in amazing abundance, or remain attached to the skin only by their upper edge. Itching is usually severe, and scratching is naturally resorted to for its relief. There may be a little oozing from the flexures of the knees, elbows, axillæ, and thighs, and in extremely exceptional cases small bullæ have been observed in these situations, suggesting to some writers a link with pemphigus foliaceus; but the rest of the surface is absolutely dry and harsh. Copious sweats are nevertheless observed from time to time. Severe seborrhea of the scalp is always present. The buccal, lingual, pharyngeal, nasal, and conjunctival mucous membranes are often congested, and severe vomiting and diarrhea are not infrequent, indicating perhaps implication of the gastric and intestinal mucosa. Meanwhile the concomitant febrile symptoms are severe and intermittent in type, an evening rise of temperature to 102°–103° F. being usually marked. Prostration is a prominent feature, and rapid emaciation occurs. Especially characteristic is the early complete loss of nails both from hands and feet, and of hair from all normally hairy parts; this may occur as early as the fourth week of the disease.

Almost all cases ultimately recover, the duration of the affection being generally about four months, but it may be prolonged. Once thoroughly arrested the disease does not recur. Considerable pigmentation may persist for some time after the subsidence of the rash. Lymphangitis, adenitis, abscesses, boils, or carbuncles often occur during the course of the disease, or they may interrupt

convalescence. Albuminuria and pulmonary troubles are sometimes present in severe cases, especially toward the end of an attack, but they do not necessarily render the prognosis unfavorable. Among various nervous sequelæ partial paraplegia, incontinence of urine, bed-sores, and functional ocular and auditory derangements may be especially noted.

(3) **The chronic universal pityriasis rubra** of Hebra represents a more severe and rarer type. Its onset is insidious and afebrile; it is generally primary, but may be secondary to other diseases, especially perhaps to psoriasis. Its spread is slow, but at the end of some weeks it becomes universal. The skin is then red, but not infiltrated or thickened. The desquamated epithelium is in the form of fine, white, branny scurf, which does not adhere to the surface; there is little or no pruritus. Gradually, however, in the course of months, or it may be years, the skin becomes infiltrated, hard, and thickened, and when partially emptied of blood by pressure, deep pigmentation may be observed. Later on it slowly atrophies, becoming glossy, thin, yellowish, tightly stretched and often fissured over prominent bony points, as well as retracted round the openings of the orbit and mouth. Marasmus only sets in after years, when ulceration and gangrene may ensue, but death is generally the result of intercurrent tuberculosis or pneumonia. The hair and nails are only affected in the last stages.

(4) **The pityriasis rubra pilaris** of Devergie may here be alluded to, although it is doubtful whether it ought to be included, as its most intimate relationship appears to be with psoriasis. Any form of exfoliative dermatitis may, however, at a certain stage of recovery present a condition closely resembling it in its objective characters, although the clinical history in two cases is entirely different.

Pityriasis rubra pilaris is an absolutely benign and local disease, unaccompanied by febrile or other constitutional disturbance. It chiefly affects young persons, and its onset is either sudden or gradual. It generally appears first on the face or hands, and other patches soon follow on the body. These may remain discrete or may coalesce: they are of a

decided rose or coppery color, are slightly infiltrated, covered with small, pityriasic scales, and present little acuminate papular prominences, due to perifollicular accumulations of epidermic cell. These "epidermic cones" are eminently characteristic round the hair on the dorsal surface of the first and second phalanges of the fingers and toes and on the backs of the hands and forearms; they never occur on the scalp or pubes. There is always marked seborrhea capitis, but the hair is not shed; on the contrary, it generally is much increased in quantity all over the body, and the nails grow at a great rate, becoming ultimately like horns or claws. The disease is of quite indefinite duration, but in the long run the patient always recovers.

Pathology.—Of the intimate pathology of the group of exfoliative dermatites we know nothing. The pathological anatomy embraces congestion and dilatation of the vessels of the deeper, but more especially of the superficial longitudinal plexus of the skin, inflammatory leucocytic infiltration of the upper papillary layers of the corium, great increase in size and depth of the inter-papillary processes of the rete, and particularly, great increase in thickness of the upper epidermic layers.

Differential diagnosis.—This must be established from the exanthemata, medicinal rashes, urticaria, generalized eczema or psoriasis, the early stage of granuloma fungoides, and especially from acute lichen ruber.

Treatment.—The value of general medication seems incontestably established. Absolute rest in bed is necessary; the diet ought to be nourishing but easily digestible, including milk, milk puddings, eggs, meat soups, juices or jellies, etc. Alcohol is, as a rule, contra-indicated, but cannot be withheld if there be much prostration. Cod-liver oil is beneficial in many cases of marked emaciation. The regulation of the bowels is of prime importance, and salines or mineral waters are most useful for this purpose. The writer is strongly convinced that arsenic is in the great majority of cases absolutely deleterious, its discontinuance, in several cases under his own observation, having been attended with marked benefit. Some, however, consider arsenic useful in the most chronic cases. The writer also has found the eruption aggravated by ferru-

ginous preparations, whereas quinine has rendered signal service, given in full doses. The promotion of diuresis was strongly advocated by Fox, and the subcutaneous injection of nitrate of pilocarpine (gr. $\frac{1}{20}$ – $\frac{1}{10}$ or more, with caution) has lately been advocated; its diaphoretic action is aided by a hot-air bath.

Prolonged warm alkaline or bran baths are occasionally of service in relieving itching and removing scales, but, on the other hand, sometimes increase hyperæmia. Oily applications are more generally useful. The whole body must be swathed in soft linen cloths soaked in the application, the face being covered with a mask. The officinal linimentum calcis is useful, and the writer can confirm Dr. Crocker's opinion of the value of a liniment thus compounded: \mathcal{R} Calaminæ \mathfrak{D} ij, zinci oxidi 3 ss, olei olivæ et aquæ destillatæ aa \mathfrak{z} j. A lotion composed of an ounce of glycerole of lead and of glycerin in a pint of water is also serviceable when similarly applied. The patient ought to lie between the blankets and on a spring mattress or water bed.

J. J. PRINGLE.

Symptomatic Indications.—The principal remedy in pityriasis is *arsenicum*; *cantharis*, when occurring in children. *Graphites* will sometimes cure when arsenicum fails, it is especially indicated in pityriasis capitis. *Sepia* is valuable when brown-red hepatic spots are present. *Mezereum*, for chronic cases, brownish miliary rash on chest, arms, and thighs, much itching.

PLACENTA, DISEASES OF.—**Myxoma of Chorion.**—This disease in its extreme development is rare, in its slighter forms not uncommon. There are two forms: (1) Myxoma, in the more literal sense, which is the so-called "hydatid mole," or "cystic degeneration of chorion." This occurs in the earlier months of pregnancy, before the placenta has been differentiated. (2) Myxoma fibrosum, which occurs in the later months, after the placenta has been formed.

Symptoms and Course.—The size of the uterus and abdomen increases out of proportion to the period of the pregnancy. Then follows hemorrhage, which is often very profuse; it may be so great as to cause death before the expulsion of the mole. The hemorrhage may begin as

early as the middle of the second month of pregnancy; and it has been known to be postponed three or four months beyond the usual term of pregnancy. But, as a rule, hemorrhage and the expulsion of the mole take place within the first six months. Either with the first hemorrhage, or with some subsequent attack, some of the small "cysts," which have been aptly compared to "white currants floating in red currant juice," are expelled. This settles the diagnosis, which cannot be made until these bodies have been seen.

Pathology.—Myxoma of chorion presents itself to us in the form of a loosely connected heap of bodies looking like white currants, but of more various sizes, attached to one another by delicate semi-translucent threads. As a rule, no trace of a fetus can be found, nor can the fetal membranes be identified. The "cysts," as they used to be called, vary in size from a pin's head to a filbert. They are dilatations of the chorionic villi, which, at the swollen parts, are degenerated into myxomatous tissue. They are not true cysts, although they collapse when cut into. The condition of the uterus, in different cases of this disease, is various. Sometimes there is great overgrowth of the decidua, and the disease has been thought to be primarily due to this overgrowth. In other cases the contrary has been found, and the disease has been attributed to the chorionic villi not being able to take root in the badly developed decidua, and so hanging free in the uterine cavity and degenerating in consequence. It has also been attributed to the allantois failing to reach, or apply itself to the chorion. In some cases the diseased chorionic villi grow into the muscular wall of the uterus, splitting it into two parts, a submucous and a subserous part, and approach so near the peritoneum that only a layer the thickness of paper separates the chorion from the peritoneal cavity. This condition has been termed "mola hydatidosa destruens."

Treatment.—While the diagnosis is doubtful, it is best to stimulate the uterus to contract by ergot and the hot douche. When the diagnosis has been made, the cervix must be dilated with tents (antiseptic precautions being taken), and, if necessary, the finger introduced to break up the mass. Uterine contractions will

then usually expel it. Bearing in mind the possibility that the mole may have grown into the uterine wall, all rough usage, such as scraping the uterus or violent manipulation, should be avoided. If hemorrhage be profuse, the uterus may be swabbed with liq. ferri-perch. diluted 1 : 6, or plugged with iodoform gauze.

Myxoma fibrosum affects one or more cotyledons of an otherwise normal placenta. These we find enlarged and studded with smooth, firm, roundish bodies, from the size of a hempseed to that of a hazel nut, arranged in stalks. These knots consist of a vessel in the interior, surrounded by connective tissue resembling the Whartonian jelly of the umbilical cord. Myxoma fibrosum of the placenta may occur with a healthy and well-developed fetus; often it goes with abortion or premature labor. It cannot be diagnosed before delivery, and therefore cannot be treated.

G. E. HERMAN.

PLACENTA PRÆVIA.—The implantation of the placenta upon the anterior portion of the uterus, over or near the os externum.

Varieties.—There are four varieties of this condition recognized, corresponding to the situation of the placenta with reference to the os: *a*, central, when the center of the placenta is more or less directly over the os: *b*, partial, when the center of the placenta lies more or less to one side: *c*, marginal, when the margin of the placenta projects over the os, and, *d*, lateral, when the margin reaches nearly to the os.

Ætiology.—The cause or causes of this condition are practically unknown, those assigned being merely conjectural; all that is certainly known is that placenta prævia is much more frequent in multiparæ than in primiparæ, and among the poor than among the rich. Abnormal size of the uterine cavity, diseased condition of the lining membrane, spasmodic contraction of the uterus, hard labor in the early part of pregnancy, and subinvolution of the uterus have all been assigned as causes.

Symptoms.—The main symptom of placenta prævia is uterine hemorrhage. This usually occurs from the eighth to the ninth month, rarely as early as the sixth month, and during labor. It gener-

ally comes on suddenly without apparent cause, and intermits, several days or more intervening between the attacks. Hemorrhage, occurring during the latter part of pregnancy, should always excite suspicion of this condition.

Prognosis.—The prognosis varies somewhat with the character of the placental insertion, but is always grave. To quote the words of T. Gaillard Thomas: "Danger—manifest, inevitable, and treacherous in its approach—attends upon every case of placenta prævia." Statistics given by various writers show an average maternal mortality of twenty per cent. and a fetal mortality of fifty per cent.

Treatment.—In the early part of pregnancy, when the fetus is not yet viable, the expectant plan of treatment, in the hope of continuing the pregnancy until the fetus is viable, is best, especially if the hemorrhage is but slight. The patient should remain in bed, avoiding all active exercise, and as much as possible an erect position; any symptoms which may arise being treated by appropriate measures. The case should be carefully watched, and, should serious hemorrhage occur, more active measures must be adopted. When the hemorrhage is so severe as to threaten the life of the mother and child, delivery should be effected at once.

The simplest and best method for this purpose is the induction of premature labor, which has been especially advocated by Greenhalgh, Thomas, and Parvin. For this purpose the cervix should be dilated, if necessary, with a sponge tent sufficient to admit the finger, when the placenta is to be freely separated from around the os and a Barnes's bag introduced into the uterus, and slowly filled with water, and left until the os is well dilated; when the bag may be removed and a larger one introduced in the same way, the finger being introduced to separate the placenta still more if the hemorrhage continues. This procedure is continued until the os is fully dilated, the largest sized bag being allowed to remain until labor pains set in strongly. When the pains are strong, and the placental attachment is lateral or marginal, the hemorrhage having ceased, the case may be left to nature; in other cases, version may be performed, or the forceps applied, the course to be adopted depending upon the conditions present.

In labors complicated with placenta prævia, the tamponment of the vagina is the best method of procedure, care being taken that the tamponment is thorough and perfect. The tampon for this purpose should be made of balls of absorbent cotton, about the size of a walnut, about fifty or sixty of them required, all of which should be prepared before beginning to introduce them. The bladder and rectum having been emptied, and the vagina thoroughly cleansed by an antiseptic solution, the balls of cotton are dipped in an antiseptic solution or smeared with an antiseptic ointment, and carried by means of a suitable dressing forceps, one by one, to the vaginal vault, until the vault is thoroughly packed. For convenience of the removal, the balls first introduced should be attached to strings. The os is then filled or covered with cotton, and the remainder of the balls introduced until the vagina is entirely filled. A large piece of cotton is placed between the labia, over which a napkin is placed and the whole kept in position by a T bandage. The tampon may remain in, when properly prepared, from twelve to twenty-four hours. When removed the vagina should be cleansed with an antiseptic solution; and, if the os is not sufficiently dilated to permit of immediate delivery, another tampon introduced. It is deemed advisable by many practitioners, after having thoroughly tamponed the vagina, to leave the case to nature, the tampon being expelled by the uterine and abdominal contractions. When the tampon is thus left to be expelled by the uterine contraction, care should be taken that, when the uterus or fetus recedes, in the interval between the pains, a space is not left at the upper surface of the tampon where the blood may accumulate. This may be prevented by pressing the tampon back at the conclusion of each pain or by the use of an elastic bandage, which will exert a continuous pressure.

B. F. UNDERWOOD.

PLACENTA, RETENTION OF.—

Adhesions of the placenta to the uterine parietes may cause hemorrhage, especially if they are partial, and the remainder of the placenta be detached. The frequency of these has been overestimated. Many cases believed to be examples of adherent placenta are, in reality, only

cases of placenta retained from uterine inertia. The experience of all who see much midwifery will probably corroborate the observation of Braun, that "abnormal adhesion and hour-glass contraction are more frequently encountered in the experience of the young practitioner, and they diminish in frequency in direct ratio to increasing years."

The cause of adhesion is often obscure, but it most probably results from a morbid state of the decidua, which is produced by antecedent disease of the uterine mucous membrane, then the adhesion is apt to recur in subsequent pregnancies. The decidua is altered and thickened, and patches of calcareous and fibrous degeneration may be often found on the attached surface of the placenta. Most frequently the placenta is only partially adherent; patches of it remain firmly attached to the uterus, while the rest is separated; hence the uterine walls remain relaxed, and hemorrhage frequently follows.

There are no very reliable signs to indicate morbid adhesion of the placenta, previous to the introduction of the hand. The following are the symptoms, any of which might, however, accompany non-detachment of the placenta, unaccompanied by adhesion: "We may suspect morbid adhesion, if there has been unusual difficulty in removing the placenta in previous labors; if, during the third stage, the uterus contracts at intervals firmly, each contraction being accompanied by blood, and yet, on following up the cord, you feel the placenta *in utero*; if, on pulling on the cord, two fingers being pressed into the placenta at the root, you feel the placenta and uterus descend in one mass, a sense of dragging pain being elicited; if, during a pain, the uterine tumor does not present a globular form, but be more prominent than usual at the place of placental attachment."

Treatment.—The artificial removal of an adherent placenta is always a delicate and anxious operation, which, however carefully performed, must of necessity expose the patient to the risk of injury to the uterine structures, and of leaving behind portions of placental tissue, which may give rise to secondary hemorrhage, or septicæmia. The cord will guide the hand to the site of attachment, and the fingers must be very gently insinuated

between the lower edge of the placenta and the uterine wall; or, if a portion be already detached, we may commence to peel off the remainder at that spot. Supporting the uterus externally, we carefully pick off as much as possible, proceeding with the greatest caution, as it is by no means easy to distinguish between the placenta and the uterus. At the best it is far from easy to remove all, and it is wiser to separate only what we readily can, than to make too protracted efforts at complete detachment. When it is found to be impossible to detach and remove the whole, or a great part of the placenta, we cannot but look upon the further progress of the case with considerable anxiety. The retained portions may be, ere long, spontaneously detached and expelled, or they may decompose and give rise to fetid discharge and septic infection. Such cases must be treated by antiseptic intra-uterine injections, so as to lessen the risk of absorption as much as possible; but until the retained masses have been expelled, and the discharge has ceased, the patient must be considered to be in considerable danger. In a few rare cases, there is reason to believe that considerable masses of retained placental tissue have been entirely absorbed. It is difficult to understand so strange a phenomenon, but several well authenticated cases are recorded, in which there seems no reason to doubt that the retained placenta was removed in this way.

W. S. PLAYFAIR.

Symptomatic Indications.—*Pulsatilla, cimicifuga.*

PLAGUE.—*Ætiology.*—This disease is of a specific nature, and generally prevails as an epidemic, but may be sporadic. Formerly it was met with in Europe, but at the present time its chief seats are Egypt, Syria, and Asia Minor. It is contagious, and can be conveyed in various ways. The chief predisposing causes are overcrowding and bad ventilation, want of cleanliness, with accumulation of filth, insufficient and unwholesome food, debility from any cause, a warm and moist condition of the air, residence on marshy soil, or in the neighborhood of certain rivers. Epidemics often follow famine, and are generally preceded by a sickly, oppressive, warm, and moist season.

Anatomical characters.—The blood is dark, and remains fluid or coagulates im-

perfectly, while it rapidly putrefies. All the organs are greatly congested and softened, especially the spleen; also the mucous and serous membranes, which may present petechiæ and ecchymoses. The serous cavities contain more or less effusion. The absorbent glands generally are swollen, dark, softened, or disintegrated. Buboës and carbuncles are usually present.

Symptoms.—Plague is characterized by fever, generally of a low type, with the local development of buboës, carbuncles, and petechiæ. The period of incubation is very short, and symptoms may set in almost immediately after exposure to infection. After inoculation, the distinctive glandular swellings are developed in four days. The invasion is sudden in most cases, and the severity of the constitutional symptoms varies from a slight fever to one of the most virulent type. The early symptoms are rigors, restlessness, a feeling of debility and languor, headache and giddiness, nausea or vomiting, and precordial oppression or uneasiness. The expression is heavy and stupid, and the eyes look muddy or suffused. Soon the temperature rises, while prostration increases, with a tendency to syncope. The pulse is frequent, but weak or irregular. The tongue is thickly furred, and tends to become dry and brown or black, with sordes on the teeth. The other prominent symptoms are vomiting, sometimes of black matters, great thirst, diarrhea with offensive stools, hurried respiration, and very foul breath. The urine is much diminished in quantity, and may contain blood. Hemorrhages from mucous membranes are not uncommon. Nervous symptoms are generally present, such as delirium, stupor, coma, or convulsions.

Buboës are formed chiefly in connection with the glands of the groin, but are also seen in the axilla, and about the angles of the jaws. They appear at different periods, being preceded by darting pains. Generally they form abscesses, which discharge and heal slowly, leaving permanent scars. Carbuncles are observed, mostly on the limbs, but may affect any part of the body. They vary in number and size, and are liable to end in gangrene, sometimes thus causing great destruction of tissues. Petechiæ, vibices, and livid patches are seen only in bad cases, and there may also be extravasa-

tions of blood into the subcutaneous tissue in such cases.

Prognosis is very grave. Death may take place before the appearance of any local signs.

Treatment.—Attention to all hygienic measures is essential. The bowels should be freely opened. An emetic at the outset is recommended. Nutritious food, stimulants, mineral acids, and tonics are the remedies which afford the best results. Probably those who advocate the use of antiseptics would give them largely in this disease. Cold affusion or sponging may also be employed. Poultices are indicated for the buboës and carbuncles, followed by antiseptic dressings when they are discharging.

FREDERICK T. ROBERTS.

Symptomatic Indications.—*Arsenicum, cinchona, or phosphorus.*

PLAGUE, COLD.—See CEREBRO-SPINAL FEVER.

PLANTARIA.—See DENGUE.

PLASTER-CASTING.—Plaster-casting is often useful to obtain a permanent record of abnormalities, and as a means of enabling instrument-makers at a distance to fit apparatus accurately.

The stages of casting may be divided into:

1. *Mixing the Plaster.*—The plaster of Paris used is of good medium quality, not the extra fine kind used by dentists, nor the coarser sort for rough castings. It should be thoroughly dry, and can be baked in an oven, or by the side of the fire, if at all damp. Take, in any common bowl, half as much water as is required of the mixed plaster (warm water causes more rapid setting than cold; and in winter the chill should be taken off the water for the patient's comfort, when the cast is from the living person), sprinkle lightly into the water—*without stirring*—spoonful after spoonful of the dry plaster until it rises up through the water, and shows just beneath the surface all over. There is now enough. Stir the whole rapidly, working it up from below and from the sides. When mixed, although quite fluid at first, it soon becomes thick. Nearly an equal bulk of plaster and water is used, and the mixture is only a little less than twice the bulk of water taken.

When a *plaster-cast* is to be taken

from the mold, ink or some other coloring-matter should be added to the plaster for the mold as it is being mixed.

2. *Taking the Mold.*—If the amount of surface to be cast is such that it can be pulled out of a one-piece mold, the process is so much the simpler. Although the pliable soft textures can be withdrawn from a plaster mold, which partly surrounds them, the extent to which this can be done will vary with the part, and must be learned by practice. A plaster-cast and mold, on the other hand, being both rigid, can only be separated when, besides not sticking, they do not inclose one another.

Suppose the back of a man's hand is to be cast. Shave off all hairs from the dorsum of hand and first phalanges—the soft hairs on a woman's or child's hand may be smoothed down with soap and vaseline—next lay the hand, fingers and thumb together, prone on a board spread with a piece of paper. Partly fill up the hollow under the wrist to prevent the plaster from getting too far round. See that the hand is well smeared with oil or vaseline. Mix sufficient plaster of Paris to cover the hand all over with a half-inch-thick layer. When first made, the plaster will be too thin to lie on the hand; very soon, however, it will become like cream. In this state lay it over every part of the back of the hand and fingers, and, as it thickens, plaster it on more and more. Care must be taken to see that every part is uniformly covered; there is a risk that some parts will be as thin as egg-shell and break very easily, while others have more than their share. When every part is satisfactorily covered, leave the plaster for five or ten minutes to set. This process will be indicated by its growing distinctly, though not uncomfortably, warm. Before the mold is ready to lift, any small projection, when tested, should crack off as a whole, and not crumble under the finger. When sufficiently hard, it should be cautiously lifted from the hand.

When both sides of an object (say the hand) are required, the mold must be taken off in two pieces. Mix plaster as before—a portion to be laid down first as a bed—and when it is thickening and can be heaped up into a level layer, the hand is allowed to sink a very little way into it. Next make a fresh quantity of plaster, and as it thickens take a piece of strong pack-

thread or thin twine, and by means of the plaster make it stick to the skin all round the most prominent part of the hand, and at the tips of the fingers if extended. Rapidly cover over the whole of the rest of the hand as before; the thread to remain in its position. When the plaster has thickened to the consistence of cream cheese, draw the thread steadily out through it all round. If the right state of the plaster has been chosen, the track of the thread should remain open. Should the plaster be too soft, it will fall in on the thread's track; should it be too firm, it will crack and break rather than let the thread come through. Do not touch the mold otherwise until it has set. By cautiously inserting a knife into the track of the thread at various parts, the top of the mold may be lifted off, and the hand withdrawn from the lower half.

The *foot* is more difficult. Two threads must be taken whose tracks overlap, and each of which must be drawn out only until it meets the track of the other. One loop of the thread passes below the sole and up the leg over the malleoli, the ends being held at first above and parallel with the axis of the leg. The other, parallel with the long axis of the foot passes round the back of the heel, and coming round the sides of the foot at its most prominent part, crosses in front of the great toe, where the ends hang forward. Having covered the foot with plaster, the caster must heap up the plaster on the ankle and lower part of the leg while it is soft enough to mold itself to the skin, yet firm enough not to run down when placed in position. The threads are to be drawn out as before—in this case from above, and from the front until their tracks cross, below the malleoli. The two pieces of the mold thus mapped out are, one covering the front of the leg and dorsum of the foot, and the other covering the back of the leg and sole of the foot.

3. *Making the Cast.*—The chief points are, to prevent the cast from sticking to the mold, and to obviate air bubbles in the cast. Freshly made plaster, if poured into a mold which has not been specially prepared, will assuredly stick to it. To prepare the mold, soak it in water for an hour or two before it is needed. To test for sufficient soaking, watch, after the mold is taken from the basin, whether water remains on the

plaster, or dries in. If the latter, the pores of the plaster are evidently not yet filled with water, and further soaking is needed. If the mold be quite soaked, the fresh plaster will lie in the most perfect contact with every detail of its surface without uniting to it. In addition to thorough wetting, the surface may be painted over with olive oil or be dashed over with soap-suds, and then again with pure water. Olive oil painted over the surface of a dry mold is almost at once sucked in and becomes useless, unless by many repeated coats the plaster is filled with it. Boiled linseed oil after two or three coats will form a varnish on the surface, but it is apt to impair the sharpness of the cast, unless care is taken to limit the amount.

The only way to prevent air bubbles from forming between the mold and the cast is to pour in the plaster slowly and by installments, and to keep constantly shaking and turning the mold round and round all the time. Sometimes it is an advantage to pour the fluid plaster into and out of the mold once or twice, in addition to turning it round and round. If plaster be poured in without these precautions, air-bells will certainly disfigure the cast. When the mold is nearly full, a loop of string should be pushed into the plaster to hang the cast by afterward.

4. *Removing the Cast from the Mold.*—Except in almost flat casts, this must be done at the expense of the mold. In all ordinary casts, only one copy can be made from the original mold. Additional copies can be taken from this by making either an elastic gelatine mold or a plaster "piece mold."

The plaster-cast, which has been filled into the mold, should be set aside for twelve hours. With a chisel and hammer the mold must then be chipped away piecemeal, care being taken not to let the chisel cut into the cast. The advantage of staining the plaster of the mold will now be apparent. It will be found an advantage to begin at the edges, and special care must be taken of any projecting or thin piece of the cast lest it be broken off with the mold.

If the cast is to be painted, one or two coats of boiled linseed oil or of size, as a preliminary, will prevent the paint from being absorbed too quickly by the porous plaster.

a. *A Gelatine Mold* is made by sus-

pending the cast, or other object, in a wooden box large enough to give an interval of at least an inch between the objects on all sides of the box. Into this is poured very strong gelatine, or glycerine and gelatine, while hot and fluid. When the mold is cold, the sides of the box are taken off, and a cut made in the gelatine all round, half-way up the most prominent parts of the object. After lifting off the top half of the mold, the object can be pulled out of the lower half. The two halves should then be laid together, and a hole cut out of the upper one, opposite its highest point. The sides of the box are now replaced and bound in position, and, in addition, the top of the mold must be held down to prevent the plaster from escaping, leaving, of course, the top aperture free. A plaster-cast can then be run into this gelatine mold.

b. *A "Piece Mold"* is made of plaster of Paris, and being rigid as well as the cast, must be made of many pieces, each of which can be lifted off without going round a corner. The object to be copied is first mapped out into areas where casts will lift off; the first area is banked round with clay, the second and succeeding pieces are ranged round the first—blank sides being banked up, and already made "pieces" being smeared with vaseline to prevent succeeding ones from sticking to them. When the whole is complete, the inner surface is covered with boiled linseed oil; and the pieces having been fitted together are bound with string, and the cast is made through a hole left for the purpose.

I. *Casting in Gelatine and Glycerine.*—1. *Preparation of the Material.*—Take of "No. 1" gelatine (this is like strong clear glue), 6 ozs. (by weight), soak it till quite soft and swollen, afterward dry it slowly until just pliable. As it has now the minimum of water necessary, melt it in a water bath, and add 6 ozs. (measure) of clear glycerine (not necessarily purified). When the two are thoroughly mixed, the material is ready. To render it opaque, add, while it is still hot and therefore fluid, small quantities of a thick paint made by rubbing up oxide of zinc in glycerine. When a skin color is wanted, use a little vermilion; prevailing colors can be given with water color as required.

2. *Preparation of the Mold.*—From the part to be cast, a mold in plaster of Paris must be taken in the ordinary way.

It will be found best to limit the casts to those whose molds can be removed from the organ or living body in one piece. When both sides are molded at once, the gelatine cast is by no means easy to extract from the mold. After the mold has been removed from the body, it must be slowly and thoroughly dried. If the mold be moist, the gelatine cast is softened; if too much heated, the plaster itself crumbles. For convenience, the margins should be banked up with clay before the cast is made.

3. *Making the Cast.*—Melt the gelatine and glycerine previously prepared, and pour it into the dried and banked up mold, being careful to roll the melted mixture backward and forward well over the face of the mold, so as to get rid of air bells. As the heated substance tends at first to run into the hollows and leave the raised parts of the mold with a very thin coating, the operator must keep ladling it up from the hollows, and as the substance cools, it will become sufficiently tenacious to remain on the upper parts.

4. *Making a Plaster Bed for the Cast.*—While the cast is still in position in the mold, its reverse side must be covered with lint or wool, and this in turn covered with plaster of Paris, either pure or mixed with cotton wadding, oakum, lint, wood-wool, etc. This must be made to fit into the hollows and elevations of the back of the cast, and when set it is to be removed so as to be dried. This cast, when cold, can be easily drawn, or rather peeled, out of the mold, and it will be found to be an elastic cast of what is wanted. When placed upon its plaster of Paris backing, it will preserve the shape which it had while in the mold.

5. *To Paint the Cast as required.*—Use water colors when a dry surface is to be imitated, oil colors when the surface has to appear moist. The water color may require several coats. Arrange an edging of black velvet to hide the irregular margins and give a finish.

PLETHORA.—A full habit of body. A condition frequently met with among those who eat and drink more than they require, and do not take sufficient exercise. Obesity, congestion of the face, sluggish bowels, general lassitude, and undue drowsiness are the chief signs of

this condition. It should be combated by careful dieting, regulation of the bowels, and the taking of such exercise as the age and other circumstances of the patient permit.

Symptomatic Indications.—*Aconite* is the best remedy for diseases arising from plethora or in sufferings of plethoric subjects, especially for apoplexy. *Arsenicum* is useful when there is determination of blood to the head.

PLEURA, MORBID GROWTHS OF.—Several forms of morbid growth may be found affecting the pleura, but in most cases they occur as secondary to the same kind of growth elsewhere in the body. Lymphadenoma, lipoma, fibroma, fibro-chondroma and fibro-myoma, osteoma, scirrhus, and sarcoma have all been found in the pleura. Primary cancer, sometimes described as endothelioma, but closely resembling epithelioma in structure, may sometimes occur. It begins in the endothelium of the small lymph vessels, and may take the form of multiple nodules, or may aggregate into small flat patches—forms of distribution which are common to all morbid growths of the pleura. A nodule of growth on the costal or visceral surface will often, by direct contact, infect the opposite surface, either with or without inflammatory adhesion.

Fibroid thickening of the pleura may take place to an extent that may simulate the appearance of a morbid growth, but the localized fibroid tumors are generally secondary, and found in association with fibroid disease elsewhere. Secondary growths of the sarcomatous type are often met with in the lung, and hence may appear on the pleura, also when the surface of the lung is implicated. They are generally secondary to sarcoma of some other internal organ, or of bone.

Diagnosis.—Morbid growths of the pleura are so rare as primary affections that the diagnosis of them is almost invariably bound up with that of a similar condition in some other part. Localized pain, and sometimes superficial tenderness, associated with dullness on percussion, and diminution in respiratory murmur, coupled with increase of vocal vibration, may serve to indicate the presence of a single patch of disease, but these signs are not by any means trustworthy, and must only be regarded in conjunction with the other features and

general history of the case. In the cases of general thickening of the pleura, the principal indications are given by the physical signs; the whole of one side of the chest may be very dull to percussion, although the dullness is rarely so absolute as in the case of fluid. Vocal vibration is seldom altogether lost, although it is, as a rule, impaired. On auscultation, the breath sound is very much feebler than on the healthy side; but it is vesicular in character, unless some other condition be complicating the case. The transmission of the voice sound is variously affected, sometimes being increased, and at others diminished. The presence of numerous small crackling râles will often be made out, and these, scattered over the whole dull area, are not unfrequently mistaken for evidence of acute mischief in the lung. They are, as a rule, but little affected by coughing, and may persist for a long time without undergoing any marked change. Bearing this fact in mind, their relative importance must be determined by the other features of the case.

Treatment.—Little can be done, the relief of pain and of any other troublesome symptoms being all that is possible.

E. CLIFFORD BEALE.

PLEURISY, ACUTE (Pleuritis).—Of all the serous membranes, that covering the lungs and lining the chest-walls is most often the seat of inflammation,

The attack may vary in severity from what is scarcely more than a sharp pain in the side to a most serious and rapidly fatal illness.

Symptoms.—After exposure to cold or wet, or perhaps independently of any definite exciting cause, the patient usually first complains of slight chilliness and pain in the side. The onset may be sudden, but is rarely marked by the severe rigor which commonly ushers in pneumonia, more often by a succession of chills which continue for two or three days.

The temperature quickly rises, and may range between 101° and 103° F. in the early days of an acute attack. The respiration becomes rapid and shallow; there is a short dry cough; the pulse is frequent and often shows an increase of tension; the face is anxious, and there are signs of severe suffering.

The pain, or “stitch,” in the side is aggravated by cough or a deep inspira-

tion, whereby friction is produced between the inflamed surfaces of the pleura; the patient therefore usually leans toward the affected side, and by pressure and gentle breathing endeavors as much as possible to restrain its movements. The pain is usually felt in the lower axillary region, but may be referred to any spot in the course of the intercostal nerves most adjacent to the inflamed area, and even in rare cases to the opposite side of the chest.

On *palpation*, friction fremitus may be felt. *Percussion* may elicit a slightly altered note, but there will be no marked dullness. On *auscultation* the respiratory sounds are weak from the deficient expansion of the lung, and a friction sound is usually audible, but this may be absent, especially when the diaphragmatic pleura is alone involved. The disease may not advance beyond this stage, the temperature falling, pain in a few days ceasing, and the friction sound disappearing owing to the adhesion of the inflamed pleural surfaces. More often, however, when the onset has been acute, and the general symptoms severe, an effusion of fluid of varying amount takes place. This is usually followed by some amelioration in the patient's condition, the pain being less acute and the breathing easier than in the earlier stage of the disease, but should the fluid continue to increase, dyspnœa may again become urgent.

The Signs of Pleural Effusion are generally first discovered at the base of the chest, owing to the gravitation of the fluid and of any solid particles it may contain.

Inspection may reveal an apparent bulging of the affected side, although this is more often due to a rounding of the outline than an increase in the semicircumference. Fullness of the intercostal spaces is a sign rarely present unless the fluid be purulent or the tone of the intercostal muscles lost owing to marked general prostration and wasting; it is on the whole more often seen in children than in adults. If the effusion be considerable and of long standing, the chest-wall may be œdematous and the superficial veins filled with blood. The heart may be seen to be beating away from its normal position.

On *palpation*, the vocal fremitus over the area of the effusion will be diminished or absent, and the heart will be found

displaced toward the sound side to a degree varying with the amount of the effusion, the displacement toward the right, however, being usually more obvious than toward the left for an equal amount of effusion.

On *percussion* over the area of the effusion resonance will be much impaired or there will be absolute dullness. The note yielded by a large effusion is more completely toneless than that elicited from consolidated lung, and the sense of resistance is greater. The upper line of dullness is usually curved, the highest point being in the axilla, whence it slopes downward to the spine behind and across the median line in front where the dullness from fluid and displaced heart merge.

A tympanitic percussion note (skodaic resonance) is commonly present beneath the clavicle above the level of the effusion, if the latter be moderate in amount and the upper lobe of the lung be healthy.

On *auscultation*, the breath and voice sounds are generally weak or absent over the dull area, but the presence of tubular breathing and whispering pectoriloquy does not exclude the diagnosis of pleural effusion or prove that in addition to the pleurisy the lung is consolidated, as, under certain circumstances, the laryngeal sounds are well conducted through the fluid.

A natural result of the accumulation of fluid within the pleura is a partial contraction or complete collapse of the lung, which, receding toward its root attachments, may lie in contact with the mediastinum or spine. If in the latter position, the laryngeal sounds conducted through the larger bronchi, which, owing to the thickness of their cartilages, still remain patent, may be distinctly audible along the spine and may suggest a diagnosis of pneumonia.

If pleural adhesion over limited areas existed prior to the attack, the lung may be held in partial contact with the chest-wall, and may act as a conductor of the laryngeal sounds to any point. About the upper level of the fluid a friction sound may be audible, and the voice sounds sometimes present a peculiar bleating quality, to which the term *egophony* is applied. This sign is usually most marked about the angle of the scapula in cases of moderate effusion. Over the opposite lung, if it be healthy,

the breath sounds will be puerile in quality.

A loud systolic displacement murmur may be audible over the base of the heart when the effusion is considerable, and it may be audible at the apex also; this sound will disappear with the absorption or removal of the fluid. In the former case it is believed to be due to the displacement of the aorta and pulmonary artery.

Measurement may prove the affected side to be enlarged, but a cystometer tracing of the chest gives the most trustworthy evidence of any change in its size or shape.

Displacements of organs other than the heart and lung may result from an effusion into the pleural cavity, but probably does not occur until there is a positive pressure within the thorax; the liver, stomach, and spleen will then assume a lower position, and the displacement of the diaphragm is an important sign of positive intra-thoracic pressure, and indication of the necessity for paracentesis.

After a moderate amount of fluid has been effused, the temperature in favorable cases falls, the general symptoms improve, and the process of absorption commences. This is marked by a gradual diminution in the dullness of the percussion note, by the return of the breath sounds, and by the expansion of the lung. The friction sound which, during the period of effusion, disappeared, again becomes audible (*redux friction*), and the affected side moves more freely during inspiration; but though the absorption of the fluid be complete, some diminution of expansion, impaired resonance on percussion, and feeble breathing may remain for a time or permanently at the base of the chest. If, however, the case be severe the effusion may increase to such an extent that the affected side becomes dull on percussion quite up to the clavicle, and the difficulty of breathing extreme—a condition requiring immediate relief.

If the temperature assume a "hectic" type, it may indicate that the effusion has become purulent, but no single sign can be looked upon as pathognomonic of that condition; the only mode of ascertaining with certainty the character of the fluid within the chest being to draw off a small quantity, for which purpose an instrument about twice the size of an

ordinary hypodermic syringe is the most useful.

Under the following circumstances, however, it is very probable that the fluid is purulent :

(1) When the pleurisy is part of a general disease of a septic nature, or (2) probably due to the escape of septic material into the pleural cavity. (3) If there be sweating, rigors, and marked emaciation; and (4) the temperature assume the "hectic" type. (5) If there be bulging of the intercostal spaces and œdema of the affected side.

Paracentesis may be required by the following conditions: (1) Urgent dyspnoea, palpitation, or retching. (2) Evidence of engorgement of the opposite lung. (3) When the fluid has accumulated with great rapidity. (4) When the dullness extends up to the second rib in front, and there is no skodaic resonance beneath the clavicle. (5) Displacement of the diaphragm and abdominal organs showing the existence of positive intrathoracic pressure. (6) When there are no signs of absorption of the fluid after a period of from two to three weeks from the commencement of the illness. (7) If the fluid has been ascertained to be purulent.

Diagnosis.—May be very simple, or present difficulties such as can only be solved by an exploratory puncture. In the early stage it may be rendered difficult by the absence of a friction sound; this is especially likely to occur when the diaphragmatic pleura is alone involved. In the latter case, the presence of severe pain, high fever, and extreme respiratory distress would point to the true nature of the disease. The various painful affections of the chest-wall, being unaccompanied by friction sound or fever, do not usually give rise to much difficulty. Close attention to the position of the heart will generally lead to a correct diagnosis; but when its displacement is prevented by previous adhesions, the most experienced may fall into error. Solid growths and a thickened pleura usually transmit the vocal vibrations, to some extent, while consolidation of the lung is rarely attended by a degree of cardiac displacement in proportion to the amount of dullness. Errors are not infrequent in the rare cases where, although a pleural effusion is present, the laryngeal sounds are distinctly

audible over the dull area. Here, again, the position of the apex beat of the heart is the most trustworthy guide. Acute pneumonia, with fibrinous exudation into the larger bronchi (massive pneumonia), and the moderate degree of pleural inflammation which usually accompanies that condition, give rise to physical signs closely resembling those of pleural effusion; but, by attention to the points already insisted upon, error may usually be avoided. If doubt still remain, no harm is likely to result from an exploratory puncture with a fine aspirator needle, if it be clean; even should a growth or a thickened pleura or solid lung be struck instead of the expected fluid. If the fluid withdrawn be blood-stained, it must not be hastily assumed that the case is one of malignant disease or tubercular pleurisy, as a hemorrhagic effusion is occasionally met with in simple pleurisy.

Pathology.—The pleura reacts to inflammation like any other serous membrane, and the changes which occur are in all respects similar. The early stage is one of hyperæmia and engorgement; then the glistening surface becomes dull and lymph is effused, and forms a thin coating to the membrane. New vessels extend from the pleura into the exudation, which consists of fibrin, leucocytes, and serum, and shows a marked tendency to coagulate; semi-solid masses sometimes forming, and either floating in the fluid or sinking to the base of the cavity. Coagulation is promoted by a relative excess of fibrin, and retarded by an abundance of leucocytes; if these latter be in great excess, and have lost their vitality, the effusion may not coagulate at all, and will then assume the characters of a collection of thin pus. This is especially likely to occur if any septic element be present in the effusion. Adhesion of the inflamed surfaces is the natural mode of termination of pleurisy, and may take place either before any fluid has been effused or after its absorption or removal. From various causes the absorption of the effusion may be incomplete; if so, provided the effusion be aseptic, the solid portions may undergo fatty degeneration, leading to the formation of a caseous looking mass which may ultimately become calcareous.

The fluid, if unabsorbed, may become

loculated by adhesions; it tends after a time to become inspissated.

Etiology.—It is probable that exposure to cold and wet, and a chill, are not so commonly the cause of pleurisy as is generally supposed; and post-mortem experience teaches that in the majority of cases there is some distinct cause for the attack. The attack may be due to local or general causes. Among the former, injuries, fractures of the ribs, and strain of the chest-wall constitute one class. In another group may be included all cases where the inflammation is set up by the escape of some material into the cavity, such as from a bronchial gland or a softening nodule in the lung; the latter, though tubercular, sometimes giving rise to a simple pleurisy. Cancer of the esophagus again may give rise to simple pleurisy. Inflammation may extend from the pericardium or peritoneum to the pleura, and *vice versa*; and it may be secondary to various diseases of the liver. Disease of the spine or ribs may involve the pleura and cause inflammation. But in the majority of cases the affection is secondary to disease within the lung—*e.g.*, pneumonia, phthisis, or other pulmonary lesion.

Among the general causes septic conditions, such as pyæmia and septicæmia, and diathetic states, as gout and rheumatism, may be mentioned. Serous membranes are especially liable to be inflamed in the various forms of Bright's disease. Pleurisy may occur at any age, and at none is there either exemption from, or special proneness to, the affection.

Treatment.—Rest in bed and a liquid diet are essential measures. The pain may be relieved by linseed poultices, changed every two hours, leeches, or a blister, or a subcutaneous injection of $\frac{1}{4}$ or $\frac{1}{3}$ grain of morphine. Strapping the affected side, as recommended in the treatment of "dry pleurisy," is sometimes efficacious if the pain be only moderate in a degree, and the attack of a subacute character. The bowels should be freely acted upon, and the action of the kidneys and skin promoted by the administration of digitalis, nitrous ether, acetate and nitrate of potassium, and liquor ammonii acetatis. The use of aconite and antimony, and the inunction of mercurial ointment, is strongly recommended by some writers as of service in the early stage of pleurisy. The temperature is rarely sufficiently

raised to require the adoption of antipyretic measures. Opium in some form may be necessary if the patient be sleepless. When effusion has occurred, if the temperature remain high, the same line of treatment should be continued for at least a fortnight, no operation for the removal of the fluid at this period being as a rule advisable. Should the temperature fall, the use of counter-irritation to the side by means of iodine or blisters, and the administration of iodine of potassium and quinine, is advisable.

Paracentesis having been decided upon, the operation may be performed with either the siphon-aspirator or a trochar and cannula; the former instrument is preferred. Draw off the fluid slowly, as the lung is then more likely to expand, and the chances of a further effusion of fluid taking place are thereby diminished. The site to be chosen for puncture will depend upon the position of the fluid; but in the absence of specific indications, the sixth interspace in the mid-axillary line is generally to be preferred. It is essential that the admission of air into the pleural cavity be prevented, and that the instruments be scrupulously clean.

The pain of the preliminary incision of the skin of the puncture will be diminished by holding a piece of ice dipped in salt to the spot for a short time, freezing it with ether; or a few drops of a six per cent. solution of cocaine may be injected subcutaneously. It is well to draw off as much of the fluid as possible, unless a very severe cough—a sign of the expansion of the lung—be induced; as, although in some cases the withdrawal of a small quantity is followed by rapid absorption of the remainder, this result cannot be depended upon. When the flow has ceased, the skin is grasped between the fingers, the needle withdrawn, and a pledget of cotton-wool soaked in collodion applied, covered with lint, and held in position with a piece of strapping. If the first tapping be "dry," it will be advisable to puncture in another spot, should there be clear indications of the presence of fluid.

Should the fluid re-accumulate, a second or third aspiration may become necessary; if, however, recurrence take place after repeated tapplings, it is generally advisable to allow the fluid to remain, as absorption occasionally occurs after long intervals, and if not, a simple

serous effusion does little or no harm ; while from the thickening of the visceral layer of the pleura which usually follows the prolonged presence of fluid in the cavity, it is very unlikely that at this period the operation will be followed by re-expansion of the lung.

E. CLIFFORD BEALE.

J. K. FOWLER.

Symptomatic Indications.—*Aconite* is the main reliance in simple acute pleurisy before effusion has taken place, and is usually all that is required. In the second stage, *bryonia*, after *aconite*, is very valuable, particularly in pleurisy after acute rheumatism. *Veratrum viride* is frequently useful in the first stage of acute pleurisy, with full, hard, incompressible pulse. *Arsenicum* is useful in acute cases when there is much effusion or when it appears as a complication. In Bright's disease, *arnica* promotes the absorption of the effusion. *Calcium sulphide* promotes the absorption of the exudation when slow to disappear, or when it tends to become purulent. *Antimonium tartaricum* is useful when there is profuse expectoration, cough, rattling mucus, dyspnœa, nausea. *Phosphorus*, when the affection involves the lungs, rust-colored expectoration, much prostration.

PLEURISY, DRY.—In this form of the disease the exudation from the inflamed surfaces of the pleura remains dry, little or no fluid being effused. It is especially common in rheumatic and phthisical subjects, and is probably in many cases of tubercular origin. It may precede, by a long interval, the development of pulmonary tuberculosis. Local injury and a chill are also among the exciting causes. The onset is rarely well marked, and the affection is often only discovered on examination of the chest, the patient's symptoms giving no clue to its presence ; or slight pain in the side, increased with the respiratory movements, may suggest the nature of the illness. Fever, if present, is usually only moderate in degree, and the general symptoms are not severe. There may be a short cough, without expectoration.

On palpation, friction fremitus is often felt, and on auscultation a dry, rubbing sound will be audible, often over a considerable area. This may soon dis-

appear, or, as not uncommonly happens, may persist for a long time without causing much discomfort.

The most common site of the friction sound is the lower part of the axilla or infra-scapular region, but it is occasionally audible over the apex of the lung, or beneath the clavicles. Recovery from dry pleurisy occurs through the adhesions of the opposing surfaces of the pleura. Whether this be the invariable result is doubtful ; the serous membrane, however, does not return to its normal condition, some thickening and opacity inevitably remaining. Probably adhesion is the most desirable termination, as it prevents the recurrence of the affection, at any rate in its original site, and a second attack is by no means uncommon.

After adhesion has taken place, creaking sounds may still be audible, and some pain may be felt on deep inspiration.

Treatment.—Firmly strap the affected side with emplastrum plumbi spread upon wash leather. The plaster should be cut into strips of about two inches wide and of sufficient length to reach from the spine to the sternum, and the strips, slightly overlapping each other, should be applied over an area proportionate to the extent of the disease. By this means the movements of the affected side are restrained, the pain is relieved, and adhesion of the inflamed surfaces is promoted. In some cases counter-irritation is of service, for which purpose a blister or equal parts of the tincture and liniment of iodine may be used. The general health must be attended to, tonics and cod-liver oil being especially useful. In phthisical subjects a change of climate is to be recommended.

E. CLIFFORD BEALE.

J. K. FOWLER.

Symptomatic Indications.—*Bryonia*, *kali carbonicum*.

PLEURISY, TUBERCULAR.—As stated in the preceding article, pleurisy of tubercular origin is very often "dry," but by no means always so, as such a case may present all the characteristics of an ordinary case of pleurisy with effusion, running on, it may be, to empyema, and terminating fatally, its true nature being only discovered on post-mortem examination. It is highly probable that many cases of pleurisy, which are believed

to be of idiopathic origin, are really tubercular.

The *symptoms and physical signs* of tubercular pleurisy, whether dry or accompanied by effusion, do not in themselves differ sufficiently from those which are present in non-tubercular cases to permit of a differential *diagnosis* on those grounds alone. The suspicion of the tubercular nature of the disease generally arises from the family history or the previous history or appearance of the individual, or from the fact of the presence of tubercular disease in the lungs or elsewhere.

Prognosis.—As a rule, more serious than in simple pleurisy, but there is every reason to believe that, even should considerable effusion occur, absorption of the fluid may take place with complete recovery, and that in rare cases this may again happen when the opposite side is subsequently attacked. The chief reason for gravity in prognosis lies in the fact that, given the presence of tubercle within the body, it is impossible to predict what organ it will attack or to state what are the chances against a general outbreak of acute tuberculosis. As stated in the article on PHTHISIS (*q. v.*), one of the distinctive modes of onset of that disease is by the occurrence of an attack of pleurisy, which in all probability is, in many cases, tubercular.

Morbid anatomy.—It is highly important to recognize the fact that the pleura may be so completely covered with exuded lymph as to hide all traces of the tubercle with which the membrane is studded. This is especially the case at the base of the lung, where the affection most often commences. At the margin of the inflammatory changes, however, the granulations may often be observed, but in many cases it is only on separating the lobes and displaying the pleura of the interlobar sulcus that it becomes apparent that the membrane is thickly studded with miliary tubercles. The interlobar sulci are sealed up at an early period of the disease, with the result that there the appearances are faithfully preserved. The fluid, if any be present, may, on microscopical examination, prove to contain bacilli, and in like manner the fluid withdrawn by aspiration during life may also contain the specific organism. In cases of dry tubercular pleurisy the serous membrane is often found to be much

thickened and covered with a tough layer of lymph; on removing this, the tubercles may generally be seen.

Ætiology.—In the majority of cases the pleura is infected from the lung, but it may be attacked in common with many other organs in a wide dissemination of tubercle. The bronchial and mediastinal glands may be secondarily affected, and also in some cases are probably the starting-point of infection of the pleura. The peritoneum covering the under-surface of the diaphragm is especially likely to be affected secondarily to the neighboring pleura, infection spreading through the diaphragm.

Treatment.—It is advisable in these cases to avoid operative interference unless imperatively called for; in other respects the treatment is not essentially different to that already detailed under PLEURISY, ACUTE, and DRY. Lowering measures are not well borne by tubercular subjects, and a rather more liberal dietary may therefore safely be allowed.

J. K. FOWLER.

Symptomatic Indications.—*Kali carbonicum* is valuable in secondary pleurisy with pulmonary tubercle. *Iodine* is useful in strumous cases; *phosphorus*, when complicated with lung disease, much prostration.

PLEURODYNIA signifies "pain in the side" and is usually due to rheumatism of the muscles of the chest-wall. As it is often associated with cough, care must be taken to exclude pleurisy or other intra-thoracic disease; the possibility that the pain may be the precursor of shingles must be borne in mind. In women, pain in the left side is often indicative of ovarian disorder. The pain, when due to a rheumatic affection of the chest-walls, may be relieved by the local employment of linimentum saponis co., or, if very severe, by hypodermic injections of morphine. It is, however, generally best treated by fixing the chest with strips of lead plaster spread upon wash leather, applied from the spine to the sternum.

Symptomatic Indications.—*Cimicifuga* is curative when the pain is due to rheumatism, or sympathetic from ovarian irritation; *bryonia*, when the pain is worse from movement; the patient wants to keep perfectly still; *arnica*, in myalgic cases, from over-exertion; *aconite*, in rheumatic form, with fever, restlessness,

anxiety ; *arsenicum* or *ranunculus*, when neuralgic.

PNEUMOGASTRIC NERVE, DISEASES OF.—The vagus or pneumogastric nerve, forming, with its fellow, the tenth pair of cranial nerves, arises from the medulla oblongata between the origin of the glosso-pharyngeal and the spinal accessory nerves, which are above and below it; its nucleus is situated in the floor of the fourth ventricle near the calamus scriptorius, and on its inner side is the hypoglossal nucleus. After its passage through the foramen jugular, it is joined by the branches from the spinal accessory nerve.

The nerve may be affected either at its nucleus of origin in its trunk, or in the terminal branches.

The disease in which the nucleus is most frequently affected is BULBAR PARALYSIS (*q. v.*) in which the neighboring nuclei of the spinal accessory and the hypoglossal are also involved. It may be mentioned here that all the motor fibers of the vagus to the head and neck are supplied by the spinal accessory nerve. Inside the skull the nerve is liable to be compressed by tumors, or by an aneurism of the vertebral artery; or it may be involved in meningeal thickening, whether syphilitic or otherwise.

In the neck, being in the same sheath as the carotid artery, it may be similarly affected by an aneurism of that vessel, or involved in a ligature, or compressed by glandular tumors in the neck. The frequency with which the recurrent branches, the right in its passage round the subclavian artery, and the left in passing round the arch of the aorta, become involved in the growth of aneurisms is to be remarked; the left being more often affected than the right, as the aorta is more often the seat of aneurism than the subclavian artery.

In regarding the phenomena produced when the nerve is divided or compressed, it will be necessary to remember that it contains the depressor fibers for the heart, accelerator and depressor afferent fibers for respiration—the former preponderating—the motor and sensory fibers for the esophagus, the sensory and some of the motor fibers for the stomach; therefore the symptoms will be due to irritation or paralysis of these fibers, according as they are irritated or destroyed.

Its chief branches are the

Pharyngeal, supplying the constrictors of the pharynx and the levator palati through the pharyngeal plexus, and producing, when affected, difficulty of swallowing.

Laryngeal, of which the superior laryngeal is sensory to the interior of the larynx, and also supplies one muscle—the cricothyroid; while the inferior recurrent laryngeal supplies all the other intra-laryngeal muscles. Paralysis of the muscles of one side of the larynx is a prominent symptom when the trunk of the vagus in the neck, or the recurrent branch is affected; the symptoms being that the voice is hoarse, and coughing impossible, as the glottis cannot be closed, owing to one vocal cord being paralyzed (*see* LARYNX, PARALYSIS OF).

Bilateral paralysis is produced in locomotor ataxia—where the spinal accessory nuclei of either side are affected—in diphtheria, and in bulbar paralysis. In the first-named disease paralysis of the abductors is especially apt to occur.

Besides paralysis, the muscles of the larynx are liable to spasms, which is always bilateral, unless brought about by irritation of one recurrent laryngeal nerve. Spasm is produced reflexly, in the form of cough, by irritation of the sensory branches of the superior laryngeal nerve in the larynx. In pertussis there is a series of expirations, followed by a spasmodic narrowing of the glottis during inspiration, and in laryngismus stridulus (*q. v.*) there is closure of the glottis without the muscles of respiration being affected. These two conditions are probably produced both reflexly and centrally (*see* LARYNX, SPASM OF). In epilepsy the cry which begins the fit is produced by tonic contraction of the vocal cords, similar to that of the limbs, and is part of the cortical discharge occurring centrally. In locomotor ataxia “laryngeal crisis” consists of spasm of the glottis, with dyspnœa and stertorous breathing, due to local irritation of the spinal accessory nucleus.

The pulmonary branches of the vagus which are distributed to the muscular fibers of the bronchi are generally believed to play an important part in the production of some of the phenomena of the asthmatic paroxysm; and through other pulmonary branches also, the trophic influence, which it is by some

supposed to possess over the lungs, must be exerted.

Cardiac Branches.—In the remarkable cases of persistent extremely rapid action of the heart occasionally observed, these branches are necessarily concerned (*see* HEART, NEUROSIS OF). The influence of the pneumogastric nerve in the production of angina pectoris is discussed in the article on that subject (*q. v.*).

Besides the esophageal, of the terminal branches to the abdominal viscera only those to the stomach need be here referred to. The vagus contains the sensory afferent nerves of the stomach and some of the motor, and the severe and persistent attacks of pain and vomiting—gastric crises—which occur in locomotor ataxia, are due to central irritation of the spinal accessory nucleus.

C. E. BEEVOR.

PNEUMONIA (Croupous, Lobar, or Pleuro-pneumonia).—The term pneumonia is generally used to denote that form of acute inflammation of the lungs which usually runs a definite course, and tends, as a rule, to complete recovery after the fever which accompanies it has subsided. Other forms of pulmonary inflammation to which the name is occasionally given, are better described as secondary pneumonia, chronic or interstitial pneumonia, and broncho-pneumonia.

Symptoms.—The onset of the disease is very frequently traceable to some exposure to chill, especially after violent exercise. A feeling of general malaise is soon followed by definite headache, a well-marked rigor, and vomiting. Of these initial symptoms, the vomiting is the most constant, and is present in a large majority of recorded cases, especially in children. When the patient first comes under treatment, which is often not till about the third day, he is found with a peculiarly hot and pungent skin, flushed cheeks and dry, coated tongue, and often a small outcrop of herpes about the lips. He usually lies very still in bed with the head low, and very often flat on the back. The face has generally a flushed and dusky appearance with a slight icteric tinge, but at the same time the eyes are bright, and there is an anxious expression of countenance. Respiration is rapid, and tends to become more so as the disease progresses, but

the respiratory movements are cautious and shallow, as they are in most cases accompanied by localized pain, due to the inflammation of the pleura covering the affected lung.

The pain is increased by movement, especially by coughing, and sometimes when attempts are made to drink, and hence its speedy relief may become a matter of importance, as thirst is a very common and prominent symptom.

The pulse is regular as a rule, and ranges from 90 to 120, but does not maintain any regular proportion with the number of respirations, the latter sometimes ranging as high as 40 to 60 to the minute, showing a marked change in the normal pulse-respiration ratio of 4 (or 4-5) to 1. The temperature in most cases quickly rises to 103° or 104°, and shows a tendency to remain about the same level during the active period of the illness, the daily fluctuations being sometimes very slight or even absent altogether. In some cases a very irregular temperature has been recorded. More or less cough is generally present. It is always short and guarded, to prevent any increase of pain. The expectoration, which varies greatly in quantity, and may be absent altogether, is thick and viscid, and adheres closely to the sides of the vessel containing it, and is typically of a dull rusty color from the admixture of a certain amount of blood. Pure blood is very rarely ejected in the course of pneumonia. The urine is high colored, *deficient in chlorides*, deposits lithates on cooling, and may contain a trace of albumin. The action of the bowels is generally sluggish, but diarrhea may occur. Delirium, especially in neurotic persons, is very frequent about the third day of the disease, and may persist as long as the fever lasts. In children, the onset is occasionally marked by convulsions in addition to, or in place of, a rigor.

The symptoms just described are apt to continue with little variation from five to eight days, but the appearance of the physical signs may be delayed for several days after the onset of the attack. In such cases it is probable that the inflammation has begun in the deeper parts of the lung and is slowly traveling to the surface during the interval. In the majority of uncomplicated cases the disease remains limited to the lobe primarily affected, but in a very considerable num-

ber it extends to other parts of the same lung and may attack its fellow.

The recovery from pneumonia is usually rapid and complete, occurring by *crisis* on or about the seventh day of the disease. A sudden fall of temperature and the restoration of the healthy action of the skin-mark, the occurrence of "crisis," and with these signs the pulse becomes slower, the respiration easier, though still very rapid, and the patient quiet and sensible, often sleeping a great deal, especially if there has been much wakefulness before. The tongue gradually cleans and the appetite returns. "Crisis" usually occurs in the evening or at night, and is not delayed beyond the fourteenth day in uncomplicated cases.

Stages and Physical Signs.—The most characteristic sign of the first stage of pneumonia, that of *engorgement*, is the presence of crepitation audible only on inspiration; this may be preceded by a change in the quality of the breath-sounds which is usually described as an increased harshness with diminished intensity, but it is rarely possible to make a correct diagnosis until the appearance of the characteristic râle. The movements of the chest are shallow, and the expansions of the affected side diminished. The percussion note may have a somewhat tympanitic character, and the vocal fremitus is increased. The second stage, *red hepatization*, is marked by dullness on percussion over the affected area, which may be the whole of one lobe, the right lower lobe being the most common seat of the disease, and the presence of high-pitched tubular or "whiffling" bronchial breathing, a sound which closely resembles that heard on auscultation over the larynx in health. The dullness is rarely so absolute as that produced by the presence of an effusion into the pleural sac. Vocal fremitus is usually increased but may be quite absent if the larger bronchi, as sometimes happens in very acute cases, are filled with a solid fibrinous exudation continuous with that in the alveoli and smaller tubes. This is a condition likely to be mistaken for that of pleurisy with effusion. Crepitation may persist if the inflammation continue to spread, but is usually only heard in the earlier stages, and before the lung has become completely solidified. The voice-sounds are altered and intensified to bronchophony or pectoriloquy, but they

may at times acquire a peculiar nasal twang which is not heard over the trachea. A friction sound is often audible, but is very frequently absent, even when a considerable amount of pleurisy exists. Measurement may show the affected side to be slightly enlarged. The spleen can sometimes be felt and is usually increased in size. All these signs may persist during the acute stage of the attack. The third stage is that of *gray hepatization*. The physical signs during this stage do not differ essentially from the above, and the presence of the condition can only be inferred from the severity of the constitutional symptoms and the non-occurrence of a "crisis."

The crisis is, as a rule, followed by the stage of *resolution*, which is marked by the presence of coarse liquid and bubbling râles (redux crepitation) audible with both inspiration and expiration, indicating that softening and absorption of the effused products is in progress; the bronchial character of the breathing becomes less and less marked and the sounds gradually return to the normal, although weeks and even months may elapse before the recovery of the lung is complete.

Course and Termination.—Recovery may be delayed, the temperature gradually declining (lysis) and certain sequelæ, leading to more serious results, may follow. The slower form of recovery is marked by the same symptoms occurring in gradual succession, but in many such cases it is not continuous. In old persons and those whose health has been previously broken down by any cause, such as alcoholic or malarial poisoning, recovery may be thus retarded, and a series of secondary changes may ensue, dependent in great measure upon the severity of the inflammation and upon the constitutional peculiarities of the patient. It is doubtful whether simple acute pneumonia ever terminates in abscess, but cases are on record in which, after a basal pneumonia, the lung has failed to recover itself, and has become the seat of a cavity, and to all appearances, the starting-point of phthisis, of which the signs subsequently develop elsewhere in the lung. Such cases are in all probability tubercular from the first, and although the pneumonic process may have been predominant at the outset, the specific character of the disease will have shown itself in the later stages, and have led to the

disintegration of the inflamed patch of lung and the extension of tubercular disease to other parts.

In rare instances absorption is only partial, small islets of inflamed tissue being left which undergo disintegration. Such a change might be indicated by the presence of elastic tissue in the sputa; the condition, however, is rarely met with except in association with phthisis, and is probably to be attributed to specific influences.

The whole or part of a pneumonic patch in a lung may become gangrenous, but the condition is rare. It is probably caused by plugging of vessels in the inflamed area and around it, whereby the blood supply is cut off. The symptom indicative of this condition is an unmistakable fœtor, which resists the influence of all deodorizing drugs. If the gangrenous area be very limited, it may ultimately be expectorated, but the occurrence of gangrene is generally the forerunner of a fatal termination.

Pneumonia is always a serious complication, especially when it supervenes upon renal disease or diabetes, œdema of the remainder of the lung being apt to ensue, a condition generally fatal in this connection.

Complications.—Inflammation of neighboring serous membranes is very prone to occur. Some degree of pleurisy is present in nearly all cases of pneumonia, although much effusion of fluid is comparatively rare. Pericarditis is a most serious complication, especially in children. Local peritonitis may also occur.

Inflammation of the mediastinal tissues and enlargement of the mediastinal and bronchial glands have been frequently noted. Hyperpyrexia may at times supervene in the course of a case and then becomes the most serious condition, requiring active antipyretic treatment. Purulent meningitis occasionally occurs as a complication of acute pneumonia, and to it are probably attributable the irregular paralytic symptoms which sometimes complicate the most serious cases.

Prognosis.—Uncomplicated cases of pneumonia recover completely as a rule, even though they may have apparently approached very near indeed to a fatal termination. This is especially the case in young patients. To this rule, however, there are many exceptions, and hence the prognosis should always be guarded. In

the complicated cases, where pneumonia attacks intemperate persons or those who are the subjects of morbid conditions elsewhere, and especially of renal disease, the issue is more often fatal. Some doubt has, however, recently been thrown by carefully prepared statistics, upon the generally received statement that pneumonia is especially fatal in intemperate subjects. Marked delirium of the type of delirium tremens, hyperpyrexia (105°–106° F.), extreme frequency of the pulse and respirations, the involvement of both lungs in the disease, the development of other acute inflammatory affections, such as pericarditis or meningitis, are all signs of danger, and, should œdema of other parts of the affected lung set in, the prospect is still more unfavorable.

Pathology.—The inflammatory changes taking place in a lung, the site of acute inflammation, may be roughly divided into three stages. The first stage is marked by hyperæmia and engorgement of the part about to be attacked; the second, by active inflammation with rapid effusion of fibrinous material into the pulmonary alveoli; and the third, by the various changes that may occur in the material thus effused and in the affected tract of lung tissue itself.

The pathological changes in the first stage of an acute pneumonia may sometimes be seen on the confines of an area in a more advanced stage of the process. The affected part is engorged and dense, but it is not solid. In the second stage, the lung is found to be almost entirely consolidated, and the layer of visceral pleura covering it is seen to be dull and dry and covered with a thin layer of lymph, which, on being stripped off, displays the injected surface of the pleura beneath. On section, the consolidated area appears of a dirty brick-red color, the surface is granular, and exudes a yellowish-red fluid. It is airless, and sinks in water. Pressure with the finger easily pits the surface or breaks into the middle of the patch. Solid fibrinous cylinders of exudation are seen projecting from the small bronchi. This condition, generally described as red hepatization, is brought about by effusion of fibrinous material from the hyperæmic vessels of the vesicular walls into the vesicles. A few leucocytes and many red blood corpuscles are effused at the same time, and as the fibrin coagulates, these are caught

in the meshes which it forms. Some swelling of the alveolar walls and of their epithelial lining takes place at the same time.

The next stage in the process has been called gray hepatization, from the fact that the consolidated lung becomes yellowish-gray in color, and is still more softened and friable than in the previous stage. This change in color is, in part, due to increase in the number of leucocytes and to fatty degeneration of all the effused cellular elements, and in part also to the enlargement and multiplication of the cells of the alveolar walls, producing pressure upon the blood vessels and obstructing the flow of blood through them, thus rendering the whole tract of tissue more or less anæmic.

These various stages of the disease may occasionally be found in progress simultaneously in different areas of the lung, so that the surface of a section may present a mottled appearance. The color of the parts in the stage of red hepatization varies with the quantity of red corpuscles effused. When the inflammatory process ends in resolution, it has probably reached its maximum intensity before gray hepatization has set in. The epithelial and blood cells then become granular from fatty changes, and gradually break up into a fine granular material, which is re-absorbed or expectorated, some of the coloring matter of the red corpuscles appearing as a red or brown stain in the sputa for some time after the symptoms of inflammation have subsided.

Ætiology.—Acute pneumonia is marked by a course which is very definite, the symptoms and the pathological changes which they indicate being more uniform and constant than is the case in any of the more febrile diseases.

Many instances have occurred in which pneumonia has been epidemic in a district, and the disease may even recur many years afterward if the dejecta of a previous epidemic be brought to light again, as by the disturbance of soil, foul linen, or old stores. Although the great majority of cases occur singly, it may sometimes happen that the disease runs through a household almost as freely as an ordinary catarrh. In whatever way it may be set going, acute pneumonia usually follows a very regular course if it remain uncomplicated.

Pneumonia occurs most frequently from January to March. It attacks persons of all ages and of both sexes, but males rather more often than females, and, although those of weak constitution are its most constant victims, yet its effects upon the strong and vigorous are often exceptionally severe. Pneumonia may occur in any part of the lung, but the lower lobes are the parts most commonly affected, and of these the right would seem to be more susceptible than the left. In children, however, apex pneumonia is by no means rare, or the disease may begin about the root and spread to the apex. Cases of bilateral pneumonia are less frequent and are not often simultaneous in their onset. The disease does not of necessity attack a whole lobe at one and the same time, although the inflammatory change is frequently limited by the great natural divisions of the lungs. It does, however, tend to attack large tracts of lung tissue, and is apt to spread beyond its first limits and gradually to extend over a whole lobe. One attack of acute pneumonia, so far from giving immunity from further recurrence of the disease, would seem to render the patient even more susceptible to a second attack.

• A form of inflammation closely allied in its morbid changes to acute pneumonia, may be set up by direct injury or contusion of the chest. The clinical course of the disease in such cases differs in many material points from that of the acute form (*see* PNEUMONIA, SECONDARY).

Treatment.—It is important that the natural course of the disease should be interfered with as little as possible; careful nursing is essential, and a sharp watch must be kept for the onset of unfavorable symptoms. The patient must be confined strictly to bed, the bed-clothes should be as light as possible; a liberal supply of fresh air maintained in the room. The patient should be disturbed as little as possible, and hence all unnecessary examination is to be avoided and conversation must be prohibited. The daily sponging for cleanliness is best done in the recumbent position. If when the case is first seen the physical signs be not yet developed, it is always desirable to act freely upon the bowels. In rare cases, where the onset of the fever has been very rapid and severe, and

before the physical signs of consolidation have appeared, the administration of small (3-minim) doses of tincture of aconite or of tartar emetic ($\frac{1}{10}$ of a grain every hour) will sometimes appear to cut the process short, the fever subsiding almost as quickly as it came on. This treatment, however, if not rapidly successful, should not be persevered with, but may be always tried when the case is seen in a sufficiently early stage, provided that the patient be not very weak. It is most successful in robust patients with a full and resistant pulse.

If these means fail, or if the patient be not seen during the early stage, the affected side may be enveloped in a lightly made jacket-poultice of linseed-meal, which should be changed about every four hours, its use being continued so long as active inflammation persists either at its original site or elsewhere. Jackets of spongio-piline may be used for children, but are not so satisfactory as the linseed-meal poultice. Of late years, since more attention has been given to antipyretic measures in the treatment of disease, the use of poultices has, in the practice of many physicians, been superseded by the application to the affected side, when the temperature reaches 103° or higher, of ice-water compresses, changed every half-hour. Relief of pain and a lowering of temperature generally attend this mode of treatment, and it is likely to become yet more firmly established in this country. When the disease is subsiding the use of any application can be discontinued, or layers of dry cotton-wool may be substituted for poultices.

The diet should consist of milk and beef-tea only. Alcohol is often of the greatest service, and in severe cases, where there is much delirium, or where the rate of pulse becomes excessive, it may be given in very large quantities, even to the extent of 12, 15, or more ounces of brandy in the twenty-four hours. As the disease progresses, digitalis may be given with advantage if the action of the heart becomes weak or irregular. Chloral may sometimes be required if the patient be sleepless. Such drugs, if they have to be used at all, should be used boldly. Hyperpyrexia should be treated with large doses of quinine (gr. xv-xx), by antipyrin (gr. x-xv), or anti-febrin (gr. v-xv), or by the use of cold applications

as above described. The action of the bowels should be maintained by saline purgatives with an occasional dose of calomel (gr. ij). Local pain is often a serious feature, and may be relieved by the application of ice compresses or three or four leeches to the affected side.

The practice of venesection in acute pneumonia is rarely adopted in this country, although largely employed in Europe. Cases are to be met with at times, in which congestion of superficial veins and general slight cyanosis are present in association with a full and resistant pulse. In such the withdrawal of venous blood undoubtedly gives marked relief, and is sometimes followed by a general diminution in the severity of the disease itself, the range of temperature becoming lower, and the dyspnœa less marked. In most of the less congestive cases, however, the constant application of the jacket-poultice appears to act in much the same way by drawing a large amount of blood to the vessels of a wide surface area. Cough, if severe, should be relieved, as it usually aggravates the pain.

The occurrence of "crisis" is sometimes marked by very decided depression; and the free use of stimulants, such as brandy and carbonate of ammonia, is called for. After the subsidence of the fever, it is usually only necessary to keep up the action of the excretory organs, and to regulate the diet according to the patient's powers of taking food. Tonics, and especially iron and quinine, will aid recovery and convalescence, and a change of air is advisable before the patient resumes his usual habits of life.

The treatment of the cases which do not end in recovery of the lung must depend upon the course which the disease may take in each case. As a general rule, it is mainly necessary to keep up the patient's strength by all available means, relieving such special symptoms as may arise. It is not advisable to attempt the evacuation of an abscess or gangrenous cavity unless its position can be pretty clearly defined, often a matter of very great difficulty. A direct opening and the insertion of a large drainage-tube is all that should be attempted; no advantage is to be gained by washing out the cavity. Experience of such cases does not indicate a hopeful prognosis, but the pa-

tient is generally saved from the annoyance of the constant evacuation of foul pus by the mouth.

E. CLIFFORD BEALE.

PNEUMONIA, SECONDARY. —

Certain forms of pneumonia are apt to occur as complications of pre-existent disease of some other organ, such as the heart, brain, kidneys, or liver. Simple inflammation of limited areas of lung tissue may also be set up by direct injury.

In most of the specific febrile diseases, this form of secondary pneumonia may be met with, but it is especially common in association with typhus and enteric fever; it is also not infrequently a complication of acute and chronic nephritis. Pulmonary apoplexy following embolism may give rise to inflammation of the lung tissue around the infarction, and foreign bodies which may have been sucked into the smaller bronchi will, if they remain, certainly produce inflammatory changes.

A condition of lung closely allied to that of pneumonia is sometimes met with in the course of erysipelas of the face or head. In some cases the disease has apparently spread by direct continuity to the throat and then to the lung, but in others the lung has been attacked independently of the upper air passages. It is marked by acute hyperæmia and effusion of serum and some degree of fibrinous exudation into the lung tissue, and is attended, like erysipelas elsewhere, with considerable constitutional disturbance. Recovery, however, when it occurs, is more rapid than is the case in ordinary pneumonia.

The *symptoms* common to most of the forms of secondary pneumonia are cough, dyspnœa, more or less expectoration of tenacious muco-pus, and very commonly hemoptysis of varying amount. In addition to the rusty sputa seen in simple pneumonia, there is often a considerable quantity of thick dark blood brought up, sometimes mixed with frothy spots, and sometimes alone. The blood, which is derived from patches of congestion or of pulmonary apoplexy, may continue to appear for many days after the subsidence of the more active symptoms; it gradually alters in appearance, and becomes of a dark brown color, and may in some cases have a peculiarly offensive taste.

The range of the temperature, of neces-

sity, varies much; but, as a rule, it is not so high as in the uncomplicated forms.

The onset of the pulmonary condition is in all cases much less marked than in the acute disease.

The *physical signs* of the disease are for the most part those of congestion. The entry of air into the affected part of the lung is feeble, the expiratory sound is more or less prolonged, and there may be crepitation or coarse crackling râles audible, according to the stage which the disease has reached. The amount of dyspnœa and pain vary greatly. The patient is usually more restless than is the case in acute pneumonia, and the cough is often very troublesome. When the disease is secondary to one of the specific fevers, the symptoms of the two conditions become too mixed for differentiation. The gravity of the pulmonary condition is usually in direct proportion to its extent.

The *course* of the pneumonia will depend in great measure upon the nature and intensity of the disease of which it is a complication. Recovery may be satisfactory when the primary fever itself subsides quickly and completely, but when the latter is prolonged and the patient's strength exhausted, if the case should not end fatally the lung mischief rarely clears up satisfactorily. Septicæmic infection conveyed through a poisoned wound not unfrequently gives rise to a most rapid and dangerous form of pneumonia, which tends to spread through the lung with great rapidity, and very commonly leads to a fatal termination.

Pathology.—The actual process of inflammation in secondary pneumonia is much the same as that observed in the acute disease. Its onset, however, is generally more insidious, the consolidation is less complete, and smaller areas are affected.

When the pneumonic patches are situated near the surface of the lung, the pleura is very likely to become implicated, causing in many cases more or less pleuritic effusion.

Pneumonia, as the result of injury or violence, is generally limited to the parts of the lung in the immediate neighborhood of the lesion. The pleura is almost always affected at the same time, and there is usually a certain amount of blood effused in the vesicular tissue before the inflammatory process sets in. The condition is generally followed by recovery,

but the lung often remains scarred and firmly adherent to the chest-wall.

Treatment of the secondary forms of pneumonia must be of a more stimulating and active kind than that of the acute form. Brandy and carbonate of ammonia will be required at an earlier stage, and may be used with a freer hand. Poultices should be kept applied to the whole of the affected side. Quinine is sometimes of value, but large doses are required (3 to 10 grains three times a day). In the cases of traumatic origin, however, it is sufficient to keep the patient in as complete physiological rest as possible, using Dover's powder (grs. v, twice a day), if necessary, with that object. In septicæmic cases the only possible treatment is to maintain the vital processes by active stimulation. Strapping the side is advisable where there is much pleuritic pain.

E. CLIFFORD BEALE.

Symptomatic Indications.—*Aconite* is the principal remedy in the early stage of catarrhal or croupous pneumonia, when inflammatory symptoms are marked.

Veratrum viride may be substituted for aconite when the pulse is full, hard, bounding, incompressible. *Bryonia*, following aconite, does excellent service, particularly when the pleura is involved; severe pains, aggravated by motion. *Phosphorus*, especially in typhoid form, is invaluable; severe, dry cough, dyspnœa, rust-colored sputa, and great prostration indicate this remedy; especially useful in children. *Antimonium tartaricum*, in the second stage, when there is much oppression and prostration; œdema of the lungs. *Antimonium tart.* is particularly valuable in pneumonia of influenza, and that occurring in persons addicted to alcoholic liquors, and to the catarrhal pneumonia of old people. *Sanguinaria* does excellent service in the third stage (gray hepatization); extreme dyspnœa, difficult speech, tenacious rusty sputa, small, quick pulse. *Kali carbonicum* is valuable in double pneumonia, with coarse, vesicular murmurs, excessive dyspnœa, hectic fever, intermittent pulse; *cheli-donium*, when the pneumonia is associated with disease of the liver; *lycopodium* when the disease assumes a chronic condition, with purulent, fetid expectoration; and for deep-seated pain, or bronchial irritation remaining after pneumonia; *calcium sulphide*, when suppuration occurs, with hectic fever.

PNEUMOTHORAX.—The presence of air within the pleural cavity.

The condition may arise from (1) perforation of the pleura by the breaking down of a tubercular nodule in the lung; (2) the rupture of air-vesicles, as in emphysema and from great efforts; (3) the discharge of an empyema through the lung or the chest-wall; (4) gunshot and other wounds of the thorax. It may also occur (5) in abscess, gangrene, and hydatid of the lung, and (6) after the operation of tracheotomy for diphtheria, and rarely in diphtheria when the trachea has not been opened; also (7) from perforation into the pleura of some part of the alimentary canal.

It has been proved that a very considerable amount of force is required to rupture the visceral pleura in its healthy state; but cases are recorded in which a violent act of straining has given rise to it, though these are extremely rare. In the vast majority of cases the point of rupture will be found to be the seat of some form of acute or chronic disease of the lung, leading to ulceration or sloughing of the pleura immediately in relation with it. Such lesions may be extremely small, and even isolated, and the most usual form which is met with in actual practice is the softening of a tubercular nodule on the surface of the lung. Simple rupture of the membrane, however, is not enough to cause the whole pleural cavity to become filled with air; a certain degree of pressure is requisite to separate the layers of pleura and overcome the elastic tension which holds them together. This force is supplied by the expiratory effort of coughing. In wounds of the parietal pleura the pleural cavity may be laid open to the air, but this is not followed by complete collapse of the lung, as used formerly to be supposed, until the layers of the pleura have been forcibly separated by some other cause.

The entrance of air from any of the abdominal viscera involves the rupture of the diaphragm, and must be the result of excessive violence. The presence of air, whether it enter through the lung or through an external wound, usually gives rise to an effusion of fluid, which may be either serous or purulent. With the escape of air from a phthisical cavity there is often some effusion of its fluid contents at the same time, and the character of this fluid must materially affect the degree

of irritation to which it gives rise. The air thus pent up within the pleura is always more or less altered in its composition, which approaches closely to that of expired air, being rich in carbonic acid. In some cases putrefactive changes may take place, and the air is then found to be charged with a large proportion of sulphureted hydrogen.

Symptoms.—Sometimes occurs without any symptoms whatever, but in most cases is very clearly indicated. Sudden and acute pain is generally felt, followed at once by more or less urgent dyspnoea; a sensation of something running down the interior of the chest is very commonly complained of, and the patient may become almost collapsed from shock. The pulse is usually small, feeble, and rapid, and the affected side is sometimes extremely tender. The suddenness of the attack terrifies the patient considerably, and he becomes restless and anxious, frequently changing his position, but generally preferring to sit almost upright. The voice becomes feeble or whispering, and some amount of cyanosis may be present. The severity and duration of the symptoms will depend upon the extent of the disease in the lungs and the amount of healthy lung-tissue left available for respiration. Unless the case is about to end fatally, the more urgent symptoms usually pass off in a few hours, but a greater or less degree of dyspnoea will probably remain for several days.

Physical signs.—The signs indicative of a general pneumothorax on one side are very definite. The whole side seems to be expanded and more rounded than before, the intercostal spaces are sometimes slightly bulged outward, so as to be indistinct, and the respiratory movements are absent or greatly diminished. The percussion note is resonant and tympanitic in tone, the vocal vibrations are either absent or else much diminished, and the normal breath sounds are altogether absent. The heart is at once displaced to the opposite side, unless there be strong pleural adhesions on that side or some local disease of the lung. In some cases where a large opening is left through which air can pass freely in and out of the pleural cavity from the lung, amphoric breathing may be present, but this is dependent on the nature of the lesion in the pleura. The conduction of the voice sounds is not constant, being in

some cases increased and in others diminished, but pectoriloquy, resembling that audible over a pthysical cavity, is rarely present. A peculiar metallic ring may occasionally be heard during the act of coughing, and if any fluid be present in the cavity there may be metallic râle at the same time. The "bell sound" may also be elicited (*see* AUSCULTATION). A pneumothorax localized to any limited area of the pleural cavity by previous pleuritic adhesion is not so easily recognizable. The same physical signs are present as in the more general pneumothorax, but they are apt to be masked by the consonance of other healthy or morbid sounds in the lung-tissue immediately surrounding the affected part.

Additional physical signs are afforded when effusion has taken place, whether the fluid be purulent or serous. Some amount of dullness is caused in the lower part of the chest, and this may be found to alter in level when the position is changed. Sometimes, on listening to the chest and shaking the patient at the same time, very distinct splashing can be heard (succussion splash). As the quantity of the effusion increases, the signs of air will diminish and the hydrothorax or empyema will then become the chief feature in the case.

Diagnosis.—The conjunction of hyper-resonance, absence of the breath sounds and displacement of the heart, with partial or complete loss of tactile vibration, forms a group of physical signs not met with in any other condition. The symptoms of pneumothorax may be present in some cases of phthisis where acute congestion takes place in the last remaining area of healthy lung, but the physical signs will fully serve to distinguish between the two conditions. A very large excavation of the lung, especially if seated about the base, has occasionally been mistaken for pneumothorax, but the resonance is rarely so complete, and there are generally more adventitious sounds and a marked degree of pectoriloquy.

Prognosis.—Reabsorption of the air without the occurrence of any fluid effusion may take place if no septic matter has escaped into the pleural sac. In most cases some amount of fluid effusion follows the escape of air into the pleura, and, as this increases, the quantity of air is found to decrease. The gravity of any case of pneumothorax must essentially

depend upon the extent of lung area which is left undisturbed for healthy respiration. In some cases, as effusion of fluid takes place, the lung becomes pressed upon and rendered incapable of further expansion, but, if the other lung be healthy, the compensatory changes which take place may render it quite sufficient for all the requirements of quiet respiration, while the enforced rest to which the diseased organ is subjected, may cause the disease to remain quiescent and the general health of the patient will be improved thereby. The duration of a case of pneumothorax may vary indefinitely from a few hours to a year, or more. In most instances the period is less than a year, but the condition of pyo-pneumothorax occasionally becomes chronic, and may then last for years.

Treatment.—It is not, as a rule, advisable to puncture the chest with a view to withdraw the air, unless the dyspnœa be extremely urgent and there be immediate danger to life. The collapse and distress are best treated by absolute rest and by the administration of opium in moderate doses. Stimulants should only be given sparingly. Gentle purgation by means of salines is advisable. Dry cupping to the side will sometimes give relief to the dyspnœa in the less urgent cases, and fixation of the side with strong strapping is often useful in the same way. When serous effusion has taken place, it is not advisable to attempt the removal of the fluid, especially if the case be one of advanced phthisis of the same side. A considerable amount of absorption of serous fluid is possible even when air also is present in the pleural cavity, and opportunity should always be given for this to take place in every case where it can reasonably be expected. The chances of re-expansion of the lung, after the chest has once been opened for the relief of hydro-pneumothorax, are but small. In cases, which are, however, very rare, where the fluid has been shown by exploration to be fetid, free removal of it is advisable, a large opening being made in the chest-wall so as to permit of thorough drainage and cleansing of the cavity.

E. CLIFFORD BEALE.

POISONOUS FOOD.—Idiosyncrasy and habit have much to do with the causation or prevention of poisonous effects from various articles of diet; certain kinds

of fish are poisonous to some, while they may be eaten with impunity by others. Although in some countries food is chiefly prized when in a state of decomposition, anything in which putrefactive changes have commenced may prove poisonous; but apart from putrefaction there are other causes of danger. An animal may have been feeding on something poisonous to man. In this way the honey of wild bees or the milk of wild goats has become unwholesome; hares that have been feeding on the chrysanthemum, or pheasants fed on the laurel, are thus rendered unfit for human consumption. Again, the animal may have been suffering from disease—*e. g.*, anthrax, foot-and-mouth disease, pleuro-pneumonia, or tuberculosis—and its flesh will then be unfit for food; or its flesh may be rendered poisonous through being impregnated with some medicinal substance administered during life. Sometimes no reason can be assigned for the poisonous symptoms; thus at times muscles will induce retching, vomiting, and an alarming state of collapse. Meat which has become putrid, and sausages under certain conditions, are believed to owe their poisonous properties to the development of certain alkaloids known as ptomaines, which are produced during the decomposition of animal matter. The poisonous symptoms which are sometimes met with in those who have partaken of tinned meats, vegetables, meat pies, or fruits are to be explained on this hypothesis (*see* PTO-MAINES).

The *symptoms* produced are those of an active irritant poison, violent retching and vomiting, with or without purging, being the most prominent. These may be accompanied by collapse, dilated pupils, and a feeble pulse. Such cases sometimes result fatally.

The *treatment* would be the same as in the irritant poisons, the vomiting being combated by ice and iced drinks, and the purging by castor oil and opiates; stimulants, such as champagne or brandy, would probably be needed.

POISONOUS GASES.—**I. Carbonic Acid.**—This accumulates in pits, wells, mines, fermenting vats, lime-kilns, etc., producing an atmosphere that may be absolutely irrespirable, a person placed in it speedily becoming suffocated; and even in crowded and ill-ventilated rooms the

air may become so overcharged with carbonic acid and so deficient in oxygen as to produce headache, drowsiness, giddiness, and loss of power, with quickened pulse and hurried breathing. After death the body presents all the outward appearances of death from asphyxia, the blood is dark and fluid, and the venous system engorged throughout the body.

2. Carbonic Oxide occurs in combination with the above, notably in charcoal vapor and in coal gas. It is a much more deleterious gas than carbonic acid, a smaller percentage of it sufficing to produce fatal symptoms; headache, giddiness, prostration, insensibility, and death from coma being the usual sequence. The characteristic feature after death is the cherry-red color of the blood and internal viscera. This appearance is due to the fact that the oxide forms a very stable compound with hemoglobin.

3. Coal Gas.—The symptoms produced may vary from the slightest degree of malaise to a fatal coma, with stertorous breathing and lividity, ushered in by headache, vertigo, nausea and vomiting, and followed by loss of consciousness and complete prostration. After death the blood is dark-colored, the papillæ at the base of the tongue are injected, the lungs are light-colored, extravasations of blood may be found in the spinal cord or its membranes, and rose-colored patches on the thighs.

Treatment.—In all cases the patient should be at once removed from the polluted atmosphere and subjected to a free current of fresh air; this may suffice to revive him. The inhalation of oxygen may be tried; venesection and transfusion with arterial blood freshly drawn will be necessary in the case of carbonic oxide poisoning and would be beneficial in the other forms of poisoning also; artificial respiration may be performed; stimulants should be freely administered.

POISONS.—**Irritant Poisons** are such as tend to produce inflammation or actual destruction of the part to which they are applied. In the latter case they are called corrosives; to this class belong the mineral acids, oxalic acid, and the alkalies.

Symptoms.—The difference between the symptoms in irritant and corrosive poisoning is one of degree rather than kind. In irritant poisoning the symptoms may not

come on at once; in corrosive poisoning they almost invariably begin immediately the poison is taken into the mouth. Most of the metals are irritant poisons. The more important of them will be found treated of under their respective headings. The vegetable irritants are elaterium, gamboge, savin, hellebore, and ergot, while cantharides and certain kinds of foods must also be ranked among the irritants.

Corrosive Poisons.—The symptoms in the most severe form come on at once, and consist of a sour taste with burning pain in the mouth, throat, esophagus, and stomach, with eructations and vomiting of black, frothy, blood-stained matter. In the case of sulphuric or nitric acid there may be brown or yellowish stains about the lips, the mucous membrane of the mouth and tongue may become white and shreddy, the breathing is labored, and there may be hoarseness, especially when hydrochloric acid or ammonia has been taken. The vomiting is constant and the pain in the abdomen intense; there is also extreme thirst, constipation, tenesmus, and dysuria. The pulse becomes exceedingly feeble and the skin clammy.

In the less severe cases, where an irritant or only a small quantity of a corrosive has been taken, the symptoms are less severe; there is not so much collapse and there is usually diarrhea. Even when the patient survives the immediate effects of a corrosive poison, he is liable to die at a later period from stricture of the esophagus, and this is especially the case in poisoning by the alkalies. The intellect is generally unaffected in irritant poisoning, but convulsions or coma may be present at the last.

Post-mortem Appearances.—The changes will be most marked in the stomach and esophagus, but lesions may be found more or less throughout the whole alimentary canal from the mouth to the anus. They may vary from the slightest degree of redness through all stages of inflammation to ulceration or even perforation, the stomach being invariably the part most affected. Where perforation has occurred, some peritonitis will be found, but this may be present, especially in corrosive poisoning, without any perforation. In sulphuric acid poisoning the contents of the stomach and intestines will be black from altered blood, and in all severe cases of irritant poisoning

blood will probably be found in the stomach or intestines. Sometimes, especially in the case of some of the metallic poisons, the large intestines will be affected while the small escape. The other viscera may show signs of inflammation.

Treatment of irritant poisoning resolves itself into an attempt to assist nature in her efforts to get rid of the poison, and in an endeavor to neutralize by antidotes what cannot be expelled. Vomiting is a constant symptom, and it should be encouraged. Where there is no contra-indication, the stomach should be thoroughly washed out with the stomach-pump until it is certain that no poison remains there. This cannot, however, be adopted in any case of corrosive poisoning, and it is also inadmissible in many of the metallic irritants. When there is no reason to fear ulceration of the stomach or esophagus, emetics may be used if the vomiting be not sufficiently free. Of these, ipecacuanha in 20-grain doses or sulphate of zinc in 30-grain doses are the most reliable, or apomorphine may be used hypodermically (dose gr. $\frac{1}{20}$ – $\frac{1}{6}$). Large draughts of tepid water or mustard and water will often prove efficient as an emetic where more active measures are contra-indicated, or the fauces may be tickled with a feather; but in the corrosive poisons not even these measures may be tried.

The best antidote for the mineral acids is carbonate of magnesia, but any of the alkaline bicarbonates may be used, or even chalk and plaster from the ceiling, failing anything else. They should be given mixed with water, milk, or gruel, the object being to neutralize and dilute the poisons as speedily as possible, for it is only when in a concentrated form that the poisons act as corrosives.

In the case of the alkalis, vinegar and water or lemon juice would be the best antidotes, or olive oil may be given in large doses. The antidotes to the metallic poisons will be found under their respective headings. The rest of the treatment would be symptomatic, the chief dangers being perforation of the stomach and peritonitis; the patient should therefore be kept in bed till all the irritant symptoms have passed off, and be kept on a light diet of milk, gruel, broth, etc. Opiates should be freely given, both by the mouth and hypodermically if there be much pain, and leeches to the epigas-

trium may be necessary. The dyspepsia or stricture of the esophagus that might result from corrosive poisoning should be treated on general principles.

Neurotic Poisons.—Those which produce their effects either chiefly or wholly by their action on the nervous system.

Of these some produce almost instantaneous loss of consciousness and complete muscular relaxation; such are prussic acid, nitro-benzol, and the aniline group. Others produce convulsions or muscular spasms without loss of consciousness—*e. g.* strychnine. Others, such as digitalis, aconite and carbolic acid are both irritant and narcotic; while others are pure narcotics, the most important being opium, chloral-hydrate, belladonna, conium, hyoscyamus, and stramonium. The chief of these are separately described, but many of the narcotic poisons so closely resemble each other in their effects and in the treatment required, that it will suffice to indicate a few points of difference. For instance, opium causes contraction of the pupils; several of the others, and notably belladonna, produce dilated pupils; delirium is a prominent feature of belladonna poisoning, though unknown in the case of opium; flushing of the face, too, so common in belladonna poisoning, is not met with in poisoning by opium.

Post-mortem Appearances.—Nothing definite is found in cases of narcotic poisoning; congestion of the brain and its membranes is common, and also congestion of the mucous membrane of the stomach, but there is nothing characteristic.

Treatment.—In cases of narcotic poisoning spontaneous vomiting is not the rule, and, as the patient will be unable to swallow, emetics are not likely to be of much service. The stomach should be washed without delay, and this should be continued until the fluid returned seems as pure as when it was put into the stomach, and is, as far as can be judged, free from any trace of the poison; nothing more will be gained by continuing the use of the stomach-pump after this. If the nature of the poison taken be known, and if there be any antidote, this may be administered by means of the stomach-pump, or preferably, if possible, by hypodermic injection, and in the latter case the treatment might be so commenced. For instance, in a case of

belladonna poisoning, hydrochlorate of pilocarpine (gr. $\frac{1}{10}$ – $\frac{1}{8}$) might be injected or a small quantity of morphine. If these methods fail to rouse the patient, it may be necessary to try the effect of cold affusions or flicking the chest or feet with a wet towel; pouring hot and cold water alternately over the head is also a powerful method of reviving persons, and is sometimes effectual. The free use of the induced current, the poles being applied indiscriminately to different parts of the body, will often succeed when other measures fail. Mustard blisters to the calves, epigastrium, or nape of the neck may be tried, and, if other treatment fail, artificial respiration, either by Sylvester's method or by galvanization of the phrenic nerves, should be tried. In a severe case these various measure will require to be persisted in for some hours before recovery is assured, and sometimes they will fail to arouse the patient from his coma. When the patient has been so far roused as to reply to questions, some hot strong coffee should be administered, which should aid in further rousing him, and the patient must then be kept moving about to prevent him from again becoming comatose, the greatest care being taken to avoid producing exhaustion or cardiac failure. Should he relapse, as is not infrequently the case, the treatment must be commenced over again, with the exception that the stomach-pump will not be required; but it must be remembered that the relapse may be due to exhaustion, and it would be well, therefore, in all cases where such active treatment as is above described has been prolonged, that as soon as the patient is aroused he should be given strong beef-tea and a little brandy, either by the mouth or rectum. The inhalation of nitrite of amyl, or the vapor of ammonia through the nostrils may be useful when signs of returning consciousness begin to appear, but not before. The after-treatment does not call for special description,

JOHN ABERCROMBIE.

POISONS, ANIMAL. — Dissecting-room wounds.—Wounds inflicted in the course of dissection usually heal readily and without complication, but in certain cases may be associated with local inflammation, and with implication of the absorbents. The condition known as "anatomical tubercle," which appears to

be a result of chronic irritation of the unbroken skin by frequent contact with decomposing animal matter, consists of a warty thickening of the cuticle, and papillary layer of the derm, sometimes followed by a pustule or painful fissure, and occasionally associated with lymphangitis. The destruction of the part with nitrate of silver or other strong caustic is generally sufficient for a cure.

"**Post-mortem**" wounds are liable to assume a gravity never incident upon dissecting-room injuries. In the majority of instances the cuts and abrasions contracted during an autopsy give rise to no bad symptoms. In other cases the sore may become more or less acutely inflamed and complicated with lymphangitis; various manifestations of digestive disorder, such as foul breath, nausea, and diarrhea, and more or less febrile reaction. Finally, in a third and much smaller group, may appear intense symptoms of blood poisoning, sometimes independent of any serious local signs, sometimes attended by diffuse phlegmon extending to the axilla and chest-wall and even to the pleura; or gangrenous inflammation of the parts with sloughing of tendons and destruction of joints. The constitutional disturbance is of varying type, but nearly always adynamic. True pyæmia may also arise under the same circumstances.

It is probable that three or four distinct affections dependent upon the entrance of specific micro-organisms into the blood have been included under the common heading of "post-mortem wounds."

Treatment.—Every wound inflicted during a dissection or autopsy should at once be sucked until the blood flows freely, washed in a stream of running water, and then thoroughly cauterized with caustic potash or nitrate of silver. Should the injury escape notice until pain and inflammation set in, the wound must be incised, if not sufficiently open, and the caustic applied as before. Lymphangitis, abscess, etc., may be treated according to the principles laid down in other portions of this work.

The constitutional treatment will be in great measure symptomatic, but as a rule it is advisable at the onset to act upon the bowels by a purgative—especially if there be signs of intestinal irritation—and to empty the stomach by an emetic where nausea or vomiting is present. Subse-

quently nourishing diet, tonics, and pure air must be relied upon as the most trustworthy means of restoring the strength.

Poisoned Wounds, of a character very similar to those met with in dissecting-room injuries, may arise from inoculation with various forms of decomposing organic matter, as the lye of mottled soap, rancid machinery oil, etc. Lymphangitis and glandular abscesses are not uncommon results.

Stings of bees and other invertebrate animals in this country seldom call for more than domestic treatment; but dangerous symptoms may arise when the points of attack are very numerous, or even from a single sting inflicted in the neighborhood of the glottis.

In most cases of bee sting, the extraction of the piercing apparatus (the modified ovipositor of the sterile female) and the local use of a little vaseline or liquor ammonia will prove sufficient; but where there is serious prostration consequent upon a multitude of stings, diffusible and alcoholic stimulants should be administered in large doses, combined, if there be much pain, with chloral or opium. The application of cocaine may be recommended as a local anæsthetic.

The caudal weapon of the *scorpion*, and mandibles of the larger *centipedes* and *spiders* of tropical and semitropical countries, may inflict serious and even fatal poisoned wounds; and it may be necessary to excise or cauterize the lesions and to combat prostration by the free administration of stimulants.

Bites of venomous serpents.—A wound inflicted by the fangs of the viper or adder, the more common poisonous snakes of cultivated regions, is followed immediately by severe pain and rapid swelling of the injured part, accompanied in some cases by vesiculation and widespread discoloration of the integuments; and attended by faintness, with nausea, or vomiting, thirst, and sometimes diarrhea and suppression of urine. The patient usually rallies, but the utility of the injured member may be impaired for many weeks by the infiltration of the cellular planes with extravasated blood and inflammatory products.

The bites of the *thanatophidia*—rattlesnake, cobra, etc. of warmer regions—are far more deadly in their results. The local manifestations are similar in kind to those described, but far more intense, and the

constitutional symptoms are those of profound shock, mental and physical and commonly associated with vomiting, bilious stools, and in some instances with acute jaundice.

The chief post-mortem appearances are the destruction of the coagulability of the blood (except in cases of cobra bite, where the change appears to be anticipated by the swift termination of life), and sanguineous leakage into the cellular interspaces and serous cavities of the body.

The virus of the serpent may be swallowed with impunity, or applied to any unbroken surface without risk of absorption.

Treatment.—No local treatment, however speedy, will altogether forestall absorption; but as it may be possible to intercept the ingress of some portion of the virus into the circulation, it is advisable to place a tight ligature above the seat of the injury (if in a limb), to suck the punctures, and if the means be accessible to apply a solution of caustic potash (liq. potassa, 3 parts in 10 parts of water) to the wound. Good results obtain from the injection of a one per cent. solution of permanganate of potash into the wound and adjacent tissues. Excision of the injured part may be practiced where other measures are not available.

Constitutionally, the symptoms may be attacked by a free use of stimulants and by galvanism. The injection of ammonia into the veins is now disapproved by most authorities. Arsenic in large doses (2 drams of liq. arsenicalis every half hour for four successive hours) has been recommended; but there is a possibility that the mineral might, in some cases, be more dangerous than the animal poison. The internal administration of potassa may also be essayed.

WM. ANDERSON.

PORTAL VEIN, DISEASES OF.—**Thrombosis.**—The formation of a clot in the portal vein is generally secondary to compression from cirrhosis or the presence of tumors, abscesses, etc.

Symptoms.—Are not very definite. It may give rise to hematemesis, diarrhea, bloody stools, ascites, enlargement of the spleen, diminished secretion of urine, and enlargement of the abdominal veins. Its *duration* is usually short, and it almost invariably terminates fatally.

Morbid Anatomy.—In recent cases the liver is simple anæmic. In cases of longer standing it is atrophied, sometimes granular and anæmic.

Treatment is powerless to remove and can only be palliative.

Inflammation (*Pylephlebitis*).—Inflammation rarely occurs as a primary condition in the wall of the vein but results from the extension to it of some neighboring suppuration, but cases of obscure origin have been observed in which no such cause could be found.

Symptoms.—The clinical picture of this affection is that of septicæmia with abdominal pain. Rigors, followed by heat and sweating, great prostration, rapid emaciation, swelling of the liver and spleen, jaundice, scanty dark-colored urine, diarrhea, coma, delirium, convulsions, suppression of urine, and death. There may be generalized peritonitis.

The *duration* may vary from a few days to several months, but is usually about fourteen days.

Prognosis.—Invariably fatal.

Morbid Anatomy.—The vein and its sheath are reddened, thickened, and infiltrated with pus; on transverse section its lumen gapes, and on being slit up the intima is swollen, grayish-yellow, and often ulcerated in places. The blood in the vein is coagulated and firmly adherent to the intima. The branches of the vein are filled with pus, and there are numerous small purulent foci scattered through the liver substance, which is softened, anæmic, and discolored.

Treatment.—Stimulant and anodyne.

Cancer may occur as a secondary condition, giving rise to symptoms exactly resembling thrombosis. The diagnosis must depend upon the evidence of the existence of cancer in the portal area.

Dilatation (*Pylephlebectasis*) is usually caused by some obstruction in the liver, but in some cases no mechanical cause can be found, and it is suggested that some nervous defect may give rise to relaxation of the wall of the vein.

Calcification (*Chronic Pylephlebitis*).—This is always secondary to thrombosis.

Rupture.—This may result from injury, but Frerichs has described spontaneous rupture of fattily degenerated radicles of the portal vein.

Parasites.—*Distoma hepaticum* and

distoma hæmatobium have both been found in the portal vein.

Gallstones have been found within the portal vein, where they had no doubt arrived by a process of ulceration and perforation.

ROBERT SAUNDBY.

POST - MORTEM EXAMINATION (*Necropsy; Autopsy*).—For the performance of a necropsy a high table should be secured in a good light. The chief instruments required will be a long, sharp section knife; a stout cartilage knife; three or four scalpels of varying sizes; scissors, large and small, probe-pointed and sharp; dissecting and bone forceps; a strong-backed saw and a couple of probes.

A careful external inspection should first be made, the natural orifices being examined for the presence of foreign bodies and the escape of pathological fluids. The stature should be recorded, the degree and distribution of rigor mortis, and the presence of discoloration or œdema. An incision into the deep blue patches often found on the trunk posteriorly will determine whether they are ante-mortem extravasations or simply livories.

The Skull should first be examined. The scalp is first reflected by an incision carried vertically over the skull from immediately behind the external auditory meatus to a corresponding point on the opposite side. A horizontal cut should then be made with the saw completely round the cranium, the line in front being carried above the superciliary ridges, whilst behind a small V-shaped piece of the occipital bone should be left projecting upward. This serves afterward to fix the skull cap in its place and preserve the contour of the head. The less the chisel and mallet are used in removing the bone the less likelihood is there of damaging the brain. The dura mater should be left uncut, the skull-cap being forcibly detached from it. The characters presented by the bones forming the inner table should be noted, and the sutures, etc., carefully inspected. In children, in whom the dura mater is usually firmly adherent to the bone, it is convenient to remove both together.

The longitudinal sinus is now examined, and then the dura is divided on each side on a level with the saw, cut and

turned upward toward the middle line. The amount of cerebro-spinal fluid and condition of the arachnoid and pia mater having been observed, two fingers of the left hand are inserted under the frontal lobes, and the olfactory bulbs separated with a scalpel from the cribriform plate. The brain being now further raised the nerves and vessels are divided in their order from before backward; and, the tentorium cerebelli being divided on each side along the petrous bone by scissors, a long thin scalpel is directed downward and backward into the spinal canal, so as to secure as low a section of the cord as possible.

The surface of the brain is next inspected, and if tubercle be suspected the Sylvian fissures are opened up and the vessels in the pia mater covering the island of Reil minutely scrutinized.

The Brain is best examined by vertical transverse sections made from before backward. The first, or pre-frontal section, is carried down $2\frac{1}{4}$ inches in front of the fissure of Rolando; the second, or pediculo-frontal section, is made three-quarters of an inch in front of that fissure and divides the second and third convolutions near their insertion into the ascending frontal convolution. It shows the anterior extremities of the caudate and lenticular nuclei with the internal capsule between them, sections of the three frontal convolutions, of the anterior convolutions of the island of Reil, and of the orbital convolutions at their posterior ends. The third, or frontal section, is made at the level of the ascending frontal convolution. It passes through the middle of the lenticular nucleus, the hinder part of the caudate, the optic thalamus, the external capsule and claustrum, the island of Reil, the convolutions of the temporo-sphenoidal lobe, and nearly the whole of the ascending frontal convolution. The fourth or parietal section traverses the ascending parietal convolution, it passes through the posterior convolutions of the island of Reil and takes the hinder end of the lenticular nucleus and the claustrum. The fifth, or pediculo-parietal section, is carried down an inch behind the fissure of Rolando and cuts the posterior extremity of the optic thalamus. The sixth, or occipital section, is made a little less than half an inch in front of the parieto-occipital fissure, and exposes the corona radiata of the hinder part of the

brain. A vertical antero-posterior incision should now be made through the superior vermiform process of the cerebellum so as to open the fourth ventricle. The pons, medulla, and cerebellum are then divided transversely by numerous sections and the precise situation of any lesion noted.

The brain being removed, the sinuses at the base of the skull may be slit up and examined; the dura must then be stripped off and the bones of the basal fossæ inspected, and any fracture traced. The orbits can be opened by removing the thin papery roof with bone-forceps, and the eye, for most practical purposes, can be satisfactorily examined by making a vertical transverse section of the globe with a sharp scalpel carried a quarter of an inch behind the sclero-corneal junction, the posterior part being removed and floated in water. The roof of the tympanum is likewise easily removed with bone forceps, and the auditory ossicula and membrane examined *in situ*.

The Spinal Cord may be examined by removing the vertebral laminae from behind or preferably from the front, in the following manner: The thoracic and abdominal viscera having been removed, the body of the fifth lumbar vertebra is first cut away with a strong knife and bone forceps. A strong, specially made chisel, armed with a blunt guide which travels in the spinal canal, is then taken, and with it the pedicles of the vertebra are successively divided from below upward, and the bodies being lifted off the spinal column is exposed. The cord is then carefully removed, surrounded by the dura, the latter is slit up the front and behind the transverse sections are made at short distances. Portions of brain and spinal cord required for hardening should be placed for twenty-four hours in alcohol and then transferred to a two per cent. bichromate of ammonium solution.

Abdomen and Thorax.—A long vertical incision should next be carried from the symphysis mentis to the symphysis pubis. The cavity of the abdomen should be opened, the character and quantity of fluid present noted, and the position of the arch of the diaphragm observed.

The sternum should be carefully removed, the innominate veins being avoided in dividing the first rib, and the

position of the lungs observed. The pericardium may be opened by an incision, carried vertically down its right border, joined by a second at right angles to it, running along the base of the pericardial sac towards the cardiac apex; the flap thus formed should be turned up and the heart exposed.

The Heart is best removed by lifting the apex and dividing first the inferior vena cava, the quantity and character of blood escaping from it being noted; next the pulmonary veins and arteries are severed, and finally the superior cava and aorta. The nature of the clot or fluid contents found in each of the vessels should be observed. The heart being emptied of its contents, the competency of the valves of the water test may be tried. The organ should be supported vertically and the water directed into it in a gentle stream. To measure the capacity of the various orifices a graduated cone should be used. The weight of the organ and any degree of dilatation and hypertrophy of the chambers should be then recorded. To examine the auricles and ventricles the heart is laid on its anterior surface with its apex toward the operator. Blunt-pointed scissors are then introduced into the inferior vena cava and an incision carried upward parallel to the posterior inter-auricular groove and brought out at the superior cava. A second incision at right angles to this, beginning again at the inferior cava and carried to the right along the auriculo-ventricular groove into the apex of the appendix, will completely expose the interior of the auricle and show the tricuspid ring. The ventricle may now be laid open from behind by an incision parallel to and half an inch to the right of the posterior inter-ventricular groove; this will be found to enter the ventricular between the left and posterior segments of the tricuspid valve, the curtains of which should then be examined. To expose the pulmonary valve, the heart must be turned over on its posterior surface. A small ridge of fat will be seen coursing upward over the front of the conus arteriosus of the pulmonary artery; if now, the apex being toward the examiner, the scissors be entered into the front of the ventricle beside the anterior inter-ventricular groove and carried upward immediately to the right of this ridge, it will be found that the instru-

ment has passed precisely between the two anterior cusps of the pulmonary valve. This completes the examination of the right heart.

To examine the left side of the heart the organ should again be placed on its front, the scissors entered at the right inferior pulmonary vein, a vertical incision carried upward and a second outward to the appendix, similar to those on the right side. The interior of the left auricle and fossa ovalis can now be completely examined. A knife should next be placed in the posterior inter-ventricular groove and made to cut forward and to the left; it will then enter the left ventricle between the aortic and posterior curtains of the mitral valve; will split the posterior papillary muscle and leave the chordæ tendineæ of each segment intact.

To examine the aortic valve the heart should be once more laid on its back and an incision made into the front of the left ventricle immediately beside the anterior inter-ventricular groove. When this cut reaches the base of the ventricle it should be turned at right angles across the inter-ventricular groove and continued upward in the conus arteriosus of the pulmonary artery. If the scissors be now made to cut between the left anterior and posterior pulmonary cusps it will be found that the aortic valve-ring has been traversed exactly between the right and left coronary cusps. The cuts into the ventricles should not be carried completely to the apex, which thus serves to hold the heart together, like the binding of a book.

The Aorta should be laid open in its entire extent and the presence of atheroma or of fatty degeneration noted, the former change being especially common about the site of the obliterated ductus arteriosus and the origin of the renal arteries.

Pleural adhesions must be dealt with according to their density; if of recent formation, they are usually easily separated by the fingers, but if very firm the simpler way is to strip the parietal pleura from the thoracic wall and remove it with the lung.

The Lungs.—When the lobes of the lung are adherent, the organ is best examined by an incision carried from its outer border directly inward to the root, for this not only gives the largest sectional surface, but also the cut lies in the

plane of distribution of the majority of the large bronchi and blood vessels. Any further dissection can be carried on by incisions at right angles to the first. When the lobes are separate, such a section is not easy to make; it is then preferable to enter the long knife in the septum between the upper and lower lobes and examine the former by an incision carried midway between its anterior and posterior aspects; the lower lobe can be dealt with by an incision beginning at its outer border and the middle lobe by one passing directly backward horizontally. The relative size of the lobes, the amount of vascularity of the parenchyma and the presence of consolidation or œdema are then carefully noted, and the blood vessels and bronchi slit up.

The Pharynx, Larynx, and Structures in the Neck should be removed together. The knife is entered below the mental symphysis and the floor of the mouth divided. The tongue is then depressed with the finger and the soft palate divided at its junction with the hard. The knife should then be made to cut back on to the cervical vertebræ and the posterior pharyngeal muscles divided from above downward. The soft palate having been examined, the pharynx is laid open from behind and condition of the glottis noted. The larynx and trachea can then be opened by a posterior incision.

In examining the abdomen the rule of removing first those organs, the ablation of which will give rise to least disturbance of the relations of the remainder, should invariably be followed.

The Spleen is first drawn forward and removed by cutting the gastro-splenic omentum. The best section of the organ is obtained by a cut carried midway between its hilum and its convex external surface.

The Supra-renal Capsules and Kidneys should next be taken out; the former may be examined by several transverse cuts across the shorter diameter, while the kidneys should be divided into two equal halves by a vertical incision from the external border to the hilum, opening the infundibulum of the ureter.

The Ureters may now be followed to the bladder and slit up.

It is most convenient to remove the pelvic organs *en masse*. For this purpose the sigmoid flexure is first ligatured in two places and then divided; the rectum

is then drawn forward, and the peritoneum overlying the brim of the true pelvis is separated all round. The knife should be directed to the hollow of the sacrum and the posterior attachments of the pelvic viscera separated; it is then brought round on each side of the pelvis to the front, and the urethra being pulled well backward beneath the pubic arch, is divided as far anteriorly as possible. In laying open the urethra and bladder the upper wall should be divided with scissors, while the rectum is best opened from behind. The uterus may be divided by a vertical lateral section which completely exposes its cavity. The testes are now brought upward to the external ring and then freed with the knife. They are best opened from behind so that the section completely traverses the epididymis and body of the organ. The ligatures being now placed on the first part of the jejunum, the intestines are removed and opened along their mesenteric attachment. The stomach and duodenum may well be examined *in situ*, the former being opened by an incision carried along its anterior surface midway between its greater and lesser curvatures, while for the duodenum the scissors should be carried along the inner attached border. The gall-duct and portal vein are then slit up as far as their entrance into the liver. The stomach must be drawn upward and the pancreas opened by a cut horizontally across the organ from its head to its tail, its duct being laid open with scissors.

The Liver may be examined by a series of vertical antero-posterior incisions carried nearly to the posterior border; the condition of its vessels and ducts on section being especially noticed.

Attention should next be paid to the lymphatic glands occupying the mesentery and the retro-peritoneal space. After the organs have been removed, the great vessels and receptaculum chyli are laid open with scissors in their whole length. Finally, any lesion of the parietes is to be followed up, and any required dissection of the joints or bones of the extremities made.

LEOPOLD HUDSON.

HOW TO MAKE POULTICES.—

The material chiefly used in hospitals for making them is linseed meal; but oat-meal, starch, bread, bran, etc., may also be employed. Care must be taken in

making poultices that they should turn out neither too dry nor too moist.

(1) **Poultice of Linseed.**—Have a kettle of water boiling, linseed meal, two kitchen bowls (1 large, 1 small) a spatula, old linen, 1 or 2 heated plates.

First put some boiling water into the larger basin, into this basin place the smaller one, which must have previously been heated by allowing boiling water to stand in it for a minute or two. Put the linseed meal required into the smaller basin, pour in boiling water gradually, and beat with the spatula into a thick paste.

Now take one of the heated plates, lay out on it the linen in which the poultice is to be placed, and spread over it quickly with the spatula the mixture from the basin. Dip the spatula into the larger basin of boiling water, otherwise the mixture will stick to it, and not spread freely on the linen. The poultice should be about $\frac{1}{2}$ -inch thick all over, and a margin of about $1\frac{1}{2}$ inch should be left all round the linen to turn up over the edge of the poultice.

If the poultice has to be carried some distance to the patient, it should be placed between two heated plates.

The poultice should be gently applied, and, in the event of there being much discharge from the wound, it will be found an advantage to lay some absorbent cotton-wool round it; over the poultice a piece of waterproof material; and then cotton-wool or flannel should be placed to prevent evaporation and to retain the heat better. The poultice should be fixed in its place by a bandage or handkerchief.

Poultices should be applied as hot as the patient can bear them, without any material between the sore and the mixture, otherwise their value is diminished. They should be changed at least every three hours. It is hardly necessary to add that the poultice should at once be burned after removal.

(2) **Oatmeal Poultices** are made in the same way as linseed, but the meal should be previously boiled.

(3) **Starch Poultices.**—The starch should be first made into a stiff paste with cold water, and then mixed with boiling water to make it hot before being applied.

(4) **Bread Poultices.**—Boil some stale bread with water for five minutes. Drain off the water, and spread the bread on a

piece of linen. A few drops of warm oil should be placed on the poultice, and so prevent it from sticking to the patient.

(5) **Bran Poultices** are made by pouring boiling water on to the required quantity of bran, and stirring well.

Antiseptic Precautions.—To any of the above poultices there may be added powdered charcoal, powdered boracic acid, or iodoform, to diminish fetor and fermentation. The material should also be freely dusted over the surface of the sore, before the poultice is applied.

(6) **Mustard Poultice.**—When mustard leaves are not available, a mustard poultice can be made either by spreading mustard, prepared as if for use at table, on linen, or by simply shaking dry mustard over a linseed poultice, and then applying it to the patient.

PREGNANCY, DISEASES OF.—

Salivation is an occasional phenomenon of pregnancy. It may be so excessive as to lead to the discharge of from 3 to 4 quarts of fluid daily. The salivation of pregnancy is distinguished from mercurial salivation by the absence of sponginess or soreness of the gums. It may be only transitory, or may last throughout gestation. It is apt to recur in successive pregnancies. The only drug that has any effect upon the action of the salivary glands is atropine, gr. $\frac{1}{100}$, which may be injected into the neighborhood of the gland. This drug has a special effect, exerted through the chorda tympani nerve, in checking the secretion.

Heartburn is a frequent and troublesome symptom, especially in the latter months. A familiar popular remedy, and a very good one, is half a teaspoonful of sal volatile with as much carbonate of soda as will go on a dime, in water. Tablets made of carbonate of soda with peppermint are also much used. Liq. mag. carb. 3 ij to \mathfrak{z} ij is disagreeable, but sometimes useful.

Excessive or Pernicious Vomiting.—The vomiting of pregnancy deserves the title of “pernicious” when it reaches the point that the patient is unable to retain *any* food, and therefore if it be not checked her life will be in danger. The practitioner must form his own judgment as to this, for it is not uncommon to be told that the patient keeps nothing down, when at the same time her condition shows that she is not suffering from de-

fective nutrition. These cases of excessive vomiting during pregnancy fall into three groups—(1) Excessive vomiting of pregnancy, *i. e.*, cases in which the ordinary vomiting of the first months of pregnancy is more severe than usual, and more persistent, not ceasing at about the middle of gestation, but steadily getting worse; there being no cause for the vomiting, save the pregnancy. The vomiting is a reflex neurosis, and is most apt to occur in weakly women of nervous temperament.

(2) Vomiting *in* pregnancy. By this name are denoted cases in which pregnancy coexists with some other condition and itself tending to produce vomiting, which it increases and renders intractable. Thus cases of pregnancy with disease of the stomach or bowels, and with whooping-cough and sea-sickness, have proved fatal; the combined effect of the vomiting and the disease exhausting the patient.

(3) Certain rare and at present imperfectly understood cases, in which the vomiting seems to depend upon acute degeneration of glands; or a degenerative change in the liver allied to, or perhaps an early stage of acute yellow atrophy; or a degenerative change in the kidneys allied to, and possibly an early stage of, that found in certain cases of puerperal eclampsia.

Fatal vomiting of pregnancy, of any kind, is rare. When it occurs the patient dies from starvation. With the continual vomiting, and the non-retention of food, there is marked wasting, irritability, restlessness, and want of sleep. At last an apathetic condition supervenes, with a dry brown tongue, small and frequent pulse, and epigastric tenderness. There is a steady diminution in the quantity of urine, which contains more or less albumen. On the first appearance of symptoms of this kind, abortion should be induced; this prevents the patient from falling into the grave condition above described.

Treatment.—As a preliminary, the bowels should be cleared out, and the condition of the abdominal and pelvic organs, not omitting the kidneys, investigated. (1) If there be no sign of disease, and the vomiting be not severe, medical treatment may be enough. There is no drug which is a specific for all cases; but there are many which in individual cases

will be found to check the vomiting. Among these are—effervescing draughts; bismuth carbonate or nitrate gr. x; oxalate of cerium gr. x; carbolic acid gr. j; vin. ipecac. mj; atropine gr. $\frac{1}{100}$, or milk of magnesia. When there is anæmia, and discomfort after food, iron and the preparations of pepsin do good. If there be epigastric pain and tenderness, a mustard poultice to this region may be useful. The bromides are indicated in conditions of great nervous irritability. If there be flatulence and a furred tongue, a mercurial purge will be beneficial. Regulation of diet is not of much importance in these cases, for appetite is very capricious, and articles of diet usually difficult of digestion may, if they excite appetite, be better assimilated than simpler food. The patient's inclination is therefore in this respect the best guide.

If treatment by drugs fail, the next remedy to be tried is *recumbency*. In most cases the vomiting ceases while the patient is lying down, and in bad cases it may be necessary to compel her to remain in bed. If, notwithstanding this, the patient still vomits whenever she takes food, the next resource is to *keep the stomach at rest*, by giving nothing by the mouth, supporting the patient by nutriment enemata. If the measure fail in improving the patient's condition, the *cervix may be dilated*. This is an empirical remedy, which often succeeds, but often induces abortion. If it fail, then *induction of abortion* is the last resource; and it should not be postponed until the patient's condition is hopeless.

Cases of vomiting *in* pregnancy are recognized by the presence of signs and symptoms of the disease which, combined with the pregnancy, is causing the vomiting; and the treatment will be dictated by the nature of that disease.

In any case in which there is reason to fear that acute atrophy of the liver, or one of the allied glandular degenerations which have been mentioned, is commencing, when, for example, besides excessive vomiting, there is headache, irritability, restlessness, great prostration, diminution of liver dullness, or albumen in the urine, abortion or premature labor should be induced without delay, for it offers the only hope for the patient, and there is but little likelihood of a favorable result unless the operation be performed at an early period.

Varicose Veins of the lower extremities and of the pelvis are often met with in pregnancy, especially in multiparæ. The usual results of the varicose condition are present: dilatation, tortuosity, thinning at some parts, thickening at others. They usually begin to be troublesome about the fifth or sixth month, causing aching and slight swelling of the lower limbs; when there is already varicosity it often perceptibly increases from the very beginning of pregnancy. Some patients describe similar symptoms without there being any conspicuous varicosity of the superficial veins to account for them. In such, varicosity of the deep veins has been assigned as a cause for the aching in the limbs. The veins commonly diminish in size after delivery. Varicosities of the superficial veins may lead to *ulceration* and to *rupture*. The favorite seat of rupture in the leg is just above the inner malleolus. The hemorrhage from this accident is often great, and may be fatal. It is to be stopped by elevation of the limb, and pressure on the bleeding spot. The varicose condition may also lead to *thrombosis* and *phlebitis*. Simple thrombosis is not common in pregnancy. Phlebitis often is more common, ending in suppuration. The attack ends in the bursting of the abscess, subsidence of the inflammation, and obliteration of the vein. It may lead to embolism or pyæmia, but these results are not frequent. A vein may burst subcutaneously and form a swelling called a *hematoma* (*q. v.*).

During pregnancy no radical treatment for the cure of varicose veins should be carried out. Support may be given to the limb by a bandage, strapping, or an elastic stocking. Phlebitis should be treated by rest, elevation of the limb, and evaporating lotions, and the patient must be warned against friction, lest a clot be detached.

Varicose veins of the vulva or vagina sometimes form tumors so large as to attract the patient's attention and cause much annoyance by producing intolerable itching, impelling the patient to scratch or rub the part. Either from such scratching, or from some slight local violence, they may burst—a very dangerous accident, for in most cases of the kind the patient has died before medical help could reach her. Bursting during labor is less serious, because, then, help is usually at

hand. In these cases, to prevent accidents and to relieve symptoms, the recumbent position should be maintained.

Hemorrhoids are apt to arise during pregnancy, and it is still more common for small piles, which have not attracted notice before, to cause a good deal of trouble then. Their cure by operation is better not undertaken during pregnancy. For the relief of the symptoms they cause the essential points are the avoidance of constipation, and the recumbent posture when discomfort is present. The rectum should be washed out with an enema of cold water every morning, and if the piles come down during defecation they should be pushed back and the patient should remain recumbent until all discomfort has passed off.

Leucorrhœa.—Some amount of leucorrhœa is frequent during pregnancy, the increased vascularity of the parts leading to increased secretion.

Pruritus is a not uncommon trouble. It is best treated by frequently washing away all irritating secretions, and by the application of a sedative. These two purposes are accomplished by the use as a vaginal douche of a solution of borax (℞ j ad Oj).

Anæmia.—The composition of the blood is altered during pregnancy. It contains more water, more fibrin, fewer red corpuscles but more white corpuscles, less albumen, and less hæmoglobin. It is increased in quantity. The condition has been described by the term “serous plethora.” It departs from the standard of health in the direction of anæmia. Some amount of anæmia during pregnancy may, therefore, be regarded as an exaggeration of a physiological change. It should be treated exactly in the same manner as anæmia occurring in a person not pregnant. There is an old belief—it is difficult to say on what founded—that there is danger of bringing on abortion by giving iron during pregnancy. Iron may be given freely in pregnancy, and in an anæmic patient tends to prevent abortion rather than to favor it.

Progressive Pernicious Anæmia sometimes comes on the second half of pregnancy. If it be allowed to run its course, it produces, first, death of the child, and then premature delivery; and this is soon followed by the death of the mother. When this disease is well established, all treatment—iron, food, transfusion—quite

fails to check it. The rapid progress of the disease as pregnancy advances, and the known tendency to anæmia therein, warrant the conclusion that in these cases the pregnancy is an important ætiological factor, and the induction of abortion the most hopeful treatment. In any such case, therefore, when, in spite of treatment no improvement results, abortion should be induced without delay.

Leukæmia.—This disease has been observed along with pregnancy, but the two conditions do not appear to have any effect on one another, except that the coexistence of the enlarged spleen and the pregnant uterus causes more than usual abdominal enlargement and consequent discomfort.

Renal Disease.—In a small number of cases of normal pregnancy, some albumen is present in the urine, due either to slight cystitis or to venous congestion of the kidneys, produced by pressure. But comparing the frequency of renal disease in pregnancy with its frequency in females at the same ages who are not pregnant, it is clear that pregnancy brings with it a special liability to nephritis. Between 0.5 and 1 per cent. of pregnant women suffer in this way. It is a dangerous complication both for mother and child, for it may lead (1) to puerperal eclampsia, a complication which occurs in about 20 per cent. of cases of renal disease; and (2) to renal diseases which persists after the pregnancy and soon proves fatal. It is probable that one in five of such cases die within two years. In pregnancy with nephritis the child often dies *in utero*; and if eclampsia supervene, and the child have survived till then, it is likely to die from asphyxia, produced by the convulsions.

Pregnancy may take place in patients already suffering from renal disease, no matter of what kind. In that case the course of the disease is likely to be accelerated by the pregnancy, and there is danger of eclampsia.

Of renal disease coming on during pregnancy, three forms may be distinguished—(1) *Acute Nephritis*.—This is rare during pregnancy, as it is rare without it. It is mostly followed by delivery, and accompanied it by eclampsia; but may occur without eclampsia. The mortality is high, but if the disease does not prove fatal, recovery takes place quickly and completely. The symptoms and

treatment are the same as those of acute nephritis in patients who are not pregnant. See BRIGHT'S DISEASE, ACUTE.

2. *Sub-acute Chronic Nephritis* is commoner. The disease comes on gradually, without any evident cause. It usually begins about the fifth month. Anasarca appears, and is often great, the lower extremities being usually the first affected; there may also be effusions of the serous cavities. Bronchitis, and œdema of lungs, disturbances of sight, and retinitis are symptoms commonly observed. The quantity of urine is diminished, and it contains abundant albumen and casts. Labor comes on prematurely in the majority of cases. Eclampsia is present in about 25 per cent. Often the nephritis terminates after delivery, and the patient gets well. But it may go on to the production of chronic and ultimately fatal kidney disease; and it may recur in subsequent pregnancies.

Treatment.—Speaking generally is the same as that of nephritis apart from pregnancy. It is mainly dietetic. If the case be seen early, and the treatment diligently carried out, the disease may be held in check, and the pregnancy go to term. But if the disease be pronounced, the only effective treatment is to induce labor. If this step be opposed on the ground of the danger to the child's life, it may be pointed out that the death of the child *in utero*, and its spontaneous premature delivery, frequently occur; whereas, if the renal disease can be arrested a future pregnancy which may go on to the term is rendered possible, thus giving a better chance of healthy child.

(3) There are cases of *eclampsia* with scanty urine, loaded with albumen, in which the symptoms come on quite suddenly, without the slightest warning, in the midst of apparent health; and on post-mortem examination no macroscopic changes are found in the kidneys. It has been suggested that the disease in these cases is an acute atrophy of the kidneys analogous to an acute atrophy of the liver to which pregnancy predisposes; and a few cases have been described in which the results of microscopical examination supported this view. But the cases are so few in number that it cannot yet be said to be established.

Dilatation of the Ureters, from the pressure of the gravid uterus, has been shown to occur in a minority of pregnant

women, and puerperal eclampsia has been ascribed to this condition. But the amount of dilatation found is slight, and such as, apart from pregnancy, is not known to produce any similar effects.

Heart Disease and Pregnancy.—There is no doubt that a large number of patients with valvular disease of the heart go through pregnancy and labor without suffering more than others whose hearts are sound. But in some cases—it is difficult to say in what proportion—the increased strain thrown upon the heart leads to its gradual failure during the latter half of pregnancy. This failure is manifested by the usual symptoms, œdema of the lower extremities, dyspnoea, cough and hemoptysis. The quantity of blood which the heart has to propel is increased, and there is a difficulty in the return of blood from the lower limbs caused by the augmented pressure within the abdomen. To these two causes the hypertrophy of the heart, which is by some believed to take place during pregnancy, is attributed. There is further danger from the straining which accompanies the second stage of labor when the heart is unsound; and also lest the sudden alteration of the conditions under which the circulation is carried on which follows delivery, should lead to cardiac failure, although the exact mode in which these altered conditions act is not known.

Bearing in mind these facts, it is our duty, if consulted prior to the marriage of a patient with cardiac disease, to warn her that pregnancy and labor will, in her case, be attended with more risk than usual. Should pregnancy take place, and slight symptoms of cardiac failure appear, they should be treated with digitalis and rest, in the same way as similar symptoms apart from the pregnant condition. Should such treatment not relieve, and the symptoms, as pregnancy advances, increase in severity, then labor should be induced without waiting for the patient's condition to become perilous. Rapid improvement in these cases follows the induction of labor. During labor, to prevent injury to the heart from straining, chloroform should be given.

Phthisis and Pregnancy.—It was formerly believed that during pregnancy the progress of pulmonary phthisis was retarded or arrested. The tendency of recent observations is to show that it is not so, but that such influence as preg-

nancy has upon phthisis, and upon patients predisposed to it, is unfavorable. Phthisis in pregnancy does not appear to exert any unfavorable influence upon the development or health of the child, beyond that the child inherits the mother's predisposition to the disease.

Retroversion of the Gravid Uterus.—

This is one of the most important diseases of pregnancy. The body of the uterus is incarcerated in the hollow of the sacrum, being prevented from rising by the projection of the overhanging sacral promontory. The cervix uteri is raised, and presses the urethra upward and forward, so compressing it as to cause retention of urine. The causes of this displacement are (1) pregnancy taking place in a uterus already retroverted or prolapsed. This is probably the most common cause. For this reason the displacement is more common in multiparæ. (2) A sudden and violent effort when the bladder is full. The bladder, when full, carries the uterus upward and backward. If at this time the patient makes a great effort, the force of the intra-abdominal pressure, transmitted through the bladder, falls on the anterior surface of the uterus, and may drive it down below the sacral promontory. (3) Contraction of the pelvis, of the flat or rickety kind, in which the sacral promontory unduly overhangs, so that the uterus, if it once gets below it, finds an unusual difficulty in rising again.

Two aphorisms may be laid down, which epitomize the important facts in the clinical history of this condition: (a) *Incarceration is everything: displacement nothing.* The mere retroversion of the uterus causes little or no trouble; it is only when incarcerated that symptoms arise. (b) *The bladder is everything: the uterus nothing.* All the trouble and danger of this disease come from the pressure on the bladder. It is important solely as a cause of retention of urine.

When the retroverted and incarcerated uterus comes to press on the urethra, it leads to distention of the bladder, and thus to pain and abdominal swelling. The retention then sets up cystitis. When the bladder has become greatly distended, the pressure in it becomes so great that it imperfectly overcomes the obstruction, and the urine dribbles away. This has been called "ischuria paradoxa." It thus often happens that the patient com-

plains, not that she cannot pass water, but that she cannot retain it. It should never be forgotten that *incontinence of urine may be a symptom of retention*. From the cystitis the urine becomes mixed with pus and blood. The cystitis may reach such a degree that sloughing of the vesical mucous membrane may take place; or the membrane may be extensively separated, dissected off, as it were, from the muscular coat, so that the whole of it lies in the bladder like a loose bag, or a large piece of it may lie loose in the bladder. This is called *exfoliative cystitis*. Or the sloughing may take place at one point, and extend through first the mucous, then the muscular coat, and then the peritoneum may give way, and so rupture of the bladder and extravasation of urine into the peritoneum may take place. More commonly the inflammation extends from the bladder along the uterus up to the kidneys, and pyelitis results. This may prove fatal long after the retention has been relieved. When either from cystitis or pyelitis, the patient becomes very prostrate, abortion is likely to ensue; but except in these circumstances, retroversion of the gravid uterus does not, as a rule, cause abortion. Cases have been described in which ulceration has occurred, and the uterine contents have been discharged by perforation of the uterine body through the vagina; but these were probably instances of mistaken diagnosis, being really cases of extra-uterine gestation. No case of this occurrence has been so well described as to remove all doubt about its nature.

The *clinical history* is usually this: A patient, who thinks herself in the fourth month of pregnancy, gives a history of retention of urine accompanied by increasing abdominal pain and swelling, followed, after a few days, by incontinence of urine. There is often also obstruction to the bowel, but the symptoms from this cause are so much less urgent than those of the bladder that they sink into the background. On examination, the abdomen is distended and fluctuating. Per vaginam, a large rounded elastic tumor is felt, filling the hollow of the sacrum, and pushing the vagina forward; leaving, it may be, only room for one or two fingers to pass between the tumor and the symphysis pubis. The cervix uteri is high up, above and behind the pubes; it may be so high as to be out of reach

of the finger. The meatus urinarius is dragged backward, and flattened by the tension on it, so that it may be very difficult or even impossible to pass a catheter without the aid of sight. The first step, in the examination of any fluctuating abdominal swelling, should be to pass a catheter and empty the bladder. When this has been done, bimanual examination will show that the body of the uterus is not in the abdomen. This will distinguish the case from one of extra-uterine gestation, pelvic hematocele, pelvic abscess, or ovarian tumor, for, in these conditions, if the cervix be high up close behind the symphysis, the body will be felt immediately underneath the anterior abdominal wall. The diagnosis between a retroverted gravid uterus and a retroverted uterus containing a fibroid, will be made from the presence or absence of the signs and symptoms of pregnancy.

Treatment.—In nine cases out of ten it is enough to keep the patient in bed, and pass the catheter every six hours. If this be done, the uterus will generally ascend into its normal position within forty-eight hours. Should it not, it must be replaced, or circumstances may indicate immediate reposition as the best course. This can be usually done by pressing the uterus upward by two fingers in the vagina, the patient being in the left lateral position. Should efforts thus made fail, the patient may be put in the knee-elbow position, and an attempt thus made. If that be unsuccessful, the patient must be anæsthetized, and upward pressure made by two fingers in the rectum. In this way, if the uterus be not adherent, it can be replaced. It is seldom that a pregnant uterus is adherent; for adhesions firm enough to prevent the uterus from rising into the abdomen usually produce early abortion. In whatever way applied, the pressure should be made not directly upward, but toward one side, so as to avoid the projection of the sacral promontory. Should the uterus be so adherent that reduction is impossible, abortion should be induced, by passing a curved sound into the uterus. If this cannot be done, the size of the uterus may be reduced by puncturing it through the vagina, and drawing off the liquor amnii. Cases are infinitely rare in which this can be required.

After the retention has been relieved and the uterus righted, a copious diuresis

usually takes place, but after a day or two the secretion of urine gradually sinks to the normal quantity. The cystitis must be treated by the usual methods. Exfoliative cystitis may be inferred if the cystitis does not yield to treatment, and if the catheter seems to impinge on something resistant in the bladder, and when this takes place the flow of urine sometimes stops. In that case the bladder should be opened by an incision from the vagina in the middle line, the exfoliated mucous membrane removed, and the opening left patent for a few weeks.

In rare cases, recovery may take place without reposition of the uterus, the organ continuing to enlarge by expansion of its anterior wall upward into the abdomen; so that, at the full term of pregnancy, the cervix uteri is above the symphysis, and the cavity is partly above it, in the abdomen, partly below it, in the hollow of the sacrum. In these rare cases, the cervix descends during labor, and comes to occupy its normal position.

Ovarian Tumor.—This involves much additional risk. The distention of the abdomen is greater. The tumor, if small, may obstruct delivery. There is special liability during pregnancy to twisting of the pedicle of ovarian tumors, and they are also liable to become inflamed or ruptured, from the pressure exerted. Therefore, if an ovarian tumor be discovered in a pregnant woman, or even during labor, the proper course is to remove it without delay.

Cancer of the Cervix.—When pregnancy is thus complicated, the progress of the cancer is accelerated. The best means of prolonging the patient's life, as well as saving her from the dangers of labor obstructed by the cancer, is to induce abortion as early as possible. This may be done the more readily, because cancer often leads, when allowed to go to term, to the death of the child *in utero*. But if the cancer can be removed, this should be done.

Hydramnios means excess of liquor amnii. Its chief interest is obstetrical. But it requires notice here because it may be difficult to distinguish from ascites, or ovarian dropsy. In ascites there is resonance in front, dullness in the flanks, the line between resonance and dullness changing with the position of the patient. In hydramnios, there is resonance in the flanks, dullness in front, and no alteration

from position. In hydramnios there are the signs of pregnancy, and *ballotement* is very distinct. In ovarian dropsy without pregnancy, there will not be softening of the cervix or other signs of pregnancy, and the uterus, by careful combination of rectal, vaginal, and bimanual examination, can be made out apart from the tumor. In ovarian dropsy with pregnancy, there will be a sulcus between the pregnant uterus and the tumor. No such sulcus is felt in hydramnios, even if there be twins. In some cases, especially when ascites complicates the other conditions named, diagnosis may be very difficult, and an exploratory incision the best course.

Relaxation of the Pelvic Joints is normal in pregnancy, but it may go on to such an extent as to prevent the patient from walking. The joints, of which the softening is important, are the sacro-iliac and the pubic. The condition is detected by putting the patient on her back, putting the thumb and finger respectively above and below the symphysis pubis, and bidding the patient draw up first one leg, then the other. When this is done, any movement at the symphysis will be perceived. The sacro-iliac joints may be examined by putting the hands on the bones forming them, and in a similar way testing their mobility; also by testing whether the iliac crests can be at all removed to and from the middle line. The treatment is to apply a strong bandage, of unyielding material, round the hips, embracing the trochanters and the iliac bones.

G. E. HERMAN.

Symptomatic Indications.—For salivation the principal remedy is *mercurius*, or *natrum muriaticum*. For heartburn, *nux vomica* or *capsicum* when the heartburn is the principal symptom; *calcareo carbonica*, when associated with acidity. *Aletris* renders excellent service in the early months of pregnancy, when there is much nausea and vomiting, with pain and colic in hypogastric region. *Nux vomica* is the most important remedy for vomiting of pregnancy, especially when associated with constipation, water brash, etc.; *ipêcacuanha*, when vomiting is due to irritability of the stomach; *arsenicum*, persistent vomiting, after eating or drinking; extreme weakness; emaciation; gastralgia; *creosote*, persistent morning sickness from sympathetic disturbance.

Ignatia or *staphisagria* has sometimes relieved when other remedies have failed. *Sepia*, when patient has been subject to uterine disease. For varicose veins, the best remedy is *pulsatilla* or *hamamelis*.

For hemorrhoids, the most important remedies are *belladonna*, *collinsonia*, *hamamelis*, *nux vomica*, *æsculus*, *sulphur*, and *arsenicum*. *Belladonna*, when there is much pain and soreness, throbbing pains, spasmodic contraction of the sphincter, causing strangulation and great sensitiveness of the piles, cannot bear the least touch or contact; *hamamelis*, profusely bleeding piles, with excessive soreness and prostration; much backache; *arsenicum*, blind piles, which burn like fire, especially at night; great anguish and restlessness; *collinsonia*, blind or bleeding piles, from pelvic congestion with inertia of rectum; *aloes*, piles from pelvic congestion, protruding like a cluster of grapes; much pain; excessive hemorrhage of bright blood; diarrhea; *nux vomica*, blind piles, with constipation, backache; the main remedy: *sulphur*, chronic cases, especially for painless piles, with dark hemorrhages; frequent weak, faint spells; *æsculus*, obstinate constipation, with sharp pains and slight hemorrhages; severe backache. For albuminuria, the main reliance is *apis* or *arsenicum*. *Cimicifuga* is useful in many affections of pregnancy, arising from uterine irritation and reflex action, especially for mental irritation; morbidness; muscular and neuralgic pains.

For other disorders of pregnancy, see under appropriate headings.

PREGNANCY, SIGNS, SYMPTOMS, AND DIAGNOSIS OF.—The signs and symptoms of pregnancy may be thus classified: (a) Signs useful to the mother. (b) Signs valuable when combined. (c) The certain signs. (d) Phenomena of no diagnostic value.

Signs Useful to the Mother.—(1)

Amenorrhœa.—The special value of this is, that it is the *first* symptom; and it is, therefore, by its aid that we estimate the date of delivery. It has no diagnostic value, for hemorrhages may take place throughout pregnancy, amenorrhœa may occur from other causes than pregnancy, and pregnancy may occur in a patient who is not menstruating regularly. But it is the symptom which usually announces to the patient that she is pregnant.

(2) *Morning Sickness*.—This is the symptom by which women usually judge whether their not having menstruated is due to pregnancy or not. It usually begins as nausea about the fourth or fifth week, reaches its height about the tenth or eleventh week, and ceases at about the middle of pregnancy. It is not invariably present, and, as vomiting may occur from many causes, it will be clear that it has no diagnostic value, but it helps the patient to form her own opinion.

Signs Valuable when Combined.—(1) *Enlargement of the Uterus*.—This enlargement is practically confined to the body of the uterus, the enlargement of the cervix being very slight. As the body of the uterus enlarges, the shape of the uterus, taking the body and cervix together, becomes more and more that of a pear; but in the second half of pregnancy, the enlargement of the body is so much greater that the cervix may be left out of account, and the uterus described as egg-shaped. The size of the uterus at different periods of pregnancy can be easily remembered, if gestation be divided into periods of three months each. At the end of the first three months the uterus reaches to the pelvic brim; at the end of the second three months to the umbilicus; at the end of the final three months to the ensiform cartilage. If, then, each of the spaces intermediate between the points be divided into three, the divisions will mark the height of the uterus at the fourth, fifth, seventh, and eighth months of pregnancy respectively.

(2) *Intermittent Contractions of the Uterus*.—Throughout pregnancy the uterus alternately contracts and relaxes, at intervals varying from five to twenty minutes. During contraction it slowly hardens, becoming soft again when relaxation follows. The recurrence of these changes is characteristic of uterine enlargements. It does not take place in any other kind of abdominal tumor. It is not peculiar to pregnancy, for it may occur in the uterus when enlarged by fibroids. It is useful in the diagnosis of pregnancy, for it assures us that the tumor which we feel is the uterus.

(3) *The Uterine Souffle*.—This is a blowing sound, synchronous with the maternal pulse. It is usually heard best low down and at the sides; but it is heard at various places in different pa-

tients, and at various times in the same patient. While the uterus is contracting it gets louder, diminishing when the contraction reaches its height, increasing again as the contraction is passing off, and becoming a soft sound again when relaxation is complete. It is not affected by the position of the patient. A murmur of the same kind, and varying rhythmically in the same manner, is often heard over uterine fibroids. A blowing murmur, very much like this, may sometimes be produced by the pressure of the stethoscope over other abdominal tumors. This does not vary rhythmically, but is altered in intensity by increase or decrease of pressure, and by the position of the patient. A blowing murmur, varying rhythmically, tells us that the tumor is uterine, but nothing further.

(4) *Mammary Changes*.—As these, to some extent, persist after the first pregnancy, they are of no diagnostic value in any pregnancy except the first. They begin early in pregnancy and gradually become more marked up to the end. They consist in enlargement and vascularity of the glands, and pigmentary changes. The enlargement is due to increase of the gland tissue. From the increased vascularity the connective tissue becomes looser, the lobules can be more easily felt and moved upon one another, and the gland acquires a knotted feel. The large veins are plainly visible through the skin. The nipple is enlarged, its color deepened, and the areola becomes wider and darker, extending from half an inch to three inches outward from the nipple. The size and color vary; in brunettes it is very dark, almost black; in blondes it is light. During the last three months of pregnancy, in the outer part of the areola, white spots appear in the dark ground; this is called the secondary areola. In the last few months the nipple becomes covered at the apex with branny scales. From about the fifth month onward, a drop of opalescent fluid can be squeezed from the nipple; in the last month or two this can be expressed more abundantly, and the fluid contains cream-like globules. These changes, when well marked, in a woman who has never been pregnant, are almost conclusive. They are not absolutely so, because it is possible for them to be produced without pregnancy, by giving suck. But it is so extremely rare

for a virgin to suckle a child that these changes in the breast form very strong evidence of pregnancy. They have especial practical utility, because the state of the breasts can be ascertained under pretext of auscultating the chest, without suggesting suspicions that might give offense.

(5) *The color of the Genital Mucous Membrane*.—In pregnancy the pelvic organs become very vascular, and, in addition, the increased pressure within the abdomen leads to distention of those veins which return their blood through the inferior cava, and frequently to a varicose condition of them. The result is that the mucous membrane of the cervix uteri, vagina, and vulva, instead of being the same pink tint as the buccal mucous membrane, becomes a dark bluish purple. This change goes on progressively throughout pregnancy, and is very marked toward the end. Occurring in a young woman who presents no sign of serious ill-health, this is an important sign of pregnancy. The bluish color may also be produced by great venous obstruction owing to heart, lung, or liver disease. But change in color as great as that in pregnancy is only produced by disease of such magnitude that it could scarcely be overlooked.

(6) *The Softening of the Cervix*.—The cervix becomes enlarged, its texture looser, and, owing to the great vascularity, it becomes softer. The vagina is altered in a similar way, but the change is more easily recognized in the cervix. The softening becomes more and more marked as pregnancy goes on. It is well described by the comparison that the consistence of the unimpregnated cervix is that of the tip of the nose; the consistence of the cervix at the full term of pregnancy that of the lip. Like the bluish color, the softening may be produced by great venous congestion, and what has been said of the value of that sign of pregnancy applies also to the softening of the cervix.

(7) *Ballotement*.—This sign consists of two sensations: (a) That of a solid body retreating from the fingers when they are suddenly pressed against the uterus. (b) That solid body again falling back on to the fingers. To obtain this sign it is necessary that the fingers should press where there is a resisting part of the child in contact with the

uterine wall. There are two chief ways of obtaining the sign. First, the patient being on her back, by palpation it is ascertained to which side the back of the child appears to be turned. The patient then lies on that side, and one hand is placed beneath the abdomen, the other above it, and with the lower hand the back of the child is sharply pushed up. If the conditions are favorable the child's body is felt to move upward, and to strike against the upper hand. When it sinks down its impact is felt by the lower hand. Second, the patient being supported in a position midway between sitting and reclining, so that the axis of the uterus is vertical, pressure is made with two fingers per vaginam on what is thought to be the child's head, the other hand being placed on the fundus uteri, the sensation of the child's moving upward and then sinking down being felt as in the former method. This sign cannot be obtained until the fifth month, because not till then is the child big enough to give a perceptible shock, and as a rule it cannot be attained after the seventh month, because then the child is so large in proportion to the uterine cavity that it cannot move freely enough. The sign is not free from error, as an ovarian tumor, with a pedunculated growth inside it, or a movable tumor with ascites, may simulate it. But, taken with other signs, it is sometimes useful.

The signs that have been mentioned, viz., a tumor shown to be uterine by its intermittent contractions and by the rhythmically varying *souffle* heard over it, and presenting ballottement, softening of the cervix, and a bluish color of the genital mucous membrane, in a woman not seriously out of health, taken together, warrant the diagnosis of pregnancy in a case in which the certain signs cannot be perceived.

The Certain Signs.—In the second half of the pregnancy, if the child be living, the sounds of the *fetal heart* may be heard.

The sound is double, and varies in frequency from 120 to 180 per minute. It is heard best over the back of the child's chest; and this, in the usual position of the child, is below and to the left of the umbilicus. It is quicker as a rule in female children than in male. If over 145, the probability is that the child is a female; if under 135, male. The action of

the fetal heart is slightly accelerated when a uterine contraction is coming on, it is retarded during the height of the contraction, and is again accelerated as it passes off, subsequently returning to its average frequency. The action is accelerated by febrile conditions of the mother. The sound is absolute proof of pregnancy.

In the first half of pregnancy, we may attain practical certainty if, by examining the patient more than once at intervals of two or three weeks, we can ascertain the *regular increase* in size of the uterus, together with the gradual development of the other signs.

Phenomena of no Diagnostic Value.—

Among these are, the appearance after the urine has stood, of an iridescent pelticle on its surface, called *kiestein*. This occurs in other conditions and even in men. Its import is unknown. The development of *pigmentation* of other parts beside the mammary areola, as along the middle line of the abdomen, on the perineum, in the axillæ, on the face, etc. *Fetal movements*, which are of no use for diagnosis, because if they are felt the fetal heart ought to beat hard. *Atrophic lines* on the skin of the abdomen and breasts, from stretching of the skin by enlargement of the parts it covers. These may be produced by any condition which stretches the skin. *Longings*, that is, cravings for particular articles of diet, generally either fruit or highly flavored things, such as pickles, salted fish, or meat. There is an old superstition that it is necessary to gratify these longings; it is baseless, but there is no harm in gratifying them.

Twin Pregnancy may be diagnosed if over different parts of the uterus two fetal hearts, not beating synchronously, can be heard.

G. E. HERMAN.

Prognosis.—The forecasting of what will probably be the result of a disease is among the most important of the duties of the physician. A prognosis, if it is to be worth anything, must be founded on an accurate diagnosis, which in its turn must depend not only upon a close investigation of the symptoms and signs of the disease, but upon an accurate knowledge of its pathological relationships, as well as upon a careful analysis of the past history of the patient.

PROGRESSIVE MUSCULAR ATROPHY (Wasting Palsy; Chronic Anterior Poliomyelitis).—A disease characterized by progressive wasting of individual muscles or physiological groups of muscles, and by an associated and proportional amount of paralysis.

The morbid change consists of degeneration and atrophy of the multipolar cells in the anterior gray matter of the spinal cord, with consecutive degeneration of the anterior nerve-roots and muscles.

Symptoms.—The disease commences slowly, and usually the earliest indication is wasting of the muscles of the hand with impairment of power, often first noticed in the act of writing or in the performance of some other delicate action. Occasionally, these symptoms are preceded by pain, of no great severity, in the muscles subsequently affected. Although the hand, usually the right, is most frequently the part first attacked, the disease sometimes begins in the shoulder muscles, the muscles of the back, the extensors of the forearms, and, very rarely, in the lower limbs. In the hand, the muscles of the ball of the thumb are the earliest to undergo atrophy, the interossei and the hypothenar eminence soon following. Of the thumb the opponens and adductor are the first affected. The hand soon takes on a peculiar claw-like form, and from the wasting of the abductor indicis the thumb assumes a position nearly parallel with the index finger. The muscles of the forearm are usually next attacked, and with them not uncommonly the supinators. The deltoid often now suffers, with the muscles of the upper arm and of the scapula, the triceps retaining its normal bulk longer than the rest. The second arm is usually attacked in the same manner as, and soon after, the first, often before the atrophy has spread beyond the muscles of the hand on the side first affected.

Of the muscles of the trunk the middle and lower parts of the trapezius are first invaded, the upper part of this muscle remaining normal. The pectoralis major, the serratus magnus, the latissimus dorsi, the rhomboidei, the extensors of the head, the other muscles of the back, the sterno-mastoid, and more rarely the levator anguli scapulæ become involved. The sternal and clavicular parts of either

the pectoralis major or of the sterno-mastoid may be affected separately. The platysma myoides is said always to escape. The intercostals and the diaphragm sometimes suffer, and occasionally the muscles of the abdominal wall; under such circumstances danger to life from interference with respiration may arise.

The lower limbs are usually affected late in the course of the disease. The muscles first attacked are the tibialis anticus group, the glutei, and the extensors of the knee. Dr. Gowers asserts that the lower limbs not unfrequently become paralyzed with little or no wasting, the loss of power which is gradual, being accompanied by increased knee-jerks and clonus.

Toward the end the facial muscles may become involved, and symptoms of glosso-labio-laryngeal palsy may supervene.

In children attacked by progressive muscular atrophy, the muscles of the face are the earliest affected, and hence ensues an expressionless and almost idiotic aspect. It is believed by many observers, however, that this "juvenile" form of muscular atrophy is really a variety of "simple idiopathic muscular atrophy."

In the advanced stage, the wasting becomes extreme, so that bony prominences normally concealed become obvious. At this period the fatty tissue may disappear, though earlier in the disease it may be abundant, and on this account the muscular wasting may be not apparent.

The loss of power in the affected muscles progresses gradually and is proportional in amount to the wasting. Hence complete paralysis does not take place until the atrophy has become extreme. The muscles respond with undue readiness to mechanical stimulation, and fibrillar movements of the muscles may very frequently be seen and felt. Such movements, however, are not peculiar to progressive muscular atrophy, although undoubtedly more common in this affection than in any other.

The galvanic and faradic irritability of the muscles diminishes as the muscular atrophy progresses, and when the latter becomes extreme, no reaction can be obtained with either form of stimulation, even with the strongest currents. The galvanic irritability may, however, persist after the faradic has disappeared. The

nerve-trunks remain excitable for a longer time than the muscles.

Vaso-motor disorders are often present in the limbs, the affected parts becoming cold, livid, or pale. In the early stages the temperature of the parts involved is said to be slightly elevated; later on a distinct lowering of the temperature occurs. Trophic changes in the skin are sometimes present, but they are rarely extreme. In exceptional cases articular swellings, chiefly of the phalangeal joints, have been noted. Changes in the pupil have been rarely described, but they are especially likely to occur when the muscles supplied from the lower cervical region are implicated. The reflex actions of the atrophied limbs become enfeebled and finally disappear. Cutaneous sensibility is not affected, though subjective sensations of numbness, coldness, and the like may be present. The functions of the sphincters remain unimpaired, and there is no tendency to the formation of bedsores. Sexual power is not uncommonly lost. Lordosis, and various deformities, of which club-foot is the most common, are occasionally seen.

Diagnosis.—It is important to bear in mind that the muscular wasting, unlike that occurring in many spinal affections, is not diffuse. The muscles are affected according to their physiological grouping. Chronic meningitis or any condition giving rise to pressure on the nerve-roots may be followed by muscular atrophy; but the posterior roots are usually involved, and severe premonitory pains are common, and anæsthesia subsequently appears. In amyotrophic lateral sclerosis the wasting is widespread, and is preceded and accompanied by rigidity, with exaggerated reflexes. The diagnosis between progressive muscular atrophy, multiple neuritis, and pseudo-hypertrophic paralysis presents little difficulty. In lead palsy the onset is comparatively abrupt, the electrical reactions are profoundly changed, and the paralysis precedes the atrophy.

Prognosis.—The disease is essentially chronic. Occasionally the affections become stationary, at any stage. Arrest is said to be more common in cases arising from over-use of the affected muscles. The outlook is very serious when the respiratory muscles are attacked, and when symptoms of bulbar paralysis make their appearance.

Morbid Anatomy.—The most constant morbid change is degeneration with atrophy of certain of the multipolar cells in the anterior gray matter. The lesion is almost always more marked in the cervical region than elsewhere. The anterior nerve-roots become atrophied, and their fibers degenerated and subsequently replaced by fibrous tissue. In some few recorded instances the destruction of the anterior gray column has apparently resulted from dilatation of the central canal (hydromyelia).

In many cases sclerosis of the direct and crossed pyramidal tracts in the cord, and sometimes of the entire system of these fibers as high as the cortex, has been described. The posterior horns and roots are always intact. In the early stage of the disease the vessels of the cord are enlarged and their walls thickened. Degeneration of the peripheral nerves, sometimes limited to the minute intra-muscular branches, sometimes affecting the large trunks, has been found by several observers. The affected muscles are wasted, pale, or buff-colored. The fibers are narrowed, granular, or fatty, and the striation indistinct or absent. Scattered among these degenerated fibers there are often many which present little or no deviation from the normal. Some interstitial change, with accumulation of fat, is not uncommon.

Ætiology.—The disease is more frequent in males than in females, and is mainly an affection of adult life. A history of nervous affections in the progenitors is found in a large proportion of cases, but direct transmission of the disease itself is much less common. Excessive muscular exertion is believed by many to be a potent exciting cause. Exposure to wet and cold, mental emotion, injury to the spine or to a limb, are occasional antecedents. Syphilis probably plays an unimportant share. The disease occasionally follows one of the specific fevers.

Treatment.—Drugs are often of little service. When there is a possibility of a syphilitic taint, mercury and iodide of potassium should be tried for a few weeks. Gowers speak favorably of arsenic and strychnine. He recommends that the latter be administered subcutaneously in the form of the nitrate of strychnine once daily, and that the dose be $\frac{1}{80}$ grain, gradually increased to $\frac{1}{40}$. Electricity is

occasionally of service, though in many cases it entirely fails. The galvanic current is usually more efficacious than the faradic, but both may be used alternately.

The electrodes may be applied to the muscles themselves, or one pole may be placed on the spinal column in the region corresponding to the diseased part of the cord. Duchenne preferred the use of the induced current, and recommended that it be applied to the affected muscles. Passive movements and massage may also be employed. Hydro-therapeutic measures are of no service. Unfortunately, in a considerable proportion of cases all remedies fail. Amelioration, however, often occurs spontaneously, and arrest of the disease is by no means uncommon.

W. B. HADDEN.

PROPHYLAXIS signifies the means of preventing disease; thus the practice of disinfection is prophylactic against the spread of zymotic disease.

PROSTATE. — **Chief Affections.** — Inflammation, acute and chronic; abscess; periprostatic abscess; hypertrophy; simple tumors; atrophy; tubercle; cysts; malignant disease.

Prostate, acute inflammation of. — *Causes.*—Gonorrhea, cystitis, strong injections, cauterization, mechanical injuries, *e. g.*, from sounds. Catching cold, alcoholic excesses, and sexual excitement will determine an attack if some other influence pre-exist, such as gonorrhea, gout, or rheumatism.

Symptoms.—Local pain extending into loins and back, weight, and fullness. Frequent and painful micturition, especially painful at the close of the act. Pain becomes shooting and throbbing. Anal and perineal tenderness and fullness. Defecation painful. Micturition often difficult or impossible. Fever. Pus in urine when abscess bursts. *Per anum* the prostate can be felt enlarged. Piles may be induced.

Treatment.—Rest in bed. An aperient to commence with. Antimony. Acetate of potash in full doses. Ten to twenty leeches to perineum and round anus. Hot hip-bath. Poultices to perineum. Retention usually relieved by hot baths and liq. opii. Or a soft catheter may be passed. Prostate remains for a long time afterward enlarged and hard, obstructing flow of urine.

Prostate, calculus of.—See CALCULUS.

Prostate, chronic inflammation of. — Usually a sequel of acute. Generally, but not always enlargement of the gland. Obstruction to passage of urine. Anal and perineal pain. Gleet discharge. Sometimes nocturnal emissions. Pain in sexual intercourse. Irritable bladder.

Treatment.—Rest. Regular and unstimulating diet. Tonics and stomachics. Iron, with a mild aperient. Counter-irritation to perineum. For the nocturnal emissions make three or four applications of a solution of nitrate of silver (gr. x-xxx to ℥j) to the prostatic part of the urethra. To be successful an efficient instrument is absolutely necessary, as well as care in injecting the fluid at the right spot. For enlargement of prostate left by acute inflammation give a prolonged course of pot. iod. and pot. bromid.; sea-bathing and tonics.

Prostatic Abscess.—1. *Acute.*—When prostatitis leads to abscess, the acute symptoms persist for more than a week or two, pain and tenderness increase, rigors probably occur, and the prostatic swelling may throb. Fluctuation may be felt sooner or later, perhaps, per rectum. Abscess tends to open into urethra, more rarely into rectum. Either termination is of good prognosis. In exceptional cases abscesses recur again and again.

Treatment.—Incise early in the median line of the perineum. Foment and poultice. "When the suppuration is due to stricture, and probable extravasation, the propriety of dividing the stricture and laying open the perineum down to the prostate cannot be questioned" (Bryant).

2. *Chronic.*—Either a sequel of acute abscess or the direct result of old stricture of urethra. Whole prostate may be destroyed. Condition always serious. Chronic cystitis, progressive emaciation.

Treatment.—Rest, highly tonic and soothing regimen, fresh air. Sometimes perineal incision is indicated.

Prostate, hypertrophy of.—A senile affection. Never occurs before fifty, usually over sixty. But, of old men, it attacks no greater proportion than one-half. Affects every constituent of the prostate, but chiefly the muscular and fibrous elements. Enlargement may be general or limited. In the latter case, an outgrowth sometimes occurs from the center of gland backward toward the bladder, improperly called the "enlarged third

lobe." Either lateral lobe may be disproportionately hypertrophied. Isolated, almost independent tumors (myomata) are very common in the substance of hypertrophied prostates. They contain very little glandular substance, and that ill-developed.

Effect on the Urethra.—Prostatic part of urethra is lengthened, and its antero-posterior diameter increased, while its transverse diameter is lessened. Its direction is altered in a manner which varies according to the part of the gland which is enlarged. The urethra takes an abnormal curve whose concavity corresponds to the lateral lobe most enlarged. So also the vesico-urethral orifice takes a crescentic form with the concavity toward the enlarged lobe. When the "third lobe" is enlarged, the urethra is bent suddenly upward in front of it. Occasional outgrowth of median portion of prostate, overlapping vesico-urethral orifice, is a valve which obstructs the flow of urine. Size of enlarged prostate often very considerably increased. Diameter of over four inches and weight of twelve ounces known. A weight of even one ounce signifies hypertrophy. Consistence varies.

Symptoms.—(In earliest stage *nil*.) Diminution of force with which urine is ejected. Frequent desire to micturate; micturition is, as it were, incomplete. Uneasiness and weight about perineum and neck of bladder. Tenesmus. Hemorrhoids tend to develop. Sometimes flattened stools. After a time, chronic cystitis. Sometimes urethral discharge, or frequent erections of penis. Urinary obstruction increases; bladder overflows at night. Bladder-dullness tends to ascend higher and higher in abdomen. General health gets worse. Accidental circumstances, *e. g.*, slight excesses, bring on attacks of retention. Small hemorrhages. Urinary change similar to those of chronic cystitis. Neutral or alkaline reaction. Mucus. Phosphatic masses, soft and white. Muco-pus. Diagnosis is usually determined by examination with the left forefinger in the rectum. Information may be thus acquired concerning the presence, absence, or position of fluctuation. Such examination is assisted by simultaneously manipulating a catheter in the urethra. If the catheter has passed easily, say nine or ten inches, and still no urine flows; and if in addition, while following its course, the handle has be-

come more than usually depressed, there will be little doubt in respect of the existence of prostatic enlargement. Of course with a healthy urethra, urine should flow through a catheter entered six and a half to eight inches. When the catheter is deflected laterally in passing, the side toward which the handle turns is probably the more enlarged. An examination should be made with a short-beaked sound. With this a possible calculus should be searched for. Stricture of urethra contrasts with prostatic obstruction, in that (1) it occurs posteriorly to prostatic urethra, (2) it appears before middle life, (3) the stream of urine is more diminished in volume (in prostatic obstruction it is rather force than volume which is lessened). Other conditions from which prostatic enlargement has to be distinguished (though it may co-exist with them) are vesical calculus, tumor of the bladder, atony of the bladder, paralysis of the bladder. Compare with the symptoms of those given under diseases of the bladder.

Treatment.—A catheter should be passed twice a day; oftener where urination is extremely feeble. Patient should learn to catheterize himself. Elastic instruments preferable. Silver prostatic catheters are either made with a large curve or else with a short beak. Great irritability of the bladder, disturbing sleep, may require a vulcanized india-rubber catheter to be tied in at night. Treat coincidentally such complications as catarrh of the bladder (*q. v.*). Attend to the general health and regulate the habits. Clothe lower limbs warmly. Operations on diseased prostate are by most surgeons avoided.

Prostate, malignant disease of.—Encephaloid is the form which affects this gland. Occurs only in childhood and at advanced age. Progress very rapid in children. The symptoms are the usual ones of cancer, added to those of prostatic obstruction, including, especially, severe pain, occasional hemorrhages, and cachexia. Lymphatic glands of lumbar, and sometimes of iliac region enlarge. Urinary deposit may exhibit cancer cells when examined.

Treatment.—If catheterism cannot be avoided, be as gentle as possible. Relieve pain by anodynes, etc. Treat hemorrhage on general principles. Support the general strength. Perhaps China turpentine,

which Clay appears to have found useful in carcinoma uteri, might be fairly tried here.

Prostate, tubercle of.—Very rare. Always secondary. Symptoms probably raise a suspicion of calculus; but no stone being found, and coincidence of symptoms of tubercle elsewhere, correct the diagnosis. Avoid instrumental interference, protect from other sources of irritation, and treat the tubercle and its results, *e. g.*, abscess, on general principles.

Prostate, cysts of.—Small cysts sometimes occur. Often numerous, often contain small concretions. Probably dilatations of gland-tubules. No known symptoms of consequence; therefore no treatment.

C. B. KEETLEY.

Symptomatic Indications.—*Aconite* is useful in prostatitis; great urging to urination, with pain on passing of water. *Pulsatilla*, the principal remedy in the acute form, sometimes useful in the chronic; *thuja*, the main reliance in the chronic form, sometimes valuable in recent cases; should be given continuously; *iodine*, in strumous cases, with swelling and induration of the testes and prostate; incontinence of urine in old persons; *cannabis indica* has given good results in hypertrophy of the prostate with much irritability of bladder.

PRURIGO.—A chronic disease of the skin which begins in early childhood, presents an extensive eruption with special characters and distribution, is accompanied by intense itching, and secondary dermatitis due to scratching.

The affection is closely allied to chronic papular urticaria (*lichen urticatus*), and may be regarded as the head of the urticarial family, the various members of which present considerable differences of character and severity. It is slightly commoner in the male than in the female sex. It appears first in early infancy in the form of urticarial wheals of the ordinary type, of various size and shape; these develop in successive crops indiscriminately all over the body. Generally in the second year of life small, hard wheals appear, which have a predilection for the trunk and outer sides of the limbs, and which become more and more numerous as time goes on. The large wheals, on the other hand, become less numerous till about the fifth year, when the condition termed "prurigo" is usually

established, but exacerbations, with crops of large wheals, occur from time to time throughout life, especially in cold weather.

In a typical case of moderate severity (*P. mitis*) the lesions consist mainly of pale or pinkish papules, varying in size from a pin's head to a hemp-seed, never arranged in groups, situated deeply in the skin, and therefore often more perceptible to touch than to sight. Their seats of election are, in order of frequency and severity, the outer sides and backs of the legs, the front and outer sides of the thighs, the buttocks, loins, thorax, and abdomen, the extensor surfaces of the fore and upper arms. A few papules are generally present on the face, especially on the cheeks and forehead. A still smaller number exist generally on the neck and scalp, although the hair is lusterless and dry. The regions conspicuously free from them are the soles, palms, and hams, but especially the popliteal spaces, axillæ, and the bends of the elbows. Where the papules are closely studded together the skin feels rough, and has been compared to a nutmeg-grater. As the result of the intolerable itching the tops of the more prominent papules are scratched off, and blood crusts form upon them. The "pruriginous habit" is thus established, and fresh lesions are constantly produced outside the originally affected areas. In consequence of constant scratching other secondary lesions are evoked, and, if severe, the case then corresponds to Hebra's description of *P. ferox*. These secondary lesions comprise linear excoriations, severe dermatitis with chronic congestion, vesication, serous discharge, pustulation, scabbing, and ecthymatous sores, deep pigmentation with infiltration, thickening, and exaggeration of the normal lines of the skin, loss of lanugo hairs and symptomatic enlargement of the lymphatic glands, especially of those in the inguinal regions, which may form large, prominent tumors. In the ultimate stages the skin becomes leathery, dry, and shrunken, both sweat and sebaceous functions being abolished. The *course of the disease* is never continuous, but the fresh exacerbations, which constitute its progress, are generally less frequent in summer than in winter—probably owing to the better regulation of the temperature of the skin produced by perspiration. The disease described, however, by

some authors as summer prurigo (*P. æstivalis*) is a form of relapsing bullous eruption much more closely allied to the vesication erythemata than to that under discussion. As the result of want of sleep from itching the patients are always pulled down, miserable, pale, and emaciated. In a few cases fatal marasmus is established, but in the great majority death results from independent causes.

The *diagnosis* is only difficult when the secondary lesions are sufficiently accentuated to mask the real nature of the disease, and even in the severest cases their distribution is eminently suggestive. The affections with which prurigo is most likely to be confounded are pediculosis, scabies, and eczema, especially in xerodermatous subjects. In establishing the differential diagnosis the history must be borne in mind and too much stress must not be laid on the discovery of the so-called typical sub-epidemic papules. These are often absent, being destroyed by scratching immediately after their formation.

The *prognosis* depends mainly on the stage of the disease when the case is first seen, and on the general surroundings of the patient. In old standing cases in adults it is unfavorable.

Pathology.—The “nervous” origin of the affection is generally admitted, and some authors maintain that the initial, as well as the secondary, lesions, are the result of scratching, thus making the disease a pure neurosis or sort of essential pruritus. The characteristic initial “sub-epidermic” papule is due to inflammatory infiltration into the substance of the corium, spreading to its upper papillary layer. Subsequently the epidermic layers hypertrophy, the rete cells multiply, are the seat of excessive pigmentation, and become enormously involuted, causing exaggeration of papillation. The *musculi arrectores pilorum* hypertrophy, and contribute to the formation of the papules. The vessels of the corium dilate, and a fibrosis of that layer occurs, which may result in the destruction of the sweat and sebaceous glands.

Ætiology.—Prurigo seldom affects persons of the upper classes; it prevails among the poor, the badly nourished, and the squalid, and is more common in temperate and cold climates. No recognized diathesis predisposes to its development or modifies its course.

Treatment, to ensure success, must be vigorous, assiduous, and applied to the earlier manifestations of the disease. The patient must be placed in good hygienic surroundings; the diet must be simple and digestible, although generous. Crustacea, molluscs, dried and salted fish, pork, tinned meats, strawberries, and other common excitants of nettlerash must be sedulously avoided. Digestive derangements must be treated on the ordinary lines. The regulation of the bowels is of special importance, and is generally best accomplished by a morning saline draught. Cod-liver oil is of great value as a reconstituent, and iron is often a useful adjunct. Arsenic is of undoubted value in some cases, the amount of itching being diminished during its administration, while in others it is inferior to carbolic acid (best given in pill form). Sulphate of atropine and pilocarpine have both their adherents, but as both are best administered subcutaneously, they are seldom applicable in the case of children. Salicin and the salicylates have also been recommended.

Prolonged warm bathing is of the greatest use; a bath of 30 gallons of water at 90° F. may be taken for twenty minutes night and morning, and the addition of sulphide of potassium ($\frac{3}{4}$ ij) tends further to diminish irritability and lessen the frequency of urticarial outbreaks. After the bath the body must be carefully dried with soft towels. A weak lotion of liquor carbonis detergens (3 j ad $\frac{3}{4}$ viij) may then be sponged on all over, but ointments are generally preferable. Of these probably the best is vaseline containing two per cent. of salicylic acid or from two to five per cent. of β -naphthol. In the aggravated cases in adults sulphur baths may be too irritating, when bran, mucilage, or linseed baths may give relief.

J. J. PRINGLE.

Symptomatic Indications.—*Sulphur* in recent, as *arsenicum* in chronic cases, are the most generally useful remedies. *Sulphur* when the skin is dry, with itching worse in the evening and in bed; *arsenicum*, itching and burning; *rumex*, when the itching is relieved by warmth, especially useful in contagious prurigo; *bella-donna* may be useful in prurigo of the vagina, when the mucous membrane is inflamed, and studded with vesicles.

PRURITUS signifies merely itching (*i. e.*, a functional disorder of sensation or paræsthesia), although the word is often erroneously used as synonymous with prurigo. It is a symptom of many diseases of the skin, especially of the urticarial group—including acute and chronic urticaria, lichen urticatus, and prurigo—of pediculosis and scabies, and of eczema, especially in its papular and squamous phases. In other affections—*e. g.*, psoriasis and lichen ruber—although it is usually present and sometimes a marked feature, its intensity varies within wide limits. Too much stress is usually laid upon its absence as characteristic of dermatosyphilis, as squamous “specific” manifestations are not infrequently accompanied by considerable pruritus.

Itching may accompany jaundice, lithiasis, diabetes, and albuminuria, probably as the result of irritation of the peripheral nerves or of the sensory centers by the toxic substances circulating in the blood. In the same category may be placed the itching which in some cases follows the administration of morphine or quinine. When secondary to digestive derangements, intestinal worms, pregnancy, organic or functional uterine or ovarian disturbances—especially about the menopause—or to genito-urinary diseases, it is generally regarded as “reflex.” Pruritus may, however, exist independently of all ascertainable cause, especially in advanced life, when the skin becomes thin, pale, dry, wrinkled, and often warty, and in persons suffering under depressing mental or moral emotions. Frequently it follows exposure to cold or exists only in winter, (*P. hiemalis*) especially in dry climates.

The itching may be universal or local, and may vary in position from time to time. It presents all grades of severity and may attain the utmost degree of torment, driving the patient to the use of all imaginable sorts of rough instruments for the accomplishment of the irresistible scratching which alone alleviates it, or even to insanity and suicide. The secondary dermatitis resulting from scratching includes the production of linear excoriations, urticarial wheals, thickened, pigmented skin, papules crowned with blood-crusts, vesicles, pustules, etc., and may mask the real nature of the malady, but the history of the case and the distribution of the lesions as contrasted with those of the above-mentioned diseases

which it may complicate generally render the diagnosis easy. The regions most affected by the secondary lesions are those most readily accessible to the hands; thus the back is seldom their seat; the inner sides of the legs and thighs are more affected than the outer and posterior sides, and the clavicular regions more than the shoulders. Not frequently, however, patients who complain even of severe itching exhibit no scratch marks. Others entertain an ineradicable delusion that they are the subjects of some parasitic affection; the fantastic description of their symptoms and of the nature of the parasites they imagined to have discovered soon give an unmistakable clew to the nature of such cases. The local forms of pruritus are more frequent than the universal.

Pruritus of the Nostrils is popularly associated with the presence of intestinal worms in children, or may be the precursor of an asthmatic attack.

Pruritus of the Anus and Neighboring Parts occurs in children as the result of the presence of oxyurides in the rectum, but is commoner in adults, especially in those whose occupations are sedentary. It is frequently associated with hemorrhoids, enlarged prostate, fecal accumulation, proctitis, or anal fissure. Its intensity may be extreme, and the secondary lesions are often very severe.

Pruritus of the Genitals in either sex may be the result of diabetes or vesical calculus. In females leucorrhœa or varix of the labial veins is often present, and the condition may exist only during menstruation as the result of mistaken neglect of cleanly precautions (*see* PRURITUS VULVÆ).

Pruritus of the Feet occurs chiefly between the toes. It appears to be the result of sweat detention or decomposition.

Treatment must always be directed toward the cause of the disease, a complete examination being made with regard to all the conditions enumerated as sometimes underlying it, the examination of the urine being of paramount importance. The bowels will require careful regulation, and errors of diet or digestive derangements must be rectified. The use of alcoholic stimulants and of tea or coffee are decidedly contra-indicated. Of the remedies recommended for the alleviation of itching their name is legion—than

which there can be no more eloquent expression of their general inefficacy or unreliability.

Internally, arsenic is occasionally useful but it is wise to administer it in small doses. The tincture of cannabis indica (m. x increased to m. xxx) is perhaps of greater service, but disagreeable cerebral effects are sometimes observed from it. Jaborandi in the form of the infusion and its alkaloid, pilocarpin (gr. $\frac{1}{10}$ or less hypodermically), merit further trial. Bromide of potassium has yielded unsatisfactory results, but the tinctures of hop, hyoscyamus, and belladonna, and the sulphate of quinine seem sometimes of decided value, and given at bedtime may secure a good night's rest. In menopausal cases ichthyol (m. v or more in capsule thrice daily) occasionally acts with remarkable success.

Prolonged warm baths are generally to be recommended; they should be taken at bedtime, and the addition of sulphide of potassium (\mathfrak{z} ij) or of borax, bicarbonate of soda or potash (of either \mathfrak{z} vj or more) to 30 gallons of water often increases their efficacy. After careful drying various lotions containing tar or its derivatives may be employed, such as: \mathcal{R} Liq. carb. deterg. 3 j, spir. vini rect. \mathfrak{z} j, aq. dest. ad \mathfrak{z} vj; \mathcal{R} Acidi salicylici 3 ij, spir. vini rect. \mathfrak{z} iv, aq. dest. \mathfrak{z} x; \mathcal{R} Acidi carbolici gr. v-xv, aq. dest. \mathfrak{z} j; \mathcal{R} Thymol 3 ij, liq. potassæ 3 j, glycerini 3 iij, aq. dest. \mathfrak{z} viij; \mathcal{R} Hydrarg. perchlor. gr. ss-i, spir. rosmarini 3 ij, aq. dest. ad \mathfrak{z} j; etc. Oily applications and ointments are less often useful, but an ointment of naphthol, 2-5 per cent., in vaseline and lanoline is to be recommended. For the local forms of pruritus, scrupulous cleanliness must be observed. It is generally serviceable to apply warm water freely on a sponge or piece of flannel, afterward drying the parts with care. Mercurial ointments are of special value, particularly the red oxide ointment of the B. P. diluted with an equal quantity of benzoated lard; and black or yellow wash is often useful. Painting the parts with compound tincture of benzoin or a solution of nitrate of silver in spirit of nitrous-ether (gr. x ad \mathfrak{z} j) is invaluable in cases depending upon varix, while suppositories of cocaine (gr. $\frac{1}{2}$) are most effectual in some cases of pruritus ani.

J. J. PRINGLE.

Symptomatic Indications.—*Mercurius*, particularly in aphthous or eczematous

pruritus, is the most serviceable remedy. *Aconite* is sometimes useful where there is furious itching all over the skin, with febrile symptoms; also in pruritus ani, especially when skin is inflamed; *ignatia* for fine, pricking itching, like flea bites, shifting from part to part. *Collinsonia* in pruritus of pregnancy is very valuable; *sulphur*, dry skin, itching worse in the evening or in bed (see PRURIGO).

PRURITUS VULVÆ.—Itching of the vulva may arise from various causes. (1) The presence of an irritating discharge. Almost any discharge may, under certain undefined conditions, cause troublesome itching. Thus pruritus is often present before and after menstruation, and during pregnancy and in cancer, gonorrhea, endometritis, and leucorrhœa of any kind. (2) It may arise from wearing pessaries, the effect of which seems to depend on some idiosyncrasy, a metal pessary causing pruritus in one patient, an india-rubber one in another. (3) Vulvitis may act as a cause, especially in children. Also skin diseases, as eczema of the vulva, which is more especially met with in gouty subjects; erythema of the vulva, a frequent accompaniment of diabetes; also herpes of the vulva, furunculus and warts. Parasites, *e.g.*, the pediculus pubis, scabies, ascarides. The pediculus pubis only causes itching when recently acquired: patients in whom the insect is habitually resident cease to notice it. (5) Nervous pruritus, as in degenerative cerebral or spinal changes.

Treatment consists in keeping the parts clean; frequently washing away by a douche all irritations, secretions, and then applying some sedative application. The douche may be a saturated solution of borax. Greasy or glycerine applications are best for after-use, as they do not evaporate. The following are useful: ung. calomel., ung. zinci., ung. plumbi acet., glyc. boracis, and boric acid 3 j, ad vaseline \mathfrak{z} j. In second class the treatment is that proper for the underlying disease. The pediculus pubis must be killed either by ung. hyd., amm. chlor., or by the application of chloroform. Ascarides may be treated by washing out the rectum daily for a fortnight with inf. quass., O j, ferri sulph., 3 j. In any case of pruritus the patient should be instructed that the effect of friction is to aggravate the condition on which the

itching depends. In children it may be desirable to secure the hands during sleep, lest bad habits should be acquired.

G. H. HERMAN.

Symptomatic Indications.—*Collinsonia*, when due to pregnancy; *platinum* with ovarian or uterine disease; *carbo veg.*, when with sexual excitement; *mercurius*, itching worse in bed.

PRUSSIC ACID, POISONING BY.

—Prussic or hydrocyanic acid is chiefly obtained from the cherry laurel or bitter almond plants, or from the kernels of peaches or apricots. Compounds containing the acid, such as essential oil of almonds, laurel water, bitter almond water, or cyanide of potassium are almost as poisonous as the acid. Nitro-benzol, nitro-glycerine, and aniline produce poisoning in much the same way as prussic acid, and call for the same methods of treatment.

Symptoms.—Sometimes the patient becomes insensible almost immediately, and dies within two or three minutes, but some cases do not prove so instantaneously fatal, though, as a rule, death, when it does occur, takes place early. A slow and irregular action of the heart, and difficulty in breathing, are at once apparent, then follow convulsions, ushered in, it may be, by a shriek; the pupils are widely dilated; the expiration labored; cyanosis, vomiting, and involuntary passage of urine and feces, and complete loss of muscular power will be observed; finally, there is extreme collapse, pulselessness, cold clammy skin, stertorous breathing, and death. Occasionally, there is time for voluntary acts not requiring many seconds for their accomplishment to be performed. If the patient survive the first half-hour there is fair hope of his recovery, while, after an hour, recovery is almost assured. The almond-like odor of the poison may be noticed in the breath, but the absence of the odor would not militate against the diagnosis.

Post-mortem Appearances.—Cadaveric rigidity comes on early. The eyes are glassy, the pupils dilated, the nails livid, the fingers and toes contracted. The odor of the acid may be noticeable either before or after the opening of the body. The right side of the heart is generally engorged with blood, dark and fluid, sometimes thick; the lungs are

engorged and œdematous; the bronchi contain frothy mucus. The brain, the stomach, and intestines may or may not be congested.

Fatal Doses.—From 40 minims to 1 dram of the pharmacopœial acid is usually a fatal dose. Scheele's acid is rather more than twice as strong.

Treatment.—Must be prompt. Cold affusion to the neck and spine, or alternate douches of hot and cold water constitute the best means of stimulating the respiration, which is the main object of treatment. Stimulants may be given by the mouth if the patient can swallow, and ammonia should be held to the nostrils. Emetics should be given or the stomach-pump used. Artificial respiration and the application of the induced current to the cardiac region are useful measures. The poison so soon gets into the blood that chemical antidotes can rarely be of any benefit, but a mixture of a proto- and a persalt of iron, followed by an alkaline carbonate, has been recommended, and might be given if at hand. But there would be no time to spare to make up such a mixture. The hypodermic injection of atropine, $\frac{1}{10}$ gr., may be tried, but the other treatment above recommended is far more important.

PSEUDOCYESIS (Spurious Pregnancy).—It is not uncommon for women to be in doubt whether they are pregnant or not. But spurious pregnancy means more than this. The patient not only thinks she is pregnant, but has symptoms which to some extent justify the belief; and the spurious pregnancy is often followed by spurious labor. That the disorder is not simply the result of imagination is shown by the fact that similar phenomena have been observed in birds and other animals. The patients generally have some irregularity in menstruation; they say the abdomen is enlarged and that they had to let out their clothes; that there has been sickness in the morning, and that the movements of a child have been felt. Sometimes the breasts have enlarged, and, if the patient have had children before, it may be possible to squeeze milk from them. In some cases these symptoms persist long after the expected date of delivery, and the patient seeks advice to ascertain the cause of the delay. Sometimes spurious labor comes on; there is a vaginal discharge, nurse

and doctor are sent for, and find the patient in paroxysmal throes of pain. On physical examination, it is at once discovered that the patient is not pregnant. But it may not be easy, owing to the resistance of the abdominal muscles, to make a thorough examination, and it is generally difficult to convince the patient that she is in error. In a case in which absolute certainty is necessary, but its attainment difficult, an anæsthetic may be administered. When the patient is anæsthetized, the uterus can be grasped between the hands, and the absence of any other tumor satisfactorily established.

G. E. HERMAN.

PSEUDO-HYPERTROPHIC PARALYSIS.—A disease characterized by progressive muscular weakness, usually associated with an enlargement of some of the affected muscles. The morbid change is an interstitial fibrous overgrowth of the muscles, frequently accompanied by an accumulation of fat.

Symptoms.—Impaired muscular power and clumsiness, especially of the lower limbs, are usually the earliest appreciable symptoms. Very shortly, enlargement, usually symmetrical, of certain muscles supervenes, the disease then presenting the features to which it owes its name. Increased bulk, however, is by no means constant. In the course of time many of the muscles undergo diminution, sometimes differing little from the normal in size, sometimes becoming markedly atrophied.

The enlargement in rare cases may be absent throughout, the muscles either retaining their natural bulk, or exhibiting a variable degree of wasting.

The muscles of the calf are most commonly the earliest to undergo enlargement, the increase in bulk being sometimes extreme. The glutei, the extensors of the knee, the lumbar muscles, the infra-spinatus, the deltoid and the triceps are especially liable to be affected. The muscles on the front of the leg, the supraspinatus and the biceps are less frequently involved. The flexors of the knee and the muscles of the forearm usually escape, and the serratus magnus is rarely implicated. With the exception of the clavicular part of the sterno-mastoid the muscles of the neck are rarely involved. The muscles supplied by the cranial nerves never suffer, with the exception of the tongue, which is

occasionally enlarged. The pectoralis major is never enlarged, but its lower part, usually in conjunction with the latissimus dorsi, and sometimes also with the teres major, is frequently wasted. The weakness of this muscular group causes inability to depress the raised arm, and the atrophy gives rise to diminished size or almost complete absence of the posterior fold of the axilla. Occasionally these muscles appear to be entirely wanting, and it has been suggested that they may be congenitally absent. The masseters and temporal muscles have in rare instances been enlarged, but otherwise the face is rarely affected. The muscles of the hand almost always escape. It not unfrequently happens that portions of muscles are involved, and this has been particularly observed in the triceps, in the component parts of the muscular mass in front of the thigh, and in the pectoralis major and sterno-mastoid. Impairment of power is said to be more marked in the wasted muscles, and, as enlargement gives place to atrophy, the loss of power progressively increases.

The attitude and gait in pseudo-hypertrophic paralysis are characteristic. In the upright posture the legs are wide apart, the shoulders thrown back and often projecting beyond the buttocks, the lower part of the back strongly curved, and the abdomen pushed forward. During progression the legs are widely separated, and the body swayed to one or other side. The gait thus presents a peculiarly awkward and waddling character. Great difficulty is experienced in rising from the floor, and the method adopted is almost pathognomonic. First the patient rests on the hands and knees with the head down, then by extending the knees the buttocks are raised and protruded. The hands grasp the thighs, and then by pushing upward with each hand alternately, the trunk is gradually extended. When the extensor muscles of the knees are profoundly affected, the patient is unable to rise.

In the course of time distortions of the joints are apt to occur. When the calf muscles diminish in bulk, talipes equinus and sub-luxation of the ankle-joints may supervene. The knee sometimes becomes permanently fixed from the unopposed action of the flexors, and by the contraction of the biceps the elbow may also become flexed. Lateral curvature

from weakness of the spinal muscles may occur.

In the early stage of the disease, the reaction of the muscles to electricity is not altered. Later, the faradic irritability is diminished, and, according to some observers the galvanic contractility is normal or increased. The knee-jerks at first are feeble, and finally disappear. Sensation remains unaffected. The power over the sphincters is preserved, except in rare cases, when, toward the end, some difficulty in retaining or voiding the urine is experienced. Mental weakness, sometimes congenital, sometimes supervening during the course of the disease, is frequent.

Course.—Pseudo-hypertrophic paralysis is a slowly progressive malady. Its duration is variable, and life may be preserved for twenty years, or even more. But long before death, often after the lapse of ten years or thereabouts from the onset, there is inability to stand. Death usually results from pneumonia or phthisis.

Diagnosis.—When there is enlargement of the calves and buttocks, there is little or no difficulty in arriving at a correct diagnosis. The gait and the mode of rising from the floor are also suggestive. Dr. Gowers asserts that enlargement of the infra-spinatus muscle, combined with wasting of the latissimus dorsi and lower part of the pectoralis major, is rarely absent.

The attitude of the lower limbs and the gait in infantile spasmodic paraplegia sometimes suggest pseudo-hypertrophic paralysis. In the former, however, the legs are in a state of active spasms, the knee-jerks are commonly exaggerated, and the peculiar method of rising from the floor is absent. Serious difficulty in diagnosis only arises in those exceptional cases of pseudo-hypertrophic paralysis in which the muscles are wasted and when there is no history of antecedent enlargement. Under such circumstances, confusion is apt to arise between this disease and various forms of muscular atrophy of spinal and idiopathic origin. In infantile paralysis, the sudden invasion, the acute wasting, the electrical reactions and the distributions of the paralysis, are the main distinguishing characters. In other forms of atrophy from spinal disease, the seat of paralysis, the altered reactions to electricity, and

the frequent implication of the muscles of the hand are usually sufficiently distinctive. In the disease known as "idiopathic muscular atrophy," believed by many to be allied to pseudo-hypertrophic paralysis, several members of the same family are often affected, there is no antecedent enlargement of the muscles, and the muscles of the face are sometimes affected.

Morbid anatomy and pathology.—After death the muscles are found pale or yellowish, and often appear to be replaced by fatty tissue. Under the microscope an abundant nucleated fibrous tissue, usually with an excessive amount of fat, is seen between the muscular fibers. Adipose tissue may, however, be scanty or absent, especially in the late stage, and occasionally even throughout the disease. The muscular fibers at first present no marked changes. Later on they become narrow and irregular. The transverse striation often persists until an advanced stage, though occasionally, even in the early stage, it is faint here and there, or the intervals between the striæ are wider than normal. Eventually, the fibers may become granular or fatty, finally dwindling until nothing is left but empty sarcolemma sheaths. The destruction of the muscular fibers is more general when the interstitial tissue is almost entirely fibrous. Many normal fibers are seen in those muscles in which there is an abundant amount of interstitial adipose tissue. The motor nerves have always been found normal. In a few instances changes have been described in the spinal cord. It is now, however, admitted by nearly all authorities that the disease is a primary affection of the muscles, and that the wasting of the fibers is due to an interstitial growth.

Ætiology.—Males are much more frequently affected than females, the proportion being about six of the former to one of the latter. The disease is often noticed shortly after the child begins to walk. In the great majority of cases the onset occurs before the age of ten, but a few cases have been recorded in which the disease began in adult life. Several members of a family are often affected, and, as in hemophilia, the disease is always transmitted through the mother, although she is not, herself, affected with it.

Treatment.—Various drugs have been

recommended, such as arsenic, phosphorus, strychnine, and cod-liver oil, but these remedies have little influence over the course of the disease. Friction, massage, passive movements, gymnastics, have sometimes been used with advantage. Duchenne strongly recommended the faradic current, which is especially effective in the early stages. When the calf-muscles become so contracted that the patient is unable to stand, division of the tendons should be performed. Great care should be exercised to guard the patient from intercurrent maladies, especially of the respiratory organs.

W. B. HADDEN.

• *Symptomatic Indications.* — See INFANTILE PARALYSIS.

PSORIASIS (Lepra; Dry Tetters).—

A chronic inflammatory disease of the skin, characterized by the presence of silvery white scales adherent to and covering dry, reddish, primarily rounded, raised patches. It occurs chiefly on exterior surfaces and is prone to relapse.

Eruption. — The disease begins as minute red papules which rapidly become surmounted by pearly scales (*P. punctata*). These spread peripherically and soon resemble drops of mortar (*P. guttata*); when they attain the size of coin, the name *P. nummularis* has been applied to them. By coalescence of these, larger patches are produced (*P. diffusa*), the outline of which is festooned, convex outward. Recovery begins in the center of the patches, causing a ringed appearance (*P. circinata*), composite patches thus assuming serpiginous outlines (*P. gyrata*). The patches are always distinctly raised, and in old-standing cases are often markedly so; they are well defined, and sometimes form a distinct rim outside the scale. Their color is at first a vivid red, but afterward becomes duller and brownish. Pigmentation is often very deep—like that of lichen planus or dermato-syphilis—in very chronic cases, in cases treated freely with arsenic and in lesions situated below the knee. The scales are most abundant and most typical in recent patches; they are pearly white, lustrous, dry, not greasy, and are easily separated from the subjacent raised patch, the surface of which presents numerous small, reddish points, from which a little blood may ooze, but which never discharge serous fluid. In a va-

riety of the disease (*P. rupioides*) the scales are excessive in quantity, and piled up like the shell of a limpet, but confusion with syphilitic rupia is, after careful examination of all the features of the disease, hardly possible. Itching is a frequent, but by no means invariable, symptom of the disease. As a general rule, its severity is proportional to the acuteness of the inflammatory process, and it is seldom so troublesome in the young, as in old, possibly gouty, persons.

The sites of election are the fronts of the knees, just below the patellæ, and the tips of the elbows, in both of which situations patches may persist for years, before a general outbreak occurs over the body, or between such outbreaks. Generally speaking, extensor surfaces are more prone to be attacked than flexor surfaces, and the eruption as a rule presents remarkable symmetry. The scalp is a frequent seat of the affection; the circular outline of the patches there is generally masked by surrounding seborrhea, but if the disease spread to the forehead or behind the ears, as it often does, its nature is revealed. On other parts of the face it is rather rare. Patches often occur on the trunk, especially on the front of the chest and over the sacrum, particularly in the psoriasis of advanced life, in which the distribution is often asymmetrical, scaling inconspicuous, and itching excessive. The scrotum and penis are seldom involved; rarely, also, the palms and soles. So-called *palmar psoriasis* is almost always a dry eczema or squamous syphiloderm; a few cases of true psoriasis of the palms and soles have been observed, and there seems some reason to think that it is specially liable to become the starting-point of a pityriasis rubra, or, after having become "verruucose," to develop malignant, epitheliomatous characters. When psoriasis affects the nails they become opaque, thickened, and brittle, the matrix beneath being much heaped up; the condition is specially intractable. Occasionally the distribution appears to be determined by pressure, *e.g.*, of garters, or by previously existing skin lesions, such as the scars left by varicella.

The *course* of the disease is essentially chronic; its tendency to recur, sometimes after perfect recovery and at regular intervals, varying in different cases, is very marked, and must compel always a

guarded prognosis. The occasional supervention of general pityriasis rubra, even in mild and localized cases, must also be borne in mind.

The *diagnosis* is seldom a matter of difficulty, but an ill-developed or abnormally distributed eruption, or one under treatment of any sort, may be mistaken for one of the following diseases: viz., dermato-syphilis, lichen ruber, chronic dry eczema, pityriasis rubra, ichthyosis, lupus erythematosus (of the face), tinea tonsurans or seborrhea (of the scalp), pityriasis rosea.

Morbid anatomy.—The pathological changes begin in the rete Malpighii, where rapid cell-formation occurs, resulting, on the one hand, in enormous increase in the cells of the upper horny layers of the epidermis, from premature conversion and imperfect cornification of the rete cells, and on the other, in increased development of the rete layers, except over the papillæ. The result is great downgrowth of the inter-papillary processes, with consequent hypertrophy, congestion, œdema, and diapedesis. The upper part of the corium, especially round the hair-follicles and sweat-ducts, is also the seat of moderate inflammatory changes, almost certainly secondary to those in the rete. In very chronic cases the deeper layers of the corium may become involved.

Ætiology.—Little is known of the ætiology of psoriasis. Heredity is certainly the most powerful factor. While generally appearing in persons in perfect health, it not infrequently attacks those suffering from lowering conditions, *e. g.*, pregnancy, lactation. On the other hand, plethora may produce, and alcoholism certainly generally aggravates it. Spring and autumn seem more favorable for its appearance than summer or winter. Psoriasis is rare before the age of five years. Whether or not the psoriasis of advanced life is to be attributed to gout or “the gouty condition” is a subject of dispute.

Treatment ought to be both constitutional and local, many cases, in which subjective symptoms are absent and local remedies not employed, yielding readily to the former alone. Any marked derangement of the general health (anæmia, plethora, dyspepsia, constipation, or gout) must be dealt with in the ordinary way. Among drugs considered as specific,

arsenic holds the first place, and exerts a potent influence over the disease; it must, however, be used with due caution and full knowledge of the limitations of its applicability. It is unsuitable, even deleterious, in acute, inflammatory cases, and, generally speaking, is more useful in psoriasis of the young than of the old. It ought never to be prescribed unless the tongue be clean, and the digestive functions in order. Then it may be administered in small doses at first, rapidly increased until the maximum dose is attained, individual susceptibility varying greatly as to its tolerance. Itching of the eyelids, diarrhea, gastric pain, or uneasiness are indications to diminish the dose; bronchial catarrh is certainly a frequent result of its administration, but there is some doubt as to the asserted frequency of the development of herpes zoster during its use. The deep pigmentation of the patches produced by its prolonged employment has already been alluded to. The liquor is the preparation most generally employed, usually in combination with alkalies and a bitter infusion; but arsenious acid (gr. $\frac{1}{20}$ or more) and arseniate of soda (gr. $\frac{1}{12}$ or more), are perhaps equally efficacious, and may be conveniently prescribed in pill form with sugar of milk and compound tragacanth powder. Arsenic is always best given after meals accompanied by a copious draught of water; opium may be combined with it to prevent or counteract gastric irritation. Antimonial wine is sometimes of use when liq. arsenicalis disagrees.

Carbonic acid internally (gr. j to grs. iij in pill) is occasionally of value, and oil of turpentine has been highly lauded when given in from 10 to 30 minims with 2 minims of oil of lemon in half an ounce of mucilage of acacia and of water, immediately after meals, three times daily, the last dose not later than 6 P. M.; during treatment at least a quart of barley water should be drunk daily.

In strumous persons cod-liver oil and iron are of special service, and with them arsenic may be easily and conveniently combined, a liberal diet being allowed. In gouty conditions colchicum, iodide of potassium, and alkalies may be prescribed with advantage, and due dietary restrictions must be observed. In such cases vegetarianism is sometimes attended with the best results.

Local treatment is, however, necessary in the great majority of cases, and may, of itself, prove curative, although, in no sense preventive of future relapses. Acute outbursts must always be treated by perfect rest, the affected parts being covered with rags soaked in olive oil or calamine liniment. It is also important to remember that psoriasis in advanced life is much more liable to be irritated by stimulating applications than in early life.

If the disease be chronic, the first condition necessary for the successful application of local remedies is the removal of all scales. Hebra's method, of rubbing in soft soap vigorously until all crusts are removed and some bleeding produced, is unnecessarily severe and no more successful than prolonged bathing, say for half an hour or more, every night and morning, in a warm alkaline bath containing about three ounces of carbonate of potash; the body ought to be well soaped afterward, and friction with a soft towel employed. For the scalp a shampooing liquid, consisting of equal parts of soft soap and alcohol (Hebra's spiritus saponis kalinus), is especially applicable for the same purpose.

Afterward stimulating applications are suitable, the most frequently employed being the preparations of tar. It is also advisable to use them at first over a limited area and dilute; their strength being gradually increased according to the tolerance of the patient and the amount of stimulation necessary. The officinal unguentum picis liquidum is a powerful but disagreeable remedy, and other more elegant preparations are now generally employed. Liquor carbonis detergens may be painted on to very chronic patches with a hard brush, may be used dilute (3 ij ad $\frac{3}{4}$ vj) as a lotion, or combined with lard, lanolin, vaseline, or other convenient vehicle as an ointment. The oleum rusci, oleum cadini, and oleum fagi—in strength varying from 3 ss to 3 iv ad $\frac{3}{4}$ j—are also excellent. Naphthol and thymol (3 j or more ad $\frac{3}{4}$ j) are useful, either in ointments or lotions, to allay itching.

The red oxide of mercury ointment is often efficacious, especially for the scalp and exposed parts, as it causes no disfigurement, and the other mercurial ointments have some value as stimulants. Chrysarobin is the most powerful local

remedy we possess against psoriasis, but requires careful watching, and should always be applied over a small patch at first, as it is apt to cause severe dermatitis. It also has the disagreeable property of staining the skin, clothes, and everything with which it comes in contact a bright yellow. It may be used in the form of the officinal ointment, but is more efficacious, less dangerous, and not at all dirty when a ten per cent. or stronger solution in traumaticine is painted over the part (a ten per cent. solution of gutta percha in chloroform); Unna's chrysarobin mull plasters may also be used with advantage in some localized cases.

A somewhat similar remedy is pyrogalllic acid, which is much used, but causes conspicuous black discoloration. It is employed as Jarisch's ointment (grs. xx to 3 j ad $\frac{3}{4}$ j); its absorption sometimes gives rise to hematuria and other toxic symptoms.

Localized excessive thickness of scale may be removed by salicylic acid in colodion (grs. xx ad $\frac{3}{4}$ j).

Finally, wrapping the part affected—if limited—in an elastic bandage or other form of impervious india-rubber covering is often of itself curative.

J. J. PRINGLE.

Symptomatic Indications.—*Arsenicum* is the principal remedy, and nearly always relieves. In recent cases *mercurius sol.* produces excellent results. *Sepia* may be useful when psoriasis occurs in women with uterine disease. *Iodine* is efficacious in the circinate variety.

PSOROSPERMIA.—Disease of rabbits, which often assumes epidemic proportions in warrens. On examining rabbits dying, the liver will be found dotted with small white nodules, varying in size from a mustard seed to a hazel nut, but rarely exceeding the dimensions of a split pea. Adjacent nodules may be connected by bands of tissue resembling cicatrices. The nodules are especially abundant beneath the serous membrane, but also occur in the substance of the organ; and in a well-marked specimen the cut surface of the liver will present numerous white dots. When a piece of liver containing such nodules is hardened, and sections prepared for the microscope, we find that they consist of dilated bile-ducts. The walls of the central cavity are lined by epithelium, and processes often project from the lin-

ing membrane into the cavity, giving it a villous appearance. The true lining of the cavity is separated from the liver substance by a capsule of dense connective tissue. The interior of the nodule is occupied by a multitude of oval bodies, known as *coccidia oviforme*. This disease occurs in other mammals and in birds; it is occasionally seen in the human subject. One of the earliest cases was recorded by Gubler in 1858. The patient, a stone-breaker, forty-five years of age, suffered from disordered digestion, bad appetite, sour stomach, and anæmia. He had a dull pain over the liver, and was of cachectic appearance. The liver was enlarged, and a spherical tumor could be made out in the neighborhood of the gall-bladder. The anæmia increased; the man had violent pain in his body, fever, feeble pulse, bilious vomiting; collapse and death followed a night of delirium. At the post-mortem examination the immediate cause of death was found to be peritonitis. The liver contained twenty tumors, some of the size of chestnuts, others as big as an egg. The large tumor felt in the liver during life was about 15 cm. in diameter. The encapsuled tumors contained thick fluid of grayish-brown color, containing countless egg-like bodies, which are now known to be *coccidia*. The brief history of this case is sufficient to show that the symptoms induced by *coccidia* in man are similar to those displayed by the affected rabbits.

Cases in man, similar to the one described by Gubler, have been reported in Germany. The earliest case recorded in England is described by Dr. Hadden, (1883), under the title, "A Case of Disseminated Sarcoma." This, in the light of subsequent events, we know to be a fatal instance of psorospermia. A gentleman, thirty-eight years of age, had long complained of occasional pain in the region of the heart. When admitted into St. Thomas's Home he was dull and heavy, with slight occasional elevations of temperature; the drowsiness and dullness increased, followed by low, muttering delirium and partial unconsciousness, ending in death. The case was under observation fourteen days. At the post-mortem examination the visceral and parietal layers of the pericardium were found dotted with numerous, slightly raised, round white nodules of new growth. Similar nodules existed through-

out the muscular substance of the heart and endocardium; the valves were free. The parietal layer of the pleuræ, both surfaces of the diaphragm, mesentery, and omentum were dotted with nodules. The liver and spleen contained several subcapsular deposits; a few existed in the substance of these organs. Similar nodules were found in the kidney, in the arachnoid, and convex surfaces of the brain.

In 1889 Mr. Eve exhibited at the Pathological Society, London, a specimen of psorospermia of the ureter and kidney from a woman, aged fifty-one years, who



FIG. 1.—Portion of a kidney and ureter showing nodules due to *coccidium oviforme*.

was taken suddenly ill. The chief symptoms were hematuria and frequent micturition. Death took place from anæmia and exhaustion on the seventeenth day.

The general appearance of psorospermial saccules in the ureter may be gathered from Fig. 1, taken from a specimen in the museum of the Middlesex Hospital. As yet we are imperfectly acquainted with the clinical symptoms of psorospermial affections of the ureter. In addition to the functional disturbance they set up, they

may produce mechanical effects; for Dr. Joseph Griffiths, of Cambridge, has met with a case in which these nodules in the ureter induced hydronephrosis. By far the most complete case of psorospermia yet described in Great Britain is one reported by Mr. Q. Silcock. A woman, aged fifty-three years, was admitted to St. Mary's Hospital seven days before death. She was thought to be possibly suffering from typhoid fever. The illness dated from a chill taken seven weeks before death.

The symptoms consisted in pains in the limbs, nausea, and occasional sickness, tenderness over the liver and spleen, fever of remittent type, the temperature reaching 103° , and slight diarrhea. The urine was albuminous; the splenic and liver dullness increased; the tongue coated with brown fur, becoming dry; the breath foul.

Death resulted from cardiac failure.

The liver was much enlarged, weighing eighty-three ounces. In its substance were a number of aggregations of caseous foci, for the most part near the surface, there being generally a well-marked red ring of congestion or capillary hemorrhage around each caseous area. The spleen was enlarged, weighing sixteen ounces, and exhibited similar caseous foci, varying in size from a pin's head to that of a pea, arranged in aggregations, and with a red inflammatory zone around each nodule. In the ileum were found six papule-like elevations, with red bases and circumferential inflammatory zones; also, in the large intestine, as well as in the ileum, were red patches of infected mucous membrane, from one to three inches square. A small pneumonic area existed in the anterior border of the left lung; the other organs and tissues presented no noteworthy change, except those associated with fever. The microscopic appearances to a certain extent resembled those of tuberculosis, but differed in the character, situation, and generalization of the lesions. On microscopic examination the nodules were found to contain coccidia, and in their relation to the bile-ducts corresponded to the disease as seen in rabbits.

There is reason to believe that psorospermial infection is not confined to internal organs, for M. J. Darier gives reasons for the belief that man is liable to certain cutaneous affections due to the presence of psorosperms and coccidia. These

parasites may invade the orifices of the follicular ducts of the skin, and, by their accumulation, plug the orifices of the follicles. Among other things, Darier thinks that chronic eczema of the nipple and molluscum contagiosum may be due to this cause. These statements are suggestive, and require thorough investigation.

J. BLAND SUTTON.

PTOMAINES (Animal Alkaloids).—Alkaloids produced by the decomposition of animal substances.

The word *ptomaine*, is derived from *πτῶμα*, a corpse or dead body, and *-inus*, belonging to, and was at first restricted to alkaloids produced by cadaveric decomposition, but it is now also employed to designate alkaloids of animal origin formed during life as a result of chemical changes induced by some agency or other acting within the organism.

The term *leucomaine* has recently been introduced to particularize the animal alkaloids formed during life from those produced by decomposition of dead animal matter; it is probable, however, that in the near future the terms *ptomaine* and *leucomaine* will be dropped, and that these bases of animal origin will be classed in one category as *animal alkaloids*.

It is only within the last few years that the existence of the ptomaines has become known. In 1866 Dupré and Bence Jones found an alkaloidal substance, resembling quinine in some of its properties, in the liver. In 1868 Bergmann obtained from putrid beer a nitrogenous crystalline substance, which they called *sepsine*, and which was subsequently thought to be present in septicæmic blood. In 1877 Silmi announced that by subjecting pure albumen to putrefaction he had been enabled to produce and separate two new alkaloids.

Since then several animal alkaloids have been discovered.

Creatinine, xanthine, hypoxanthine, guanine, carnine, and betaine, all genuine alkaloids, were found in the tissues of animals or in their excrementitious products. Creatinine, discovered in urine by Liebig and Pettenkofer, was the first body of animal origin acknowledged to be an alkaloid. Later Liebrich detected the already known vegetable alkaloid betaine in normal urine. In 1880 Pouchet detected carnine in the urine of man, and this was confirmed in 1881 by Gautier, who showed that it possessed the general

properties of a ptomaine. In 1882 Bouchard demonstrated that not only were alkaloids present in appreciable quantities in normal urine, but that they augmented notably in the course of certain maladies, typhoid fever, for instance; and later, Lepine and Aubert concluded that these alkaloids in the urine increase in quantity until the crisis of a disease is reached, after which they diminish (no alkaloid was isolated in connection with any disease in sufficient quantity or sufficiently pure to admit of its ultimate composition being determined). It has also been shown that in the course of uræmia there is a notable increase of creatinine in the urine. Since 1882 Gautier, as the result of his investigations, has affirmed that the incessant production of alkaloids at the expense of albuminoid materials is a function of all the animal tissues, and is an essential concomitant of the vital phenomena of all living things, animal and vegetable.

The following ptomaines have been extracted from human corpses, and their composition determined by analysis:

Putrescine ($C_4H_{12}N_2$).

Cadaverine ($C_5H_{16}N_2$).

Neurine ($C_5H_{13}NO$).

Choline ($C_5H_{15}NO_2$).

Putrescine and cadaverine have also lately been found by Jauksch in fæces.

The following is a list of the principal animal alkaloids that have been extracted from the secretions of living beings, and from animal tissues:

Creatinine ($C_4H_7N_3O$).

Pseudoxanthine ($C_4H_5N_5O$).

Sarkine ($C_5H_4N_4O$).

Xanthine ($C_5H_4N_4O_2$).

Crusocreatinine ($C_5H_8N_4O$).

Xanthocreatinine ($C_5H_{10}N_4O$).

Guanine ($C_5H_5N_5O$).

Carnine ($C_7H_8N_4O_3$).

Betaine ($C_5H_{11}NO_2$).

Some of these alkaloids are toxic, inducing somnolence, purgation, and vomiting.

Animal alkaloids have also been detected in the liver, brain, heart, lungs, spleen, and saliva of man. The poisonous effects of certain shell-fish (mussels, etc.) have been shown by Brieger to be due to a ptomaine, which he has named *mytiloxine* ($C_6H_{15}NO_2$).

The animal alkaloids that are being incessantly produced within our bodies as a result of the normal physiological processes of life are eliminated by the bowels, kidneys, liver, skin, and lungs, but if from

any cause these eliminating organs fail to perfectly fulfill their excretory functions, then an accumulation of these alkaloids in the circulation occurs, and a toxic action is exerted by them on the nervous centers. In this way can be explained the headache resulting from constipation, and the more serious nervous symptoms resulting from deficient excretory action of the kidneys in certain diseases of those organs. But it is not only on the excretory organs that the removal of these animal alkaloids depends; for a powerful agent is at work, in the oxygen of the blood, which is continually oxidizing them and burning them up, and it seems probable that this combustion, to a large extent, occurs in the liver.

If, the emunctories remaining sound, there be excessive production of animal alkaloids, but inadequate elimination—a condition which is obtained in all forms of overexertion, as in a prolonged march—then accumulation of material, elaborated, in excess and imperfectly eliminated occurs; an auto-infection, a temporary poisoning of the system results, the poison affecting the nervous centers and producing the fever of overexertion, the fever of prostration.

With regard to the possible relation of the ptomaines to the infectious fevers, one view is that, after the admission of the specific micro-organisms into the body, and provided they find the conditions suitable, they live and multiply, and that, as a result or as a residuum of their vital activity, a powerful alkaloidal poison is produced, the toxicity of which is the cause of the symptoms of the disease. If this view be correct, then each infectious fever is the result of a fermentative decomposition of albuminous matter within the body, induced by a special micro-organism manufacturing its own peculiar poison for each disease. But in many non-contagious diseases it seems probable that, without the intervention of micro-organisms, abnormal chemical changes may result in the formation of poisons which exert a toxic influence on the body within which they are placed.

Pouchet has extracted from the fæces of a cholera patient an alkaloidal body, which, injected into animals, produces slowing of the heart, and later, death, followed quickly by rigor mortis; and has obtained from cultivations of Koch's cholera bacillus traces of an alkaloid

which appeared to be identical with the preceding one. Again, from cultivations of the typhoid bacillus, Brieger obtained a small quantity of a poisonous alkaloid that he calls *typhotoxine*, and which yielded reactions different from the alkaloids he had previously isolated from putrefying animal matters. Quite recently Dixon Mann has extracted from the abdominal and thoracic organs of a patient dying of typhoid fever during the third week of the attack, an alkaloid, which, however, differed in some of its reactions from the typhotoxine of Brieger. Dixon Mann has also extracted from the organs of a patient dying of septicæmia, of unknown origin, a small quantity of an alkaloidal poison. Brieger, from cultivations of the tetanus bacillus, extracted four ptomaines, all of which when injected into mice produced tetanus. Lastly, and most recently, the writer has extracted from the urine of typhoid fever patients, a ptomaine, and also one from the urine of scarlet fever patients. Both of these ptomaines are absent from normal urine, and in their properties and reactions they differ from any previously known ptomaine.

ARTHUR P. LUFF.

PTOSIS.—A drooping of the upper eyelid and inability to raise it, from paralysis of the levator palpebræ superioris. It is seldom so complete as to conceal the whole of the eyeball. In the majority of cases, when the lid is raised, the pupil will be found dilated and the eyeball turned outward, the whole being due to paralysis of the third nerve. Partial drooping may be caused by chronic inflammation of the lids (granular lids), or it may be the result of a blow, and is then usually transient, or it may depend upon paralysis of the sympathetic nerve in the neck. It is often congenital, and is then commonly bilateral (*see* FOURTH NERVE, DISEASES OF; THIRD NERVE, PARALYSIS OF).

Symptomatic Indication.—*Gelsemium*.

PUERPERAL FEVER (Metria).—

A severe and generally fatal febrile disease occurring after delivery. The term "metria" has been proposed as equivalent to it, and is less open to objection. Many different theories have been held as to its nature, and still find defenders. Before describing what puerperal fever

is, it will conduce to clearness to state what it is *not*.

1. It has been, and still is, maintained that puerperal fever is a *specific disease*, peculiar to lying-in women, not occurring in any other subjects. This view now has very few supporters, and their number is diminishing.

2. It is thought by some that many cases of puerperal fever are due to the poison of *zymotic diseases*, more especially *scarlet fever*, which, when introduced into the body of a lying-in woman, produces a peculiar disease closely resembling septicæmia, and, indeed, not to be clinically distinguished from it. The evidence adduced in support of this view consists of cases of illness resembling septicæmia, in which, after the illness, a search for some way in which the patient might have been infected with septic poison resulted in failure to discover it; while inquiry directed to finding a possibility of infection from a scarlatina case, revealed some way in which this might have happened. It is concluded, from such cases, that the illness was due to scarlatina, and could not have been ordinary septicæmia. Against them there is the evidence of epidemics of scarlatina observed in lying-in hospitals in which proper precautions against septicæmia were taken. In these epidemics, the only illness scarlatina produced in lying-in women was a disease differing in no important respect from scarlatina in other persons. The conclusion follows that the cases in which scarlatina was supposed to have produced septicæmia, were either cases of septicæmia or of scarlatina complicated with septicæmia. *Scarlatina produces in lying-in women scarlatina and nothing else.*

3. Many observers think that there is a close connection between *erysipelas* and puerperal fever. They have undoubtedly this in common, that the propagation of each disease is favored by bad ventilation and uncleanness; and, therefore, in places, and at seasons, when these conditions occur, these diseases, if once introduced, are apt to spread, and thus the apparent epidemic prevalence of the two is likely to coincide. The question of their relationship has been rendered obscure by the fact that under the term "erysipelas" two diseases have been included, which modern research has shown to be different from one another; and

one of these diseases produces a form of puerperal fever, the other does not. One of these diseases is called "simple" or "cutaneous" erysipelas. It affects the skin only; is transmitted by contagion through the atmosphere; is characterized by redness of the skin with a distinct margin; and is produced by a definite microbe (the erysipelas coccus of Fehleisen), which is found in the lymphatic vessels of the skin at the advancing edge of the disease, but seems to be destroyed in the morbid process, for it is not found in the parts where the disease is older. This disease, when given to puerperal women, produces the same symptoms, and runs the same course, as in non-puerperal patients. *Simple cutaneous erysipelas produces in puerperal women erysipelas and nothing else.* The other disease is called "cellulo-cutaneous" or "phlegmonous" erysipelas. This affects the cellular tissue, and not the skin only. It is not produced by atmospheric contagion; the redness of the skin has no defined edge; the diseased parts contain micrococci, which are different from those of cutaneous erysipelas, and are found in all parts affected by the disease, and not at the advancing edge only. This disease may occur in puerperal women, and is one of the diseases classed under the term puerperal fever.

4. Puerperal fever has been ascribed to *epidemic* influences, that is, an atmospheric or telluric influence or contagion, such as produces epidemics of smallpox, scarlet fever, influenza, etc. But examination of mortality records shows that epidemics of puerperal fever are unknown. This disease is present at all times of the year. It is slightly more common in winter and spring, when variable weather leads to neglect of ventilation.

5. Among causes to which particular cases are often assigned, are: chills, grief, excitement, shame (in the case of unmarried mothers), blood changes, such as hyperinosis, hydræmia, suppression of milk, deficient excretion, etc. All these causes occur just as often in lying-in hospitals where antiseptics are used as they do anywhere else, but in these hospitals they are not found to cause fever.

All accurate knowledge of puerperal fever dates from the time of Semmelweiss, who, in 1847, showed that puerperal fever was caused by inoculation of

the patient with decomposing organic matter, and that by taking precautions to prevent such inoculation, puerperal fever could be prevented. We now know that puerperal fever is due to the access to the patient of certain micro-organisms. The precautions introduced by Semmelweiss were very rough as compared with those now in use, and, therefore, some cases of fever occurred in spite of them. Semmelweiss supposed that these patients infected themselves, and he, therefore, divided cases of puerperal fever into two classes, those infected from without, and those self-infected. These terms appear in some text-books of to-day as "heterogenetic" and "autogenetic." This classification is a delusive one, because (1) all our present knowledge goes to show that there is no such thing as self-infection; (2) if there be, we cannot in any way distinguish an "autogenetic" from "heterogenetic" case, and (3) if we could, it makes not the slightest difference in treatment or in prognosis. It may, therefore, be confidently stated that *puerperal fever is a wound disease.*

In the process of parturition, the cervix uteri, the vagina, and the vulva are often torn. The same diseases may result from these wounds as result from wounds elsewhere. The wounds caused in parturition are more likely to become the seat of diseased processes caused by microbes than wounds of similar size elsewhere, because they are bathed with the copious lochial discharge, which offers a fertile soil for the multiplication of germs. The wounds of the vaginal orifice are probably those through which poison generally gets into the blood. The researches of bacteriologists show that the secretions in the lower part of the vagina always contain abundance of microbes, the secretions in the uterus usually none, and those in the upper part of the vagina very few. It will be evident that, if decomposition of the lochia take place, this process will be most advanced in the lochia lying in the lower part of the genital tract. Clinically, it is found that syringing the vagina is, as a rule, enough to keep the secretions healthy; it is but seldom necessary to wash out the uterus.

The diseases which affect wounds of the genital passage received in delivery are the same which affect wounds elsewhere. Certain morbid states of the wounds themselves must be first described.

1. So-called "**Diphtheritic**" Ulcers.—An unhealthy condition, in which the wound becomes covered with a whitish or grayish pellicle, while the healthy discharge of pus ceases, and is replaced by a slight serous exudation. The surrounding tissues are swollen and reddened, and healing ceases. The pellicle is a superficial slough, and contains abundance of micrococci. Febrile disturbance is always present. It is to be regretted that the adjective "diphtheritic" should have been applied to this and the following condition, for they have no relation to true diphtheria. This disease, before the introduction of antiseptics into midwifery, was quite common in lying-in hospitals, so that this state of laceration of the vaginal orifice has been given the name of "puerperal ulcers." In this country, at least in private practice, it is rare. It ought never to be met with, for it can be prevented by antiseptic precautions. The *treatment* is to dust the unhealthy surface of the wounds with iodoform, and to syringe the vagina twice daily with a 1 in 2000 solution of corrosive sublimate.

2. **Diphtheritic Inflammation.**—In some cases the disease reaches a greater degree of severity. There is not merely the grayish pellicle over the wound, and inflammation around, but the ulcer spreads by molecular sloughing of its edges. There is a higher degree of fever and greater prostration. This condition is identical with the disease known as hospital gangrene, or phagedena. It is scarcely ever seen except in badly managed lying-in hospitals; and as it can be prevented by antiseptics, it ought never to occur.

The *treatment* is to anæsthetize the patient, clean away the slough, wash away all discharges, and freely mop every part of the ulcerated surface with strong nitric acid, and then use vaginal injections of 1 in 2000 corrosive sublimate, twice daily.

3. **Spreading Traumatic Gangrene.**—This is a still more formidable condition, attended with high fever, and with, at first, redness and swelling round the wound. The redness becomes dusky, then purple, then black, till the tissues are converted into a black pulpy mass, and the gangrene which follows spreads with great rapidity. The decomposition of the gangrenous tissues leads to the

evolution of gas, so that there is emphysematous crackling, and, when cut into, gas escapes. The general symptoms are those of septic poisons with great prostration. This is rare as a puerperal disease, but the writer has known it spread from a tear in the perineum. It is to be prevented by antiseptics. When it has commenced, treatment is hopeless. Sloughing of small tags of tissue, killed by the bruising and tearing to which the parts are exposed in parturition, is common, and if antiseptics are used, leads to no harm.

There may be not only the unhealthy state of the wounds of the vaginal orifice, which have been described, but similar conditions higher up. The tears of the cervix may show the same appearance as those in the vulva. The inner surface of the uterus is covered by what looks like a diphtheritic false membrane. When this is stripped off, the uterine muscle is found bare, swollen, and presenting points of suppuration; and in section, venous and lymphatic channels are found filled with pus. In some cases the inner surface of the uterus is converted into a grayish-brown sloughing mass. The signs are often especially marked where the broad ligaments leave the uterus.

The inflammation may be found to have spread along the cellular tissue of the broad ligaments, which are swollen, spongy, and infiltrated with sero-purulent fluid. In slight cases the poison causing the disease may be stopped by the lymphatics, and then a simple *parametritis* is the result, which may end either in resolution or in suppuration, but remains local (*see* PARAMETRITIS). In other cases there may be rapidly spreading suppuration or even sloughing inflammation, and in these cases the inflammation early extends to the peritoneum. It is to these cases that Virchow applied the term "erysipelas malignum internum," and it is this kind of spreading inflammation of the pelvic cellular tissue which is analogous to, and there is reason to think may be produced by, contagion from so-called "phlegmonous erysipelas" of skin and cellular tissue. Clinically, these cases are characterized at first by high fever, with slight physical signs, but when the peritoneum becomes affected, the symptoms of *peritonitis* become the conspicuous phenomena.

The inflammation may also spread to the *ovary*, which becomes enlarged, infiltrated with serum or pus, or even converted into a pulpy mass; or, in less severe cases, just as the inflammation may end in production of a circumscribed abscess in the cellular tissue, so an *abscess*, or *abscesses in the ovary*, may be the chief features in the disease.

In slighter cases, the unhealthy condition of the interior of the uterus may not extend beyond that organ or lead to general infection, but remain as a *purulent endometritis*. This is especially likely to happen if a portion of the placenta or membrane be retained *in utero*. This endometritis is not itself difficult to cure. Its chief importance is that the inflammation may extend along the fallopian tube, and cause peritonitis by direct extension; or pus may accumulate in the tube, and late in the lying-in the tube may ulcerate and burst and the pus escape into the peritoneum. If neither of these events happen the pus may become inspissated, and partly absorbed; the tube is now liable to recurrent attacks of inflammation, by which it becomes greatly thickened, and the patient may be an invalid for months or years.

The conditions that have been described are local diseases, which induce changes in the blood, the local processes being the conspicuous and main features of the disease. There are other diseases in which blood poisoning is the main character, the local changes not being conspicuously different from what is seen in those who go through the lying-in process without grave illness. It is unfortunately the case that the names given to the diseases about to be described have been used by different writers in different ways. The words "*septicæmia*" and "*pyæmia*" have been applied to three different diseases. 1. *Septic intoxication*: also called *septic poisoning*; or, shorter, more distinctive, and therefore better, *sapræmia*. 2. *Septic infection*, or as opposed to *sapræmia*, *septicæmia*, sometimes called *lymphatic septicæmia*. The word "*septicæmia*" has been, unfortunately, by some writers applied without discrimination to both these diseases. 3. *Pyæmia*. This word, also, has been by some made to include *septicæmia*, that disease being called *pyæmia simplex*. *Pyæmia* has also been called *phlebitic septicæmia*.

1. Septic Poisoning, Septic Intoxication, or Sapræmia (*σαπρός*=putrid).—

This disease is produced by infection of the blood with poisonous matter produced by the action of organisms, in this case in the lochial discharge. The poison is here a chemical one, the effects of which are proportionate to the dose, and cease when the poison is eliminated; not a living one, which multiplies in the blood. The bacteria which produce putrefaction are not themselves a poison, for it has been shown that they can be injected into the body without effect. They grow in dead organic fluids, not in the living body, but, by their action on dead matter, they can produce a poison capable of destroying life.

Symptoms.—The symptoms vary with the amount of the poison which has been absorbed, from mere slight fever up to a rapidly fatal illness. The symptoms may begin on the second or third day after delivery, or at any time from this up to the end of the third week. The symptoms are those of fever. The initial symptom may be a rigor, and the temperature may rapidly rise to 104° or higher. The patient feels ill, there is loss of appetite, thirst, dry, furred tongue, and headache. There may be delirium, especially at night. Vomiting is common, in bad cases, and there may be diarrhea. There is not usually at the onset great prostration, but if the illness go on unrelieved, the symptoms become augmented, the pulse becomes rapid and feeble, the skin sallow and slightly jaundiced; sordes appear about the lips, the patient sinks into stupor, followed by coma, and death occurs. In fatal cases the disease runs a course of at least some days. The lochia may be so fetid that the smell is almost insupportable, both to patient and doctor, but in some cases there is no great alteration in the smell of the lochia. The discharge may be suppressed, or rather retained in the uterus. The decomposed matters irritate the parts with which they are in contact; hence putrid lochia in the uterus set up endometritis, which in its turn augments the amount of secretion, and thus, by furnishing fresh supplies of decomposable matter, aids the continued production of the poison.

The *post-mortem appearances* are the same as those after death from septic infection.

Treatment.—The essential point in treatment is to wash away the poisonous matter which is producing the disease. When this is done, there is rapid improvement, the symptoms sometimes disappearing in a few hours. For the removal of symptoms, it is enough to wash out the uterus with water; but as this does not destroy the germs which cause the decomposition, it is necessary, for a permanent effect, to wash out the uterus with an antiseptic solution, the best being a 1-2000 solution of corrosive sublimate. One washing out of the uterus with this solution may be enough to cure the patient, but it may need repeating once or twice, on successive days. The best instrument for the purpose is a Neugebauer's tube, made of celluloid. This can be attached to an ordinary syringe.

2. Septicæmia, or Septic Infection, is produced by the entrance of virulent micro-organisms into the blood. For the entrance of these organisms the smallest breach of surface is sufficient. Hence the liability to this disease has no necessary relation to the extent of the wounds received in parturition, or to the amount of the lochial discharge. The *symptoms* are those of high fever, with great prostration. There is usually a rigor, with rapid rise of temperature and pulse. Slight yellowness of the skin may be present. There may be mental hebetude, with delirium, deepening into stupor. The pulse, as it gets rapid, becomes extremely feeble. Often there is dyspnœa. The tongue becomes dry and brown, and the lips covered with sordes; there is often vomiting and diarrhea. The temperature, high at first, may sink and become subnormal as death approaches; death usually takes place before the end of the third day.

The *diagnosis* between sapræmia and septicæmia is difficult, because the symptoms in the early stages are the same, and later the two diseases are often associated. The conditions which favor the access of one class of germs, favor that of the other also. And some think that under conditions favorable to their growth, the ordinary germs of putrefaction may become, in successive generations, changed into the virulent germs of septicæmia, so that sapræmia may produce septicæmia. Septicæmia can only be distinguished from sapræmia by the greater prostration which accompanies

the former disease. In any case of doubt, that is to say, in any case of severe febrile post-partum illness in which there is not present evidence of local disease sufficient to account for the pyrexia, the disease should be treated as one of sapræmia, and the uterus washed out. It must not be forgotten that such washing out may cure the patient, even though no fetor of the discharges is reported, or can even be perceived on vaginal examination.

The *post-mortem appearances* are those of rapid decomposition with visceral congestion. The surface, a few hours after death, becomes marked with dark lines corresponding to the superficial veins. The lungs are congested, the spleen is large and soft, the liver and kidneys are congested, the blood is fluid and imperfectly coagulated, the interior of the vessels is stained with blood, from rapid disintegration of the corpuscles. The heart is flabby, and there are ecchymoses in the serous membrane. The blood corpuscles do not run together into rouleaux, but form irregular clumps.

Treatment in septicæmia is hopeless.

3. Pyæmia, or Phlebotic Septicæmia.—A disease resulting from the entrance into the circulation of a specific poison developed by the action of micro-organisms in unhealthy or decomposing pus. In most cases of puerperal pyæmia a uterine phlebitis is the source of the pus. It is characterized by two series of phenomena. (1) Fever of a peculiar type, marked by recurrent rigors, with great and increasing depression. The rigors are sudden and severe; they recur once in forty-eight or twenty-four hours, or even oftener. During the rigor the temperature rapidly rises to a great height, 105° F. or more, and each attack is followed by profuse and exhausting perspiration, during which the temperature falls. The breath has a sweetish odor, which has been compared to that of new-mown hay. The prostration, indicated by increasing muscular weakness, small thready pulse, dry brown tongue, with sordes about the lips, and rapid wasting, increases. An icteric tint of skin (hematogenous jaundice) and patches of fugitive erythema are often present.

(2) The formation of secondary or metastatic abscesses. This commences from the sixth to the tenth day, and is the most characteristic feature of pyæmia. These abscesses are marked by their

multiplicity, the rapidity of their formation, and the insidious way in which they come on, without being preceded by any sign of disease in the part. They are most common in the lungs and liver, but also occur in the spleen, kidneys, and other parts. Inflammation of the serous membranes is generally secondary to the formation of abscesses. Peritonitis is in puerperal women the most common of these inflammations. The effusion is usually abundant, and rapidly becomes purulent.

Suppurative inflammation of joints is frequent. The joints, often without pain or other sign of local mischief, rapidly become filled with yellowish puriform liquid. Excepting for the effusion, they are usually tolerably healthy, so that, if the patient survive the disease, use of the joint is regained. There may also be diffuse abscesses in the limbs, either deep down in, or between the muscles, or superficial, under the skin. Their presence is commonly indicated by patches of cutaneous redness, and a doughy state of the overlying tissues. Suppurative panophthalmitis, dependent on the lodgment of infective emboli in the vessels of the eye, is commoner in puerperal pyæmia than in other forms. There may be retinal hemorrhages without this destructive disease.

The *prognosis* in pyæmia is grave. Death usually takes place about the tenth or twelfth day, although some patients linger on for six or seven weeks. Recovery occasionally occurs.

The *treatment* must be conducted on general surgical principles.

4. Puerperal Peritonitis is one of the commonest forms of disease included under the term puerperal fever. It may arise in several ways: as a result of direct injury, laceration, or perforation of the peritoneum; by direct extension of endometritis along the fallopian tubes; by extension of phlegmonous inflammation of the womb, or of the cellular tissue, to the peritoneum covering it; by the escape into the abdomen of products of inflammation from the fallopian tube. When occurring in one of the three first mentioned ways, it quickly follows delivery, and soon becomes general. The abdomen is swollen, tympanitic, painful, and tender; respiration is thoracic, vomiting becomes incessant, the pulse hard, quick, and small, the face pinched, the patient

lies on her back, with the knees drawn up, unable to move. The prostration rapidly increases, and death takes place from asthenia. After death the intestines are found distended with gas, the peritoneum injected and covered with puriform lymph; but there is not, as a rule, a large effusion of fluid.

Treatment is, as a rule, hopeless; it consists in the free administration of opium and alcohol.

5. Late Peritonitis.—Cases of peritonitis which arise from the escape of pus from the fallopian tube into the peritoneum are of much interest, because there is good reason to think that by prompt treatment some at least might be saved. These cases come on later, from the third or fourth day up to the end of the third week, or even later still. The symptoms of peritonitis are, as a rule, preceded by some local pain and tenderness in the region of the affected tube. The pain suddenly becomes acute, sometimes immediately following an unusual exertion, and symptoms of general peritonitis follow.

The *treatment* in such cases (cases of late onset, the general tenderness being preceded by pain in a definite spot) is to open the abdomen, search for the diseased tube, remove it and the other also if diseased, with the ovaries, and wash out and drain the peritoneum. This has not yet been done successfully in a case shortly following parturition; but there is good hope that prompt operation may yet be successful in such cases. An operation, however, could only succeed in cases in which the disease causing the peritonitis was of a purely local kind.

The same principles of treatment apply to peritonitis caused by the bursting of an ovarian abscess, but it has not yet been carried out in such a case.

The diseases which have been described all occur under like conditions—viz., those which favor the access and growth of micro-organisms. Therefore, the different morbid conditions which have been mentioned often occur together. Indeed, cases in which one form of wound disease only is seen quite pure and uncomplicated in the puerperal state are rare.

Treatment.—The essential treatment after the mischief has occurred has been given under each heading. The treatment otherwise is simply that of fever

generally. Strength must be supported by easily digested food. The tendency to asthenia must be combated by alcohol. The nervous system must be sustained with quinine, and opium, if there be pain. If the temperature be very high, tepid baths are almost always grateful to the patient, although they do not seem to have much influence on the ultimate issue. If the circumstances do not admit of a bath, tepid sponging or the wet pack may be used in its place. Antipyretic medicines are of very doubtful value.

Puerperal fever can be prevented by antiseptic precautions. These consist in perfect cleanliness of patient, doctor, nurse, and everything about the patient; that is, an aseptic condition. An aseptic condition can be attained without the use of antiseptic drugs, but without these drugs it is difficult to be *certain* of maintaining it; and, therefore, the patient is safer if antiseptics are used. In lying-in hospitals the difficulty of preserving everything in an aseptic condition without antiseptics is so great, and the consequences of any lapse from the aseptic condition so terrible, that the use of antiseptics ought never to be omitted.

The first thing that doctor or nurse should do, when they enter the lying-in room, is to well wash the hands with soap and water, using a nailbrush, and taking care that the nails are made perfectly clean. To make this easy, the nails should be kept short. After washing in soap and water, and rinsing away the soap, the hands should be dipped in a 1-1000 solution of corrosive sublimate. The nurse should wear a dress of a light-colored material that can be washed, so that everyone may see that it is clean. She should wear no rings, other than the plain wedding ring, for in the crevices of fancy rings much dirt may lurk. For lubricating hands, instruments, etc., a solution of corrosive sublimate in glycerin, 1-1000, is best. Before any manipulation or operation, hands and instruments should be dipped in a 1-1000 sublimate solution. Immediately after the completion of labor the vagina should be syringed with a 1-2000 solution of sublimate, and this should be repeated, night and morning, for the first three days; after this, until the lochia have ceased, a 1-4000 solution should be used. These are the precautions which have been found effective in lying-

in hospitals. The objection to them in private practice is that there is some danger of mercurial poisoning. This is likely to happen if the douche be given by an unskillful nurse, in such a manner that the fluid distends the vagina and does not flow out. Therefore, sublimate should be prescribed as a douche only when it is certain that it will be used by a competent person. The symptoms of mercurial poisoning, which in some susceptible patients follow the use of sublimate douches, even when properly given, are slight, and quickly subside when the mercury is left off. The first symptoms are diarrhea and slight soreness of the gums. If these occur the use of the douches must be omitted, and the diarrhea treated by the administration of bismuth, not by opium. On account of the importance of the early recognition of poisoning, sublimate should only be used in private practice so long as the medical man is visiting the patient daily. On the whole, looking at these disadvantages, and at the slight risk of infection in private practice, it is better, while using sublimate during the labor, and for the douche immediately after, to use Condyl's fluid $\frac{3}{4}$ ss and water Oj or carbolic acid 1-50, for all ordinary cases during the lying-in; reserving sublimate for cases where some special circumstance, such as difficult delivery, prolonged labor, retained placenta, or exposure to risk of infection seem to indicate special danger.

6. The old physicians grouped together cases of short and slight febrile attacks occurring in the lying-in period, under the name of *Ephamera*, or *Weed*. Such illnesses are not uncommon, and may arise from various causes. In some cases we find that with rapid elevation of temperature, and other symptoms of fever of a mild type, there is pain and tenderness over the lower abdomen. In such cases, counter-irritation to the abdomen, in the form of a linseed poultice, mixed with a quarter of its bulk of mustard or sprinkled with oil of turpentine, combined with the administration of opium, is often followed by the disappearance of the symptoms within three or four days. In such cases, the inference that there has been *slight peritonitis* best explains the symptoms and the effect of treatment.

Pyrexia of short duration in lying-in women may arise from *emotion*. This kind of fever is recognized by the rapid

rise and fall of the temperature. For example, in an hour or two it may reach 104° F., and sink to normal within two or three hours. Excepting the emotional disturbance and the temperature, there are no symptoms or signs of disease.

If the bowels should become so confined that a strong aperient, possibly attended by griping, is needed, irritation from this cause is sufficient in a lying-in woman to produce slight rise of temperature.

The fact that in badly managed lying-in hospitals, febrile attacks of short duration and slight severity are more common than in those in which antiseptics are used, points to the conclusion that many slight illnesses are cases of *slight sapræmia*, in which the decomposition is not enough to produce perceptible fœtor, and in which the poison is small in quantity, and spontaneously eliminated.

7. Milk Fever.—A febrile disease following delivery was described by the old writers under this name, and was supposed to be due to some disturbance of the system attending the establishment of mammary activity. Accurate thermometric observations, made in well-managed lying-in hospitals, have shown that, in a healthy lying-in, the establishment of lactation is not accompanied by fever. But if the nipples become sore and inflamed, if the breasts be not properly emptied, and become hard, painful, tender, and distended with milk, fever may arise, but it will subside when the painful condition of the mammæ is removed. If not properly treated, a condition such as that described may go on to the formation of a mammary abscess.

The *treatment* for this condition is to apply glyc. boracis to the nipples, if sore; and to empty the breasts with a breast-pump if the child be unable to do it in the natural way. A soda-water bottle, filled with hot water and then emptied, forms an excellent readily procurable and easily applied breast-pump.

8. Erythematous Rashes are not uncommon in lying-in women, and require mention because they sometimes cause alarm. They are not accompanied by fever, and subside in a day or two without special symptoms.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is valuable in early stages, when chill, with pain and tenderness, is present. *Bella-*

onna in congestive stage, tendency of blood to the brain, delirium, throbbing pains; lochia suppressed, or scanty and fetid. *Apis* is useful in puerperal cellulitis to avert suppuration. *Hyoscyamus* when the disease assumes a typhoid character; furious delirium, with refusal to be covered; painless diarrhea; apathetic indifference. *Arsenicum* is valuable in advanced stage of the disease; rapid prostration, with sinking of the vital forces; great anguish, restlessness, and fear of death; involuntary discharges of foul blood and mucus.

PUERPERAL INSANITY.—That the puerperal state predisposes to insanity, and that the occurrence of insanity within the lying-in period is more than a mere coincidence, is shown by the fact that almost all cases occur within a month after delivery, and the majority within a fortnight. From the fifth to the tenth day is the usual time for the appearance of the symptoms.

Mania.—*Symptoms.*—This is the form of insanity most often met with, especially in the cases which occur in the first fortnight after delivery. The outbreak is often preceded by sleeplessness and refusal of food. The temperature is not raised, unless the insanity be complicated by some condition causing pyrexia; but the pulse is quick. The urine is scanty, and urea, urates, and phosphates in excess, from the increased waste of the tissues. There is maniacal excitement, with delusions, hallucinations, sleeplessness, possibly filthy habits, obscene talk, sometimes erotic tendencies with masturbation. Patients take food badly, and are constipated.

The *prognosis* is more favorable than in almost any other form of insanity.

The *duration* of puerperal insanity of this form is seldom longer than three months.

Melancholia.—*Symptoms.*—In cases occurring after the first fortnight, this form is more common. It generally comes on gradually, with mental depression, often with suicidal tendencies, anorexia, constipation, cold, clammy hands and feet, and sleeplessness. Insanity beginning as mania may pass into this form.

The *prognosis* in this form, though still good, is not so favorable as in the maniacal cases.

Duration.—Melancholic cases last

longer, but most of them are cured within six months, and the large majority within twelve months.

Ætiology.—The conditions which favor the occurrence of insanity in the puerperal state are (1) an inherited tendency to insanity; (2) anæmia, from hemorrhage during or after labor; (3) depressing emotions, such as attend the death of the child, or illegitimate pregnancy; (4) damage to the brain from eclamptic seizures; (5) fever in the lying-in period.

The *preventive treatment* consists in making the patient eat and sleep. The removal of pyrexia, followed by the administration of iron and quinine, and easily digestible food, favors the first indication. The sleeplessness, which in the lying-in period so often leads to insanity, is best combated by a dose of alcohol at night: *e. g.*, 6 ozs. of port wine, with hot water. Morphine and chloral are to be avoided, on account of the depression they produce. Bromide of potassium may be given if there be much reflex irritability. See INSANITY.

The *insanity of lactation* may come on at any period during the fulfillment of this function. It occurs in poor and weakly patients, and is usually of the melancholic form. G. E. HERMAN.

Symptomatic Indications.—The most important remedy in mania is *stramonium*, which allays the excitement and quiets the nervous irritability. It is especially useful in wild and furious delirium, with quiet intervals; tendency to suicide or to destroy the child. *Hyoscyamus* is valuable in milder cases, with hallucinations, especially when induced by jealousy. *Aconite* in puerperal mania, with high fever, restlessness, fear of death, does excellent service; also in puerperal mania from fright. In puerperal melancholia *cimicifuga* gives the best results. In violent delirium from lochial suppression *belladonna* is very valuable; particularly with furious or muttering mania; desire to bite or cut things; congestion of the head. In silent melancholia, with obstinacy, *ignatia* is frequently curative. Mania following prolonged lactation or flooding requires *cinchona*.

PUERPERAL THROMBOSIS AND EMBOLISM. — During the lying-in period the patient is especially liable to thrombosis of the veins of the pelvis and lower extremities. These veins are

greatly enlarged during pregnancy; the circulation is unusually slow, the blood contains an excess of fibrin, and thus thrombosis is favored. Phlegmasia dolens (*q. v.*) is due to thrombosis of venous and lymphatic channels. It is probable that small fragments of clot may be detached from plugged veins, carried into small branches of the pulmonary artery, and there, if not containing septic germs, be absorbed without much harm following. But a clot may be detached large enough to block the pulmonary artery, or one of its main divisions. In that case sudden death will take place. The patient is seized with sudden and intense dyspnoea, and a sense of terror; there is lividity, a rapid and feeble pulse, cold perspiring skin, and the patient may die in a few minutes, perhaps almost instantaneously. The suddenness with which death follows depends upon the extent to which the pulmonary artery is blocked. If a main trunk be not affected, the symptoms will be less severe, and the patient may linger on for some hours, days, or even weeks, dying at length from exhaustion; or it may even be that after a protracted illness slow recovery takes place. The physical signs on the chest in these cases are at first none, and later not well marked. There is some deficiency of expansion and resonance, and feebleness of the breath sounds over a greater or less area of the chest, and a murmur over the pulmonary artery. Well observed cases of recovery from pulmonary embolism are too few to admit of generalization as to their clinical history. In some cases the symptoms seem to be due to thrombosis beginning in the right auricle, and extending into the pulmonary artery, and some think that in the majority of cases the pathological change is of this nature.

Treatment.—The only treatment of use is to keep the patient absolutely at rest, lest any further fragment of clot should be detached, and to obviate the tendency to death by stimulants—alcohol, ether, musk, or ammonia. Warmth to the limbs, and poultices to the chest and epigastrium, may give comfort.

G. E. HERMAN.

PULMONARY ARTERY, EMBOLISM AND THROMBOSIS OF.—The pulmonary artery may be blocked by an embolus, or by clotting of the blood in the vessel.

Obstruction of the pulmonary artery is apt to occur during the *puerperal state* or *after parturition*, at which times the blood in the venous system is especially liable to undergo coagulation. Post-partum hemorrhage, placenta prævia, and septic conditions of the uterus predispose to coagulation of the blood in the uterine veins; and this coagulation extends into the veins of the pelvis and legs. The femoral and saphena veins are very liable to thrombosis, a condition which gives rise to phlegmasia dolens. In such cases the clot may be detached, and, by blocking the pulmonary artery, produce sudden death. Playfair collected twenty-five cases of pulmonary obstruction occasioning sudden death; seven were distinctly of embolic origin, and occurred at a remote period after delivery, in none before the nineteenth day. In fifteen cases there were no post-mortem evidences of embolism; in all these death occurred before the fourteenth day, often upon the second or third. These latter cases he attributed to *primary thrombosis*. If, however, sudden dyspnœa arise, thrombosis can scarcely be supposed to be the cause, unless it be assumed that, after the formation of a clot, the circulation is still carried on, and that the sudden accession of symptoms is due to the occurrence of further clotting, or to the clot having shifted, so as to completely block the vessel. Pulmonary obstruction from embolism, produced by the detachment of a clot, may also occur from phlebitis in gout or Bright's disease, from thrombosis of the cerebral sinuses, or of the veins of the limbs in exhausting diseases.

Rare instances have occurred of blocking of the pulmonary artery by hydatid cysts, and by the detachment of cancerous masses which have grown through the wall of a large vein.

Cardiac Thrombosis, secondary to blocking of the pulmonary artery, is less liable to lead to sudden death than when the clot is detached from a vein; because before the clot is detached it nearly always undergoes softening and disintegration, and the *débris* which is discharged into the pulmonary circulation causes embolism of the middle-sized and small arterial branches, producing pulmonary infarction and its attendant symptoms. It is especially liable to occur in mitral disease, particularly mitral stenosis. In leucocythæmia a clot may be detached from the right

heart, of sufficient size to block the pulmonary artery, or one or more of its main branches, causing sudden death. In many cases in the death agony, or during the last few hours of life, a clot forms in the right ventricle which extends into the pulmonary artery and its branches.

Symptoms.—If the pulmonary artery itself, or one or more of its larger branches be blocked, then a train of symptoms will arise which will probably be of such short duration that death will frequently occur before the physician can be called. There will be sudden *dyspnœa*, pain in the chest with anxiety of impending death, the jugular veins may be distended, the lips blue, the skin cold and clammy, the pulse weak and thread-like, the heart's action tumultuous and irregular, or so feeble that the impulse cannot be felt. Auscultation shows that air is entering the chest freely, but the blood being unable to reach it, the respiratory efforts are without avail. In some cases, where an embolus is situated in the pulmonary artery or one of its branches, but has not completely filled it, a systolic murmur can be heard over the vessel so affected. Toward the end, which may occur within a few minutes, convulsions and unconsciousness may come on; the patient dies, in such a case, of *asphyxia*. A number of cases, however, die of *cardiac syncope*, owing to paralysis of the heart from distention of the right cavities, the left being empty and contracted. In such cases the skin is pale, and the end sudden, often being indistinguishable from angina pectoris, rupture of an aneurism, or of the heart itself into the pericardial cavity. The case may, however, not terminate fatally, for the clot may be driven farther along the vessel and allow some portions of the pulmonary circulation to receive blood, and the patient may recover, or after hours or days another accession of symptoms may arise, terminating fatally.

Symptoms of obstruction of middle-sized branches of the pulmonary artery are dyspnœa and blood-stained expectoration, the sputum consisting almost entirely of dark blood, or of blood mixed with more or less mucus, but there is never much air in it. This characteristic expectoration lasts for several days. A large peripheral infarction may give rise to dullness on percussion, crackling râles, and harsh or bronchial respiration.

and sometimes pleuritic friction. When small branches of the pulmonary artery are blocked, causing small infarctions, there may be absence of sudden dyspnoea and oppression, although, on account of an attendant pleurisy, the patient may complain.

Diagnosis.—If one of the causes enumerated be present in association with the sudden supervention of the symptoms described, particularly if the patient be a woman who has not long been delivered, or if there be evidence of venous or cardiac thrombosis, a diagnosis may be made, but it is often attended with difficulty.

Prognosis.—When the artery or one of its large branches is blocked the prognosis is always very grave, but if the case be not suddenly fatal, there must still be circulation going on in some part of the pulmonary system, therefore a chance of recovery exists; but it must be borne in mind that a further obstruction may occur by an addition to the clot. Some undoubtedly severe cases have, however, recovered. The occurrence in the heart disease of embolism followed by hemorrhagic infarction is, on the whole, unfavorable, since it points to weakness of the right ventricle, and hence to the formation of a thrombus in it; yet frequently the symptoms of a pulmonary infarction pass away entirely.

Treatment.—*Prophylactic.*—The accident can often be prevented by care. A patient suffering from any of the conditions which may give rise to embolism of the pulmonary artery or its branches should not be allowed to make any exertion, or to get out of bed, or strain at stool, lest the clot be detached.

Therapeutic.—Very little can be done. Stimulants, such as ether, ammonia, or brandy, or a hypodermic injection of ether may be given in order to keep the patient alive. Leeches, dry cupping, and sinapisms over the cardiac region, and perhaps bleeding from the arm might do good to relieve the distention of the right heart. If the case be not suddenly fatal, and oxygen can be obtained, its inhalation might be tried. Absolute rest should be enjoined, even after alarming symptoms have passed away, for any exertion may lead to a renewal of dyspnoea and cardiac embarrassment.

F. W. MOTT.

PULSE.—What is known as the pulse is not a distention of the artery by the blood which is being driven through it, but a change in the shape of the artery, due to a temporary increase in the tension of its walls.

Dr. Broadbent has shown that the pulse is felt in the normal condition only when an artery is somewhat compressed and flattened against a bone or other hard substance. With each beat of the heart the fluid pressure in the whole of the arterial system is increased, and consequently the compressed vessel tends to resume its former cylindrical form; it is this change of form which is felt as the pulse. The pulse can be felt wherever an artery lies near the surface, and can be compressed against a bone beneath it, and for practical purposes the radial artery at the wrist is always chosen. The pulse may be examined by either the finger or the sphygmograph. Very rarely does the latter instrument convey more, or even as much, information as the educated finger, yet its tracings are useful as records of the pulse at various times (*see SPHYGMOGRAPH*).

Examination of the Pulse.—The method to be pursued in examining the pulse is the following: The first three fingers are laid lightly upon the radial artery at the wrist, and are then carried transversely to and fro across the artery. Thus its size is appreciated and the degree of fullness between the beats of the pulse. Next, the fingers should carry the skin along the artery, using varying degrees of pressure. In this way a tortuosity of the vessel and an irregular thickening of its walls from atheroma will be detected, and when the vessel is completely emptied by pressure its walls may perchance be found uniformly thickened so as to form a cord beneath the finger. Now, pressing upon the artery with the finger, or the two fingers, nearest the heart and using moderate force, the pulse itself will be perceived. The characters of the pulse to which attention should be directed are:

The frequency.—This is an indication of the frequency of the heart-beat, but may or may not correspond with the latter.

The size.—That is the degree in which each heart-beat diminishes the flattening of the artery by the finger. The force of the heart-beat being the

same, the size of the pulse will be greater when the arteries are relaxed and easily flattened, less when they are contracted or distended, and, therefore, not readily compressible. Moreover, in the latter condition, the size of the pulse will be found to increase as greater pressure is applied to the artery.

The uniformity.—The beats should be regular in rhythm and equal in size.

In each individual beat there must be noticed the *sharpness* with which the beat strikes the finger, the *duration* of the beat and its *mode of decline*, whether gradual or sudden.

The strength.—This cannot be estimated from the size of the pulse, since the latter will vary with the degree of relaxation or contraction of the artery; it must be judged by the amount of pressure required to obliterate the pulse. Pressure should be applied by the finger, or two fingers, nearest the heart, until by the third finger the pulsation is found to have disappeared. The degree of pressure necessary will serve as a guide to the force of the heart-beat.

The bilateral similarity.—It is desirable in certain cases to examine the pulse at each wrist, and, bearing in mind a possible abnormal distribution of the arteries, to note any differences there may exist in the characters of the two pulses, or any want of synchronism.

Recurrent Pulsation.—In certain conditions, even though the circulation through the radial artery toward the periphery be completely interrupted by the observer's fingers, there is still felt a slight and somewhat delayed pulsation in the artery. This is due to a transmission of pulsation through the palmar arch, and it occurs when the vessels are relaxed. It is associated with two conditions, namely, such a low tension pulse as occurs in aortic regurgitation, and the condition which is met with at the end of a case of chronic Bright's disease, when peripheric resistance to the circulation remains, but the arteries have ceased to contract upon the blood.

Abnormalities of the pulse involving all these points will now be briefly described.

Excessive rapidity of the pulse; Tachycardia.—The normal rate of the pulse is about 72 beats per minute, but this is easily varied by many physiological conditions, such as food, exercise,

excitement, the upright position, etc. There are many pathological conditions which accelerate the pulse. Pyrexia from any cause, but especially that which accompanies scarlet fever, is perhaps the most frequent. States of anæmia and debility are notable, not only for general rapidity of the pulse, but also for the ease with which the physiological conditions mentioned above increase the average pulse rate. In Graves's diseases, the symptom most constantly present is increase of the frequency of the pulse, together with a sense of palpitation of the heart. Many nervous disorders, and among these may be mentioned locomotor ataxy, are accompanied by persistent frequency of the pulse, and the same symptom is noticed as an early sign of cardiac failure from any cause.

There exists a strange group of cases in which rapidity of the pulse is almost the only symptom observed. This condition is not infrequent as a paroxysmal occurrence in gouty or mentally overworked subjects. It comes on suddenly after slight exertion or excitement, and is accompanied by a great sense of oppression and of impending danger. This form of so-called tachycardia generally passes off after a period of rest in the supine position. But in another class of cases the extreme frequency of the pulse may remain for a considerable time as a constant symptom, and may reach such a degree as to cause the heart to beat more than three hundred times in the minute. This tachycardia comes on suddenly, and often without apparent cause. There is rarely any feeling of distress in the early stages, and nothing to account for the condition can be discovered by stethoscopic examination. In severe cases, the face becomes pale or cyanotic, and signs of œdema of the lungs and general failure of the circulation may be detected. The cause is doubtless some disorder of the nervous mechanism of the heart. It is not a safe condition, for sudden death has been known to occur in a number of cases. In one such case, the writer was able to detect after death nothing more than an enlargement of the heart and some degeneration of its fibers, which were more likely to be the result than the cause of the rapid action. The cardiac nerves were structurally normal. Rest and freedom from excitement should be enjoined in such cases, and drugs which

steady the heart, such as digitalis, convallaria, and strophanthus should be prescribed. Yet all these remedies, while useful for a time, seem powerless to effect a cure, which may, however, occur spontaneously.

Slow Pulse, or Bradycardia, may be habitual to some persons and not indicative of a departure from health. Again, it is produced by jaundice, and is found sometimes as a symptom of fatty degeneration of the heart. It must not be confused with that condition known as *dropped beat*, in which each alternate beat of the heart fails to reach the pulse. As Dr. Broadbent has shown, this is due to the second contraction of the left ventricle being too weak to raise the aortic valves, the right ventricle at the same time acting normally. An extremely slow pulse may be associated with epileptic seizures, because the slowly acting heart is incapable of supplying a sufficient amount of blood to the brain.

Intermittent and Irregular Pulse.—The pulse may vary its rhythm in relation to the heart's action or independently of this. An intermittence in the pulse may therefore be dependent on an intermission in the cardiac action, and it may be regular or irregular in its occurrence.

Such a condition is habitual to some persons, is common in gouty subjects, and is readily produced by dyspepsia, nervous excitement, and abuse of tea and tobacco. On the other hand, intermission of the pulse may be merely a form of the dropped beat just described. An irregular pulse is one in which the rhythm, and possibly the force of the pulse-beats varies irregularly. It is especially associated with cardiac failure and with mitral regurgitation. Varieties of the intermittent and irregular pulse are the so-called *pulsus bigeminus*, *pulsus trigeminus*, and *pulsus paradoxus*.

The **Pulsus Bigeminus** receives its name from the fact that the beats of the pulse occur in pairs, each pair followed by a somewhat longer interval than usual.

The first beat of the pair is a normal one; the second is often much weaker than its predecessor. The heart-beats correspond in rhythm, and Dr. Broadbent has observed that a mitral murmur, heard with the first beat, may be inaudible with the second, and that a tricuspid murmur may be heard only with the second beat.

This pulse is common in mitral stenosis.

In the **Pulsus Trigeminus** the associated beats are three in number.

Pulsus Paradoxus is the name given to that condition in which the pulse-beat is lost or becomes much weaker during each inspiration. It is found in association with weak heart, with adherent pericardium, and with chronic mediastinitis, where fibrous bands surround the roots of the large vessels, and also bind the pericardium to the sternum. Its ætiology in the latter case would seem to be evident, for with each inspiration the fibrous bands would be dragged upon, and thus the entry of blood into the large vessels from the ventricles would be hindered. Another mechanism, however, is possible, and may obtain in those cases where no such adhesions are found. With each inspiration the negative pressure on the thorax is increased, and may thus offer more resistance to the emptying of the ventricles than a weak heart, or one acting under conditions otherwise unfavorable is able to overcome.

High-tension Pulse.—The tension of the arterial walls is increased at each systole of the ventricles and causes the pulse.

But the mean tension of the arteries is capable of variation under many conditions. The mean tension depends upon the force of the ventricular systole, and the amount of resistance which the blood experience in passing through the capillaries; variations in either of these two factors will cause corresponding changes in the character of the pulse. A normal pulse is, as a rule, easily compressible, and the artery can scarcely, if at all, be felt between the beats. Increase of the peripheral resistance, together with a corresponding increase in the force of the ventricular systole, produces the high tension pulse, the characters of which are, that it is gradual in its impulse, long in duration, slow in subsiding, with difficulty compressible, and the artery is felt between the beats as a firm, round cord. Usually, the artery is small, and the pulsation may appear to be small and weak, until considerable pressure is applied to the artery, when the beat is found to be really very forcible. The sphygmographic tracing is characterized by a short sloping upstroke, the absence of percussion waves, a rounded or lengthened summit, and a gradual descent, in which the dicrotic wave is very slightly marked, and the dicrotic notch is high about the base line.

Virtual-tension Pulse.—If, with the peripheral resistance still continuing, the heart power should fail, the pulse of high tension becomes one of virtual tension.

In this variety the artery is still full between the beats, but is generally large; the impulse is sudden, lasts but a short time, and suddenly declines. The sphygmographic tracing shows a moderately high and perpendicular upstroke, very often percussion waves, and a somewhat gradual descent, in which the dicrotic wave is well marked, but the dicrotic notch is high above the base line.

Some degree of high arterial tension is often a natural condition with individuals, and not infrequently many members of a family may show it without any symptoms of, or inclination to, disease, being detectable. As a rule, however, a high arterial tension indicates an impure state of the blood, which renders it incapable of passing easily through the capillaries, and which is induced by abuse of nitrogenous food, habitual alcoholic excesses, constipation, and deficiency of exercise. It is especially found in association with Bright's disease, gout, lead poisoning, and pregnancy. Dr. Broadbent has observed that the pulse of scarlet fever differs from that of the other eruptive fevers, in that it shows high instead of low arterial tension. Some cases of anæmia present a persistently high arterial tension, and it must be noted that neurotic subjects, under the influence of excitement or worry, will develop a great increase of the arterial tension, which sometimes comes on very suddenly and as suddenly declines; this is clearly not due to an impurity of the blood, but doubtless to contraction of the arterioles. The pulse of virtual tension is met with in similar conditions when the heart begins to fail. It is hence most often found in the late stages of Bright's disease.

Of the evils brought about by high arterial tension, it must suffice to say that they result on the one hand from the strain upon the heart and blood vessels, and on the other from the failure of nutrition of all parts of the body, but especially of the nervous system, which is induced by the deficient circulation. High arterial tension is best combated by a due regulation of the habits of life and a limitation of alcohol and of nitrogenous food. Salines should be given, the bowels kept freely open, and mercurial purges occasionally

administered. The pulse of virtual tension is a sign of heart failure, and calls for treatment based upon this view.

Low-tension Pulse.—The pulse of low arterial tension is sudden in its onset, short, and quickly declines. The artery is scarcely to be felt at all between the beats, and the pulse is easily obliterated by pressure. The size of the pulse will depend entirely upon the force with which the heart is acting, being large when the systole is strong and *vice versa*.

Dicrotic Pulse.—This is observed when the arterial tension is low. On applying the fingers very lightly to the artery, a second impulse can be readily detected following the first. The second shock is due to the rebound of the elastic arterial walls, after the systole of the ventricle has stretched them, the closed aortic valves acting as a fulcrum. It must be carefully distinguished from the *pulsus bisferiens*, or *pulsus triferiens* observed sometimes in aortic stenosis, which are due to the re-enforcement of a prolonged ventricular systole near its close, by one or two accessory spasmodic contractions. The sphygmogram of low arterial tension shows an abrupt ascent, varying in length according to the force of the heart-beat, a sharp summit, and an abrupt descent, in which the dicrotic wave is well marked and the dicrotic notch is placed near the base line.

Low arterial tension indicates a beneficent power in the circulation. Its most frequent cause is pyrexia, and it is found generally in a state of debility. It calls for the administration of tonic remedies.

The Collapsing Pulse of Corrigan, found in aortic regurgitation, is a special form of the low tension pulse. It is very sudden in its impulse, large, of short duration, subsides with great abruptness, and between the beats of the artery is scarcely to be felt. The size of the pulse is due to the dilatation and hypertrophy of the left ventricle, which, for the purpose of compensation, always accompanies aortic regurgitation. The non-closure of the aortic orifice, during the diastole of the ventricle, allows part of the blood driven into the artery to flow out again. Thus, while the great increase of tension, due to the systole of the hypertrophied ventricle, is felt in its full force, yet immediately the systole is over, the artery is no longer kept distended, but "collapses." At the same

time, a distinct delay can be perceived before the systole as timed by the apex beat, produces its effect on the radial artery. In this condition, too, the blood which flowed out of the artery during the ventricular diastole, is projected into the more or less emptied vessel at the next systole, and this refilling of the artery causes the "visible pulse." The mechanism of such a pulse is thus quite different to that of the normal pulse, as felt by the fingers, which, as has been stated, is not due to progression of blood through the artery, but to increase of tension of its walls. Again, the shock of the ventricular systole, and the return of the blood to the relaxed and partially emptied arteries, causes them to move in their beds and exaggerates their curves, producing the vermicular appearance known as "locomotive" pulse. All the features of the collapsing pulse are more marked when the arm is raised above the head. The sphygmogram shows a very high and abrupt ascent, the presence of percussion waves, a sudden descent, and a very faint and low diastolic wave.

Capillary Pulsation is a phenomenon seen in connection with very relaxed states of the arteries, and especially with aortic regurgitation. If a capillary blush be raised by scratching the forehead, its edges will be seen to pulsate distinctly with each beat of the heart. The same pulsation may be seen under similar circumstances at the edge of redness under the finger-nail, when the tip is pressed firmly.

Venous Pulse.—Dr. Broadbent has shown that, in the same conditions, the pulsation may be communicated even to the veins, and can be well seen in the veins of the wrist, when the hand hangs down. Pulsation also occurs in the veins of the neck, in tricuspid regurgitation, where the systolic shock of the right ventricle is communicated to the contents of the right auricle and through them to the superior vena cava and its radicles.

Aneurismal Pulse.—An aneurism of the thoracic aorta, or of one of its large trunks, may modify the radial pulse in a characteristic manner. The artery is then full between the beats, and the pulse itself is small, but becomes somewhat more evident when pressure upon the artery is increased. The impulse is not sudden, is long in duration, and subsides gradually. These points become

more marked when only one radial pulse is affected by the aneurism, and comparison can be made with its normal fellow. It will then be found that the affected pulse is considerably delayed behind the healthy one.

The characteristics of the aneurismal pulse are much more evident in the sphygmographic tracing than to the unaided finger, and can be discovered by the instrument at an early stage. The sphygmogram shows a low and gradual ascent, a rounded summit, a gradual descent, and almost entire obliteration of the secondary waves. Such a tracing may be imitated almost exactly by aortic stenosis, but is distinguished by this point—that considerable pressure is required with the screw of the sphygmograph to bring out the characters of the aneurismal tracing, but is not required for that of aortic stenosis.

The cause of this modification of the pulse, when present in its typical form, is the interposition of the aneurism as an elastic reservoir between the heart and the radial artery. The shock of the systolic and also of the diastolic wave is received by the aneurism, and only gradually distributed to the peripheral parts, while the radial artery is kept constantly full, as if by the elastic reservoir of a bulb syringe. The position of the aneurism will determine whether one or both radial pulses will be affected by it. If it affect the descending arch only, both pulses may be altered, and, consequently, comparison between those of the two sides is useless. Here the sphygmograph will often be found a great help. If the aneurism involve the innominate artery, the right radial pulse will exhibit the aneurismal character, and not the left; and, again, the right pulse may be behind the left in time. When the aneurism is situated beyond the origin of the innominate artery, the right radial pulse will be normal, the left, aneurismal. If it be beyond the origin of the left subclavian artery, of course neither radial pulse will be affected. Moreover, a comparison of the radial with the carotid pulse of the same side will sometimes reveal that the aneurism has involved the subclavian artery and left the carotid intact, and will show, too, that the aneurism is not situated on the proximal side of the carotid.

The above remarks refer to typical

cases, but the conditions are liable to be complicated. Thus the filling of an aneurism with fibrin will, to a great extent, hinder its action as a reservoir, and so prevent its influencing the pulse. The writer thinks, too, that considerable narrowing of the neck of the aneurism will have the same result. Again, the aneurism may press upon the subclavian artery or cause the orifice of that artery to be greatly narrowed when it arises directly from the sac. Both these latter conditions will produce a radial pulse very like the true aneurismal pulse, but the writer would recommend, in such cases, a reference to the degree of pressure required to bring out the characters of the sphygmogram. He has reason to believe that in such cases the best tracing will be obtained with a much lower pressure than is the case with the true aneurismal tracing. In one instance he was by this means led to a correct diagnosis of the embolic narrowing of the subclavian artery rather than of aneurism of the aorta when the differences of the radial pulses suggested the latter condition. Finally, the subclavian artery may be entirely obliterated by an aneurism, and then the pulse in the radial artery is wanting. See also SPHYGMOGRAPH.

ROBERT MAGUIRE.

PUPIL, DISORDERS OF.—The aperture in the iris, whereby rays of light are admitted to the percipient parts of the eyeball, is usually circular and situated a little to the nasal side of the middle of the cornea. The muscular portion of the iris consists of central circular fibers for the contraction of the pupil, and of peripheral radiating fibers having an opposing action. The center for the regulation of the former is situated in the anterior part of the nucleus of the third nerve, behind the center for accommodation, the connecting motor path being formed by the second fasciculus of origin of the third nerve (probably), its trunk, the lenticular ganglion, and the ciliary nerves. The center for the dilator fibers probably lies below the corpora quadrigemina, from which the motor path extends down the cervical portion of the spinal cord, thence by the rami-communicants of the first, or probably the second dorsal nerve to the sympathetic. The pupil is affected by disease implicating any part of these tracts.

Mode of examination.—The pupils should be examined as to equality, size in ordinary light, mobility, and shape. To detect any inequality, care must be taken that the same amount of light falls in each eye. Their size may be estimated by comparison with a series of dots, ranging in size from 1-10 mm. in diameter, held alongside the eye.

Normally, on shading one eye and allowing a bright light to fall suddenly upon the other, the pupil is seen to contract (direct reflex action). The shaded pupil also contracts, coincidentally, but to a less degree (indirect reflex action). The pupils should dilate in the shade and also upon the application of some cutaneous irritation, such as the faradic wire brush applied to the neck; in some, this happens when one of the extremities is pinched.

The pupils have also an associated action with the ciliary muscle, so that during relaxation of accommodation, as in looking into distance, they dilate, but contract concurrently with increasing accommodation.

Variations from the Normal.—1. It is extremely rare for marked inequality of pupils to exist apart from disease or great difference in the refraction of the two eyes. In some cases one pupil, though at times equal to the other, is liable to undergo dilatation, and with it the accommodation is proportionally weakened. Such a condition is generally associated with neuralgia, and seems to depend upon want of tone of the corresponding part of the nucleus of third nerve. In general paralysis of the insane inequality of pupils is usually present, but varies considerably during the course of the disease, and also from day to day. In peripheral neuritis, especially of alcoholic origin, the pupils are often unequal. Irritation of the sympathetic causes a dilatation of the corresponding pupil; paralysis of the same nerve, a slight contraction, so that in a moderate light the affected pupil is rather smaller than the other.

Paralysis of the circular fibers of the pupil causes a moderate dilatation. The pupil of a blind eye soon becomes rather larger than the other.

2. The pupils are commonly large (mydriasis) after the administration of large doses of belladonna, in anæmia, syncope, aortic incompetence, bilateral

paralysis of the third nerve, during great pain, and also in the convalescence from typhoid fever, in which case such dilatation sometimes occurs that the red fundus can be seen. The local application of atropine, daturine, or cocaine, causes a dilatation far exceeding that which is produced by paralysis of the third nerve. Contraction of the pupil (myosis) is found in the course of typhus fever, tabes dorsalis, sleep, and photophobia. It also results from the local application of eserine, and of large doses of opium internally.

3. Affections of mobility are common and of great importance. One of the earliest signs of tabes dorsalis is the so-called Argyll-Robertson pupil, which consists of the loss of the light reflex, with the retention of the associated movement. In many of these cases, the pupils are uninfluenced by cutaneous irritation. The Argyll-Robertson pupil is also present in some cases of general paralysis and of old-standing syphilis. If both eyes be equally shaded in one-sided paralysis of the symptomatic, it will be seen that the affected pupil does not dilate, and hence appears much smaller than the normally dilated one. In those rare cases of paralysis of the circular fibers alone, the moderately dilated pupil is unaffected by the brightest light. When paralysis of both sphincter and dilator occurs (iridoplegia), the pupils are altogether uninfluenced by light, but retain their associated action, except in very old standing cases. In amaurotic eyes the direct light reflex is lost, but the indirect is increased. This is in marked contrast with what occurs in hysterical blindness, in which the light reflex, both direct and indirect, is quite normal. In some conditions these reactions to light and accommodation are mechanically prevented, as in glaucoma, by thinning of the iris and pushing forward of the lens; serous iritis; excluded pupil, due to the gumming of the edge of the iris to the lens; and occluded pupil, in which the iris is adherent to a false membrane, occupying the area of the pupil. *Hippus* is a very rare condition in which the pupil contracts and dilates without obvious cause.

4. The most marked changes in the shape of the pupil are found in iritis, and are especially evident after the instillation of atropine, which dilates only those parts not bound down by adhesions. Sometimes shreds and filaments are seen,

of the same color as the iris and attached to the anterior surface close to its pupillary border. These are persistent remains of the pupillary membrane. In some cases of tabes dorsalis the pupils are of irregular shape, and in glaucoma they are often vertically oval. Sometimes there is a congenital cleft in the iris, usually symmetrical and always in a downward or down and inward direction.

WM. GAY.

PURGATIVES are substances which act on the bowels, causing increased evacuations. This they do either by increasing the peristaltic action, or by increasing the secretion from the intestinal glands. The former is the mode of action of the *simple aperients* or *laxatives*, the largest class, to which belong rhubarb, senna, aloes, castor-oil, sulphur, magnesia, belladonna, and certain fruits such as figs, tamarinds, rhamnus frangula, cascara sagrada, etc. The other class, viz., those which cause increased glandular action or *drastics*, includes elaterium, croton oil, gamboge, and colocynth. Between these, however, are certain groups of substances which act in both ways; of such the *hydragogues* or *cathartics* act on the glandular secretion—they are mercurials, scammony, and jalap; the *salines* increase secretion while also promoting peristalsis—such are the sulphate of magnesia and the salts of potash and soda. Another class, viz., *cholagogues*, are so called because they promote the expulsion of bile from the body: this they do in two ways, either by stimulating the liver to an increased formation of bile—the direct cholagogues, of which the chief are sulphate of soda, nitro-hydrochloric acid, dandelion, jalap, rhubarb, aloes, colocynth, euonymum, and iriden—or they act indirectly by stimulating the intestinal glands, especially those in the duodenum, hurrying on the bile, and preventing the reabsorption which normally occurs in that part of the intestine. The mercurial preparations are the best indirect cholagogues.

Apart from constipation there are three conditions especially in which the administration of purgatives is indicated, viz., (1) at the commencement of an acute illness, when a blue pill, a dose of calomel or colocynth, may be given with benefit; (2) in general or partial dropsy, whether from heart, liver, or renal disease; in this class

of cases the hydragogues are especially useful, jalap in the form of the pulpis jalapæ co. being the favorite remedy; where a more powerful action is desired a pill of elaterium may be employed; (3) in cases of cerebral hemorrhage, where a speedy reduction of the blood pressure is called for, a drastic is indicated, of which croton oil is the most efficient and speedy in its action; one or two drops may be placed on the tongue.

As a general rule, where a single purgative dose is indicated, the remedy should be given at bedtime and followed in the morning with a saline draught—*e.g.*, Carlsbad salts or seidlitz powder. In cases of dropsy, where the purgative has to be administered repeatedly, it is better to give it early in the morning, before any food is taken.

PURPURA.—A comprehensive term which includes all extravasations of blood into the skin and mucous membranes, not resulting from traumatism.

Symptomatic Purpura may be (1) mechanical, due to increased blood pressure; either permanent, as in chronic pulmonary or cardiac ailments, or temporary, as in paroxysmal affections (pertussis, epilepsy). The tendency to hemorrhage is greatest in dependent parts owing to gravitation, and in lax tissues where the vessels are badly supported (*e.g.*, the eyelids).

(2) Dependent on changes in the blood or walls of the blood vessels, as in anæmia, leucocythæmia, hemophilia, Hodgkin's disease, sarcomatosis, scurvy, rickets, ague, jaundice, Bright's disease, rheumatism; or in lardaceous disease, chronic alcoholism, and old age. Purpura occurring in children immediately after birth is referred to the circulatory changes which then take place.

(3) Toxic, as in snake poisoning and from the administration of various drugs—iodides, bromides, phosphorus, mercury, quinine, salicylic acid, chloral, ergot, belladonna, copaiba.

(4) Due to disordered innervations of the blood vessels, resulting in nutritive changes in their walls, or in their irregular contraction and consequent excessive strain at certain points. Such are the hemorrhages which occur in hysteria, after neuralgia, in tabes dorsalis, and many other diseases of the spinal cord and brain.

(5) The result of a specific infective virus—*e.g.*, in all the acute specific fevers, syphilis, tuberculosis, malignant endocarditis, and septicæmia.

(6) Cases which cannot be considered as belonging to any of the foregoing types, may be grouped together as idiopathic purpura, although recent researches tend to establish their close connection, if not absolute identity, with the last mentioned form.

Purpura simplex.—Its mildest degree generally occurs suddenly in persons who are apparently healthy, and especially in the young. Roundish or irregularly shaped petechiæ appear, of a deep red color, which does not disappear on pressure and soon becomes purplish, not raised above the surrounding skin, and usually remaining discrete. There are no concomitant, constitutional, or subjective symptoms. In children they are commonest about the upper part of the trunk, neck, and arms; in adults, about the inner surface of the thighs, but they may affect any part of the body, and are generally symmetrical. Fresh crops may continue to appear for weeks, each spot as it fades becoming successively bluish, greenish, yellowish, and brownish.

The condition is apt to be mistaken for flea-bites.

Purpura hemorrhagica (*Morbus Maculosus Werlhoffii: Land Scurvy*).—A greatly aggravated form of purpura simplex. Although common in weakly and anæmic persons—especially in girls about puberty—with bad hygienic surroundings, it is of comparatively frequent occurrence in the apparently robust of either sex and of any age, without appreciable cause. A severe case is usually preceded by marked general malaise, fever, headache, pains in the limbs and abdomen, and vomiting. Then hemorrhagic points, larger than in purpura simplex, appear upon the lower limbs, soon to extend in successive crops over the whole body surface, coalescing to form irregularly shaped, extensive ecchymotic patches, or even raised bloody tumors (ecchymomata). Hemorrhages from mucous surfaces, often alarming in amount, occur with special frequency from the nostrils, mouth, stomach, intestine, and kidneys, the patient becoming greatly reduced thereby. Hemorrhagic effusion also takes place into the serous cavities, and sudden death may result

from bleeding into the ventricles or upon the surface of the brain. Throughout the case there is generally some elevation of temperature, sometimes of marked septicæmic type, but no constant relation has hitherto been established between the severity of the pyrexia and of the general symptoms.

In considering the *differential diagnosis* from the various forms of symptomatic purpura, it is of the greatest practical importance to eliminate scurvy.

Recovery is the rule, and, in cases of average intensity, usually takes place in about four weeks. A favorable termination sometimes ensues in apparently desperate cases, after several week's duration; but, on the other hand, death often occurs.

Pathology.—In a few recent cases, plugging of the capillaries with colonies of bacilli containing spores, or with streptococci, has been demonstrated. As the result, extravasation occurs into the corium or its papillary layer, whence it may penetrate the deeper layers of the epidermis; the serum is absorbed, and the subsequent changes in color are due to alterations in the hematin. In mucous membranes, breaches of continuity, hemorrhagic erosions rapidly form.

Treatment.—No treatment may be called for in the mildest cases. In severe cases, absolute rest in bed is imperative. The diet ought to be liberal and stimulating, generous wines, strong soups, and meat essences or jellies being useful. If scurvy be suspected, fresh green vegetables, mealy potatoes, and lemons may be given with advantage. The bowels ought to be acted upon by mild saline laxatives, if there be any tendency to constipation. Iced drinks, iced enemata, and ice locally are often indicated. Turpentine, ergot, hamamelis, acetate of lead, perchloride of iron, the mineral acids, and chlorate of potash are the drugs usually employed, and all are occasionally of service. Arsenic has been strongly recommended by some authorities.

For Purpura Rheumatica see PELIOSIS.

J. J. PRINGLE.

Symptomatic Indications.—*Aconite* is useful in the sthenic form, with febrile symptoms; *mercurius* in the asthenic form; *arsenicum*, in severe cases with much prostration, tendency to disorganization of the blood, gives excellent results. *Ergot* has cured, especially in later stages.

Phosphorus, in purpura hemorrhagica, is the principal remedy.

PUSTULE, MALIGNANT (*Anthrax; Woolsorter's Disease; Splenic Fever; Carbuncle; Charbon*).—An acute disease, due to the absorption of a specific virus, the bacillus anthracis; sporadic among human beings, frequently epizootic and enzoötic among sheep, cattle, and some other animals.

The term Woolsorter's Disease, now in common use, is derived from the fact of the disease prevailing among the sorters of certain kinds of wool.

Malignant Pustule.—This term is applied specially to that form of anthrax in man in which the virus has entered the body by a cutaneous wound, the point of inoculation becoming the site of a peculiar and characteristic sore. The actual breach of surface may be very small; as observed among woolsorters in Bradford, it is often not larger than a split pea, but the tumor may be as large as an apple, or larger.

Symptoms.—Sometimes the patient feels a distinct tingling or slight "pricking" pain at the time of inoculation, but it is never sufficient to attract more than momentary attention. The face, neck, hands, and arms are the most usual situations of the malignant pustule, being the most exposed parts.

In the course of some hours a pimple forms at the spot, which has itched from time to time. A few hours later a vesicle forms, the top of which is invariably rubbed off by scratching; the spot becomes redder and hard, the induration extends, and the central part gradually changes to a dark gray or brown color, and ultimately, by about the end of the second day, to a black or gray-black color. Around this black patch a ring of vesicles forms, the individual vesicles being small, usually not larger than a canary seed. The swelling may extend and sometimes produces immense tumefaction of the neighboring parts. When the face is attacked the features often become quickly concealed and unrecognizable, the eyes disappearing entirely in the swollen tissues. Neighboring glands are generally enlarged, though without much tenderness, and red lines often ramify toward the nearest important collection of glands—*e. g.*, toward the axilla when the arm is the affected part. The patient may

die on the fourth or fifth day, by which time the black eschar will rarely exceed a fifty-cent piece in area. The surface of the tumor is sometimes red, and may be either hot and inflammatory, or cool; it is sometimes emphysematous.

The patient is perfectly conscious and clear in mind, even when the rapid, irregular, feeble pulse betrays the serious nature of the disease. There is usually a good deal of local swelling before any complaint is made, but not infrequently he dies without complaining of any symptoms whatever, always answering that nothing ails him. Sometimes there is slight headache and dry tongue, but prostration and a feeling of "sinking" are the symptoms most often complained of, and also a feeling of uneasiness about the chest, hardly amounting to dyspnoea. The temperature usually rises for a brief period to 100° or 101° F. (rarely higher), but this temporary rise is soon followed by a subnormal temperature, the thermometer standing at 96° and even 95° F. The fever is ever a serious element in the disease, and the worst cases are those in which the temperature ranges lowest.

Course.—It sometimes happens that the general symptoms remain in abeyance and the ailment continues entirely local, and gradually disappears, the eschar sloughing out and the sore healing with disfigurement proportionate to the amount of tissue destroyed. The eschar is sometimes thrown off, without suppuration, after the formation of a line of demarcation from the healthy tissues.

It sometimes happens that no distinct local sore is formed in the early stage, although there is extensive œdema, which has spread from a center. Later, if the patient survive more than three or four days, which is rare in these cases, pustules may form with eschars. If the case becomes one of general infection, the symptoms resemble those of general anthrax (*q. v.*).

Diagnosis.—The nature of the case will generally be apparent when the local sore has developed. Where this is not so, one most striking feature is the disproportion between the symptoms and signs, there being perhaps utter prostration without any discoverable cause. The co-existence of perfect mental lucidity with conditions so evidently pointing to a critical state of the patient, which he does not realize, is very suggestive.

Microscopic examination of the effused fluid from the pustule or the surrounding œdema may, by the revelation of the presence of the bacillus anthracis, prove the case to be specific anthrax, but the bacilli may be entirely absent from the inflammatory exudation, and also from the blood up to a short time before death.

Prognosis.—The gravity of the case depends mainly on the occurrence of a general infection of the organism; death, when it occurs, being due to this cause, and not to the local lesion.

Pathology.—If the disease become generalized it is essentially a case of anthrax, and differs in no way from disease acquired by internal absorption, except that it is less fatal (*vide infra*).

Structure of the pustule.—There is usually a crust on the top of the eschar, consisting of amorphous exudation and *débris* of the superficial tissues, which may contain a few specific bacilli, with other microbes. It consists of the mortified papillæ and upper part of the derma. Its parts are quite disorganized; it presents no structure, nor is nuclear staining possible. It is separated from the still living parts of the subjacent derma by a layer of embryonic cells, a sort of rampart between the living and the dead tissues. The subcutaneous cellular tissue beneath is infiltrated with exudation and embryonic cells. Anthrax bacilli may be present in the eschar, and, if so, will be most numerous in the stratum of embryonic cells. The bacilli are scattered through the derma and subdermal tissues, sometimes in great abundance, sometimes in islets, with clear, intervening spaces, but are not found in the blood vessels. The bacilli are also absent from the hair follicles, and from the glomeruli of the sweat glands. They do not usually extend beyond the deep cells of the rete mucosum. When they penetrate the rete mucosum they speedily cause destruction of the epidermis, and the formation of microscopic eschars. By the coalescence of several of these, larger eschars are formed. The skin and subdermic cellular tissue are frequently infiltrated with gelatinous exudation, rather resembling in consistence the vitreous humor of the eye.

Treatment.—The main indications are to destroy the nidus of bacilli, so as to prevent general infection of the organism. To this end active surgical treatment is

called for, and the earlier it is employed, the more likely is it to be successful.

The destruction of the pustule is best effected by the thermo-cautery or other powerful caustic, as incision may lead to the introduction of the virus into the blood through gaping wounds in the vessels. The application of roughly powdered bichloride of mercury to the raw surface is strongly recommended by some. It causes a hard, dry eschar to form. Potassa fusa, Vienna paste, carbolic acid, and chloride of zinc have also been employed for the same purpose. The local application of powerful disinfectants is especially useful, and subcutaneous injections into the œdematous tissues of such fluid is also to be recommended. For this purpose weak solutions of iodine, carbolic acid, or bichloride of mercury are the best. The injections should be made once or twice daily in several places, according to the size of the infected part. Internally, quinine, ammonia, and bark, carbolic acid and iodine are especially advisable, with abundance of beef tea, eggs, and wine; in fact, any form of good nourishment which is acceptable and digestible. The bowels and skin must be attended to, and, if there be evidence that the virus entered by the intestines, active purgation and the administration of iodoform in pills, with a coating insoluble in the gastric secretions, are indicated.

Internal anthrax.—The virus of anthrax may be spontaneously absorbed otherwise than through a wound in the skin. In such cases it produces a disease known as internal anthrax. This form of the disease is undoubtedly due, in the majority of cases, to infection from the digestive tract, and probably, in most cases, the intestine; infection through the lungs also occurs.

Symptoms.—In *wool sorter's disease* the symptoms usually come on and terminate with terrible rapidity. They last as a rule three to four days, but a wool-sorter, who was well and at his work at 10 A. M., has been known to die of anthrax at 2 P. M. on the following day.

The patient usually goes to work feeling in perfect health, and after a time complains of being dizzy, faint, or "out of sorts." Chilliness follows within an hour or so. Sometimes there are complaints of tightness in the chest, or of dull pain in the front or back of the thorax;

but pain is not a prominent feature. Usually, as the case proceeds, moist râles may be heard over the lungs, but there is no evidence of pneumonia. The temperature, which may rise to 100° or 101° F. for a short time, in the axilla, soon falls below normal. But this fall in the temperature of the axilla does not affect the whole body equally, and erroneous conclusions may be drawn from it. It is a regular experience to find that the rectal temperature exceeds that of the mouth and axilla much more than is normal, sometimes by as much as 1°–2° F. in the former, and 3°–4° F. in the latter.

Frequently the body is bathed in cold, clammy sweat. The patient is very weak and prostrate; he is dull and dejected, the breathing is quick and shallow, the pulse rapid and very feeble, but the mind is usually clear. Liquid nourishment is taken readily to the last. As the end approaches unconsciousness supervenes, and the breathing becomes labored. Among the less common symptoms are delirium, diarrhea, and severe pains in the limbs and joints.

When the local sore is extensive and foul, there may be added to the symptoms of anthrax those of wound fever, or pyæmia.

The symptoms in cases which do not run so rapid a course, generally commence with a feeling of fatigue, dull pains in the limbs, and headache, singing in the ears and giddiness, with general feeling of malaise. These symptoms may be followed by pain in the stomach and bowels, with distention, vomiting, and diarrhea, the motions being sometimes bloody. As the case progresses the breathing becomes embarrassed. There is cyanosis, restlessness, or perhaps drowsiness. The pulse is generally quick and compressible. The temperature in the axilla is but slightly increased. If the case does not soon take a favorable turn, cyanosis and alidity occur with profound prostration, and the patient dies.

Morbid Anatomy.—The following are the chief changes observed. At the seat of experimental inoculation in animals there is never a tumor similar to the "malignant pustule" of man. There is, indeed, rarely pus, or other evidence of inflammation. In animals death generally ensues so rapidly that there is little time for extensive lesions to form in the

tissues. As in man, the blood is not coagulated, but dark and liquid. Externally there is commonly more or less cyanosis, notably of the extreme points, nails, tips of ears, etc. There is sometimes subcutaneous emphysema, no doubt from rapid decomposition. Microscopical examination and cultivations of blood and exuded fluid may show the presence of the specific bacillus, and inoculation proves the pathogenic properties of the microbe. Ecchymotic patches also occur in the lymphatics, and elsewhere. There is usually more or less exudation of serum, sometimes bloody, sometimes clear and straw-colored, into the serous cavities. The serous surfaces of the stomach and intestines commonly present ecchymoses, varying in size from a pin's head to that of a twenty-five cent piece, and either light or dark red in color. The mucous surface is generally not affected. Clear gelatinous infiltration is often found under the sternum, and around the kidney and other parts. The spleen is enlarged and soft, or even diffuent, and very dark. The lymphatic glands, especially near the pustule, are large, dark in color, and engorged with blood. Mediastinal cellulitis and an engorged and hemorrhagic condition of the bronchial glands are also characteristic appearances.

Pathology and Ætiology.—The specific organisms, the bacilli anthracis, are not, as a rule, to be found in the blood during life, but may be discovered in small numbers immediately before death; shortly after death the blood swarms with them. They appear then under the microscope as motionless, straight, clear, cylindrical rods, in length from twice to ten times the diameter of a human red blood corpuscle. The longer ones are found to consist of several short ones united by their extremities, the individual bacilli being about the diameter of a human red blood corpuscle, and in breadth about a quarter to a third of their length. When stained with basic aniline colors—*e. g.*, methyl violet—a bright unstained spot appears at the junction between two bacilli, due to the ends of each being concave, and thus leaving a space when brought together end to end.

The bacilli multiply by fission within the body, but by fission and endogenous sporulation out of the body in a suitable medium, they grow readily in neutral peptone-broth-gelatine, milk, urine, on

vegetables, etc., at the ordinary temperature of the air, and produce spores at temperatures between 12° and 43° C. (=53.6° and 109.4° F.) The bacillus grows in a suitable culture-medium into long, undulating filaments, which, when stained, exhibit spores, distinguishable by not absorbing the coloring matter in the ordinary way.

The macroscopic appearance of a cultivation in or on gelatine is as highly characteristic as the microscopic appearance of the organism. Gelatine culture-medium (ten per cent.) begins to liquefy at the top from the third to the fifth day.

The bacillus is easily killed by heat, cold, desiccation, disinfectants, etc., but the spores are much more resistant; the bacillus will die in one per cent. solution of carbolic acid in ten seconds, but the spores will resist a five per cent. solution for over a month; bacilli perish in water at 55°–60° C. (=131°–140° F.) in ten to fifteen minutes, but spores will resist a temperature of 100° C. (=212° F.) for some minutes.

The process of digestion will destroy bacilli, but spores can resist it, and, by being absorbed in the intestine, may cause general infection.

Incidence of Anthrax.—The disease never occurs spontaneously in man. The virus in cases of internal anthrax may be derived from the consumption of meat, milk, or butter from infected animals, or from dust inhaled or swallowed, as may occur during the preparation of certain mohairs and alpaca, which are usually very dry, and give off clouds of dust. The disease is practically limited to persons brought directly in contact with the virus developed in infected animals, *e. g.*, shepherds and cowherds, stablemen, slaughtermen, farmers, hide and skin dressers, and persons engaged in preparing wool, hair, bones, horns, etc. Wool-sorters believe that a person may have many slight attacks, and at last be fatally attacked; but it is proved experimentally that animals may be protected for some time by giving them a mild attack by inoculation of attenuated virus.

Treatment.—The indications are the same as for the local disease (see Malignant Pustule). Various methods of attenuation of the bacillus for preventive (not curative) inoculation have been practiced. Pasteur uses two "vaccines." The first (weaker) has been attenuated by

keeping at 42°-43° C. (=107.6°-109.4° F.) for twenty-four days; the second (stronger) has been similarly treated for twelve days. They are inoculated at an interval of twelve days. The attenuated bacillus may be propagated without increasing its virulence, or it may be restored to its primitive virulence by suitable cultivation. Chauveau used oxygen, Arloing utilized the action of sunlight; others have used certain disinfectants (carbolic acid, etc.) to effect attenuation. After "vaccination" with attenuated virus, animals enjoy immunity for about a year.

T. W. HIME.

Symptomatic Indications.—*Silicea*, followed by *lachesis*, has cured several cases. *Arsenicum* is very valuable, antagonizing the tendency to disorganization of blood; great prostration, restlessness, burning pains.

PYELITIS (including **Pyelonephritis** and **Pyonephrosis**).—Inflammation of the pelvis of the kidney. If combined, as is often the case, with inflammation of the kidney substance itself, the term "pyelonephritis" is given to the disorder; while, if the purulent results of the inflammation are pent up in the pelvis of the kidney, the resulting cyst, filled with pus, is called a "pyonephrosis."

Pyelitis is produced by the mechanical irritation of calculi or blood-clot lodged in the pelvis of the kidney, or by the presence of parasites, tubercle, or tumors in its mucous membrane. Pyelitis may also arise in the course of various specific fevers, of diabetes, and of chronic Bright's disease. It may be the result of cold or of the action of turpentine, cantharides, and other irritant diuretics given internally. Stagnation of urine in the pelvis of the kidney and ureters, especially if the urine be decomposed, is prone to set up severe pyelitis. Such stagnation may be due to obstruction in the ureter or to pressure upon the tube from the outside, as by a tumor of the pregnant uterus. Inflammation may extend to the pelvis from the lower urinary passages, from the kidney itself, or from neighboring tissues. When secondary to bladder or urethral disease, pyelitis is a variety of so-called **SURGICAL KIDNEY** (*q. v.*).

Symptoms.—The early symptoms are pain and tenderness in one or both lumbar regions. A slight amount of pyrexia may

be caused by the pyelitis alone, independently of the original disease. The urine is generally faintly acid, contains a large quantity of mucus, and deposits copiously the characteristically irregular epithelial cells of the pelvis of the kidney. A small quantity of blood also may be present in the urine. Somewhat later, the irregular cells become fewer in number and pus corpuscles take their place. The urine contains albumen, but in quantity only proportionate to the amount of blood and pus which are found in it, provided that the inflammation be confined solely to the pelvis of the kidney. When the disease has extended to the kidney substance proper, constituting a pyelonephritis, albumen appears in larger amount, and with it various forms of casts and cells from the renal tubes may be found in the urinary deposit. The urine is commonly passed more frequently than is normal. There may be rigors, becoming more pronounced and frequent as pus formation is more definitely established. Accompanying the rigors, the temperature shows variations resembling those of hectic fever. The bowels act irregularly. Usually, there is obstinate diarrhea; but when the pelvis of the kidney becomes so distended as to press upon the colon constipation is observed.

The condition of the urine is subject to variations, for ropy mucus and viscid pus, coagulated blood, epithelial *débris*, or portions of calculus and hydatids, according to the nature of the original cause of the inflammation, tend to obstruct the lumen of the ureter, and so lead to the accumulation in the pelvis of the kidney of the inflammatory products which no longer reach the bladder. If the disease be unilateral, the urine now becomes normal, since it comes from the normal kidney; if bilateral, the abnormal deposit in the urine is diminished in amount; such obstruction is usually temporary. When at last it is overcome, there is a sudden rush of the pent-up secretions, and the urine is again loaded with pus, mucus, and epithelium.

The accumulation of inflammatory products distends the pelvis of the kidney, and in the later stages causes a swelling to appear in the lumbar region. This swelling has the ordinary character of a tumor of the kidney; it is crossed by the colon, it can usually be separated from the liver and spleen respectively, and it

often causes distinct bulging, not only in front, but behind, in the loins. It is dull on percussion, presents obscure fluctuation, is tender on pressure, and is the seat of dull, aching pain. The swelling may attain a considerable size, but is in this respect subject to variations according to the relatively closed or open state of the ureter.

When a swelling has formed in the flank, the urine may still possess the characters described. By this time, however, it has in most cases decomposed and become alkaline and ammoniacal. In certain cases the distended pelvis is completely shut off from the lower urinary passages, and then, provided that the opposite kidney be sound, the appearance of the urine is normal.

The symptoms described above are those which are due to the pyelitis itself. In addition, the primary disease, whether stone, hydatids, or tumor of the kidney, will cause its own characteristic symptoms, which may even entirely overshadow those of the secondary pyelitis.

Results.—When free communication is maintained between the kidneys and the bladder, the discharge may gradually disappear, or it may continue profuse and the patient be exhausted by the drain. The sac of a pyonephrosis may undergo spontaneous cure. The pus may become inspissated; if so the sac contracts, its walls thicken, and at last nothing may be left but a mass of fibrous tissue in the place of the kidney. Again, the contents of the sac may become caseous, especially if the exciting cause be tubercle. Lime salts may be deposited in the inspissated pus in such amounts as to cause absolute obliteration of the sac and its transformation into a calcareous mass. Lastly, the sac may burst, and the liberated pus may make its way along various channels (*see SUPPURATIVE NEPHRITIS and PERINEPHRITIS*).

Diagnosis.—Without tumor in the flank, the symptoms of pyelitis are likely to be mistaken for those of cystitis, and the two conditions may be combined. With pyelitis there is pain and tenderness in the region of the kidneys, the urine is more frequently acid than in cystitis, and there may have been a history of renal colic or renal hematuria, pointing to a stone in the pelvis of the kidney. The character of the cells found in the urine will not help in the diagnosis. The tu-

mor of pyonephrosis must be diagnosed according to the rules for other renal tumors. Its fluctuation, deeper than that of perinephritic abscess, its regular form, the preceding pyrexia, and the constitutional symptoms of suppuration will serve to distinguish the pyonephrosis from other tumors of the kidney. The fluctuations in size of the tumor, corresponding with variations in the state of the urine, constitute an important diagnostic feature.

Prognosis.—Depends on the cause of the disease. If it be due to cold or to one of the general diseases mentioned, it is commonly of little importance. If caused by obstruction to the lower urinary passages, it adds materially to the gravity of the prognosis, whatever may be the nature of the obstruction. The rupture of a pyonephrosis is a very serious matter; but though the condition is grave, favorable results may be obtained by the adoption of proper measures.

Pathological Anatomy.—In the early stages the mucous membrane of the pelvis of the kidney is congested, and may show ecchymoses. Microscopic examination reveals proliferation of the epithelial layer. Sometimes, in severe cases, portions of false membrane may be seen to cover the surface of the pelvis. In the later stages, the mucous membrane is thickened and of a grayish color. It is often ulcerated in patches, while, on microscopic examination, the tissue is seen to be infiltrated with leucocytes, and the normal coating of irregular and dovetailed cells is exchanged for layers of leucocytes. The pelvis is now more or less dilated, and the infundibula become merged into the general cavity.

In pyelo-nephritis, in addition to the changes mentioned above, the kidney shows the appearance of parenchymatous nephritis, or even of acute interstitial suppuration.

When pyonephrosis has formed, the appearances vary according to the stage which has been reached. A sac of pus is invariably found, to which may be attached an almost normal kidney. As the distention of the pelvis increases, the kidney-substance atrophies; so that finally nothing is found but a loculated sac, constituted by dense fibrous tissue, filled with more or less inspissated pus and degenerated epithelial cells, with possibly a calculus or other matter which has been the exciting cause of the inflamma-

tion. If the urine has remained acid, a deposit of uric acid or urates may be found. When, however, the urine has become ammoniacal, phosphates are deposited. Adhesions are commonly observed between the sac and surrounding parts.

Treatment.—The cause of the pyelitis must be treated by the measures appropriate to each condition. The pyelitis itself may be treated in the early stages by rest, warm fomentations, and poultices, and leeches or cupping applied to the loins. The diet should be light and easily digestible; diluent drinks should be administered freely. Pain, if severe, may be alleviated by the use of opium. When the disease has become chronic and a pyonephrosis has developed, the object of treatment should be to diminish the secretion of pus and promote the obsolescence of the suppurating sac. To this end, the internal use of the mineral acids, the perchloride of iron, alum, and other astringents may be tried. In chronic cases turpentine, best given in capsules, and tincture of cantharides, have been found of value in checking the inflammation. The patient's strength must be maintained by nourishing food, quinine, cod-liver oil, and change of air. If, however, there are signs of hectic, and the patient is becoming emaciated and worn-out by continuous discharge, palliative treatment is no longer to be pursued, and surgical interference is urgently called for. Nephrotomy must be performed according to the recognized rules of surgery. Further, when the kidney has been transformed into a cheesy mass, and also when, after incision, the abscess cavity refuses to close, the more serious operation of removing the whole kidney (nephrectomy) may be required.

ROBERT MAGUIRE.

Symptomatic Indications.—*Aconite* is useful when marked inflammatory symptoms are present; *belladonna*, when the pain is severe; *calcium sulphide*, when pyonephrosis has developed, will control and limit the pus formation. If hectic fever appears from the continued drain of pus secretion, *cinchona* is useful to sustain the strength.

PUS.—*Nature and Varieties.*—Pus, the product of suppuration, varies in appearance and composition according to the conditions under which it is formed.

That obtained from a simple acute abscess, or from a healthy granulating sore, is a fluid of creamy consistency, and of a yellowish white color. Its specific gravity is from 1030 to 1033. As it presents no special evidence of constitutional disease or of complication of the local inflammatory process, it is termed laudable. When freshly secreted, it is alkaline in reaction. With liquor potassa it gives a gelatinous mass. It contains from ten to fifteen per cent. of solid matter, and of this about two-thirds is albumin. Of the other third one-half is fatty matter with traces of cholesterine, while the remainder consists chiefly of salts like those of blood serum, chloride of sodium predominating. Tyrosin, leucin, and other nitrogenous derivatives are present in minute quantities. If allowed to stand, healthy pus divides into two strata; the upper, named liquor purus, is a clear liquid, almost identical with the fluid portion of the blood; in fact, it is mainly the latter exuded through the walls of the vessels. The lower layer, which is faint yellow, contains little else than corpuscular elements. On microscopical examination the cells, which average 1-2500 of an inch in diameter, are found to be of two kinds, the minority being exactly like white blood corpuscles, for they are possessed of amœboid movements, have no limiting membrane, and contain only one or two nuclei. The greater number, however, are more coarsely granular, and have two or more nuclei, which are only visible after the addition of reagents. Acetic acid brings them into prominent relief by dissolving the albuminoid particles, and causing the protoplasm to swell up. Ether or liquor potassa removes the fat granules.

Pus is subjected to various modifications, which are indicated by special names; thus, when it is mixed with blood it is said to be *sanious*; when it is more watery than usual it is called *ichorous*. The matter secreted by inflamed mucous membranes, and some ulcers, is often glairy from the presence of mucus (*muco-pus*). As it is readily decomposable it not seldom contains putrescent gases, and it may have a characteristic smell; thus the pus from an ischio-rectal abscess has a fecal odor. Pus is known as *inspissated* when a great part of its water has been absorbed; and *caseous*, when still further desiccated. The term

curdy pus indicates that flakes of degenerated fibrin and cells are present in the fluid, and adherent to the walls of the abscess.

Pus from a chronic abscess is sometimes thin and watery, at others of firm consistence; the variation depending upon the disintegrative changes in the solid constituents, and the degree of absorption or effusion of serous fluid. In many instances very few corpuscles are present, but in their place are innumerable fat granules, and crystals of cholesterine and stearic acid. If the abscess is consecutive to bone caries there is an excess of phosphate of lime, and there may be minute osseous sequestra. The pus cells still remaining are very coarsely granular from advanced fatty degeneration. Some of them are greatly swollen; these are the so-called "compound inflammatory corpuscles" of Gluge; others are misshapen, and show evident signs of dissolution. The discharge from *gouty* abscesses is laden with needle-shaped crystals of urate of soda.

Pus from specific sores possesses contagious properties, and microscopical organisms are invariably present; but whether they constitute the virus of the disease in every case is a disputed point.

The pus from all acute abscesses contains micrococci. Pus exposed to the air is crowded with rod-shaped bacteria. Long bacillary filaments are met with occasionally in true infective inflammations. The contents of closed chronic abscesses are devoid of organisms. Very rarely the pus escaping from open wounds assumes a blue color, which is given by a particular form of micrococcus, *M. cyaneus*.

Circumstances influencing suppuration may be divided into *local* and *constitutional*. It need scarcely be said that so long as the essential cause of the suppuration continues to act, so long will the process continue. The *local* conditions favorable to suppuration are (1) tension, (2) septic decomposition of the inflammatory products, (3) extensive mechanical or chemical stimulation of the affected tissues. The influence of *tension* is well exemplified in cases of suppuration beneath resisting structures, *e. g.*, the periosteum, fasciæ, sheaths of tendons, etc. Take acute periostitis of the tibia; an early and free incision will

not only cut short the mischief which is going on, but will probably prevent necrosis of the bone. In thecal whitlow, again, the fate of the tendon depends almost entirely upon the continuation or removal of the pressure of the imprisoned pus.

The danger attending inoculation of a wound with septic, or still more with infective, matter can scarcely be overrated. In each there is the certainty of increasing the local inflammation, while, in the latter, there is the probability of starting fresh centers of suppuration in distant parts.

The *constitutional* states predisposing to, or exciting suppuration, act in a two-fold manner; by causing primary disturbance in the nutrition of the tissues; by undermining the patient's strength so that he is less able to recover from the effects of existing disease. To this it may be added that the products of suppurative inflammation of constitutional origin may in turn be the cause of further lesion, local and general. Lastly, the shorter-lived the general disease, the more likely is it to induce acute suppuration, and *vice versa*; take, for example, small-pox, and tuberculosis or syphilis.

Absorption of pus.—It was formerly believed that pus in its entirety frequently found its way in large quantity into the general circulation, but the grounds for this belief were not well founded. It is possible that pus may be driven into veins which have burst into the cavity of an abscess, but then, as Billroth has pointed out, it cannot happen to any great extent, for thrombosis quickly supervenes on the hemorrhage. At present, absorption of pus is understood to mean the passage of fluid and cells into the vessels much in the same way as they exuded from them, *i. e.*, by osmosis and migration through their walls. The chief cause of the absorption is the extravascular pressure; hence the necessity for efficient drainage of suppurating cavities, and the inexpediency of applying a rubber band to limbs about to be amputated for diffuse inflammations. The peril lies not so much in the absorption of uncontaminated pus, but of septic and infective material with which the pus may be charged; and yet it is certain that the products of simple suppuration are capable of producing general pyrexia.

AUGUSTUS J. PEPPER.

Pyæmia.—A disease characterized by remittent fever and the formation of multiple collections of pus in various parts of the body. It is a near ally of septicæmia and ordinary surgical fever, but the scattered abscesses are characteristic.

Causes.—The absorption of pus or of septic material into the blood. It is still disputed whether pus, in order to produce pyæmia, must be putrefying; and it is still uncertain whether the immediate cause of pyæmia can be absorbed through the mucous membranes, or whether it can enter only through an open wound. The immediate cause of each scattered abscess ("metastatic" abscesses they are often called) is venous thrombosis and embolism; but what is the exact way in which the thrombosis is brought about? Some of the abscesses near the original wound are merely terminations of lymphatic inflammations, a track of inflamed lymphatics being sometimes traceable to them from the wound. Cases of pyæmia sometimes occur apparently spontaneous in origin, and are called "idiopathic pyæmia." It must be remembered that their idiopathic nature rests on negative evidence only.

Conditions predisposing to pyæmia are (1) bad ventilation and foul air; (2) accumulation of many wounds in one ward; (3) neglect of having sick-rooms thoroughly and periodically cleansed; (4) dirty and careless dressing and nursing; (5) unnecessarily meddling with and disturbing injuries; (6) bad drainage; (7) other analogous conditions. A second set of causes belong more personally to the patient. They include (1) drunken habits, (2) old age, (3) weak constitution, (4), unmanageableness and restlessness. Many slight cases of feverishness have been converted into acute blood-poisoning by severe exercise, *e. g.*, ascending a mountain.

"You will find in every day's practice that fatigue has a larger share in the promotion or permission of disease than any other single causal condition you can name." "After wounds, children are singularly free from pyæmia" (Paget).

Pathology.—The nature of the changes in the blood is unknown. Localities attacked are (1) joints, (2) viscera, (3) serous membranes, (4) mucous membranes, (5) skin; and to these may be added the veins, lymphatics, and cellular

tissue throughout the rest of the body. In the viscera are found low inflammations and metastatic abscesses. The affected joints and serous cavities are inflamed and filled with pus. External to the joints are œdema and flushes of redness. The affected mucous membranes are inflamed, and may give vent to great discharge. This, in the case of the gastro-intestinal canal, causes diarrhea and even vomiting. When the skin is affected, blood-poisoning usually shows itself as erysipelas or as pustular inflammation. Veins become the seat of thrombosis, with or without precedent inflammation. Jaundice and suppression of urine sometimes occur in the course of pyæmia.

Symptoms and course.—1. Of acute pyæmia, rigors and feeling of illness. Perhaps purging and vomiting, with or without jaundiced hue of skin. High temperature. Rapid and frequent pulse. Erysipelatous inflammation of neighborhood of wound. Tender and inflamed glands. Acute pneumonia or pleurisy. Finally, "the patient—flushed, anxious, restless, even delirious—is in a hopeless condition, with prostration and rapid sinking." Duration, about five or six days. 2. Subacute or chronic pyæmia. A typical case presents, successively, the following symptoms: wound dry and inflamed, its edges swollen. This local inflammation spreads. Pain and tenderness; burrowing of pus; fever; rigors; abscess forms near the wound; neighboring joints swell; other abscesses form. Large lymphatic and glands may inflame and suppurate. Fever continues; temperature rises and falls irregularly, high rises usually coincident with rigors. Distant joints swell. Progressive emaciation; yellow skin; no sleep; no appetite; despondency. Cough; pain in chest (indicating pleurisy or metastatic pneumonia). Tongue furred and dry. Bed-sores. Occasional delirium. Eyes dull. Finally, utter prostration and death. Duration of subacute pyæmia, two to four weeks; of chronic, one to five months.

Prognosis.—Of acute cases, practically hopeless. Chronic and mild cases may recover, especially if prime cause can be removed. Paget relates a case which lasted three years and finally recovered.

Treatment.—Chiefly prophylactic. It includes the whole art of treating wounds

properly. Cleanliness, quietness, etc. Antiseptic treatment. Hospitals properly situated, arranged, and ventilated; wards periodically cleansed and disinfected; clean bedding; obedient and sensible nurses. When pyæmia is actually developed, plenty of fresh air, diligent nursing, feeding with milk, eggs, etc.; cooling drinks; quinine (5-15 grains for a dose); morphia at night; hypsulphite of soda (grs. xx every two hours); warm baths and wrapping in blankets to produce copious diaphoresis. In chronic pyæmia amputation may be indicated. Liq. potassa (3 j ter die) to remove pyæmia deposits. The commonest surgical causes of pyæmia are compound fractures.

C. B. KEETLEY.

Symptomatic Indications.—*Carbolic acid* in half-drop doses, in water, every three or four hours, has been successfully used. *Lachesis* is the most prominent remedy, covering the toxæmia and the prostration. *Arsenicum* is often useful, combating the tendency to disorganization of the blood; great prostration, restlessness, and anxiety. *Cinchona*, in chronic pyæmia, with hectic fever, does excellent service.

PYLORUS, OBSTRUCTION OF.

—The pylorus may become obstructed from the cicatrization of a neighboring ulcer, or from fibroid thickening, but commonly results from cancer. It may also be due to the pressure of neighboring tumors and to spasm from the presence of an ulcer in the neighborhood.

Symptoms.—Pyloric obstruction is evidenced by pain and vomiting. The pain steadily increases as digestion proceeds, and extends from the epigastrium round the waist. If the obstruction be severe, it is only relieved when vomiting occurs. Vomiting is delayed till four hours or more after food, or may occur only once a day, or at still longer intervals, and is profuse in amount on account of the dilated state of the stomach. The vomited matters may contain sarcinæ and torulæ, but no bile, the regurgitation of which is barred by the obstructed pylorus. As obstruction increases, the stomach becomes dilated and its muscular coat hypertrophied.

On examination of the abdomen, while the symptoms are at their height, and before vomiting has taken place, a de-

pression of the epigastrium and a fullness of neighboring regions of the abdomen, especially of the *left* hypochondrium, will probably be detected, and peristalsis may be observed. The area of stomach dullness or the stomach percussion-note will be extended downward. A succussion splash may be felt, or heard with the stethoscope. The heart will probably be found displaced upward. The range of the stomach downward may be plumbed with a probang.

Diagnosis.—The differential diagnosis between obstruction due to malignant and non-malignant disease is often a matter of considerable difficulty. It turns mainly on the presence or absence of a defined tumor, but also upon the age of the patient and the history of the case. The degree of emaciation is rarely of much service as a guide, as it is usually considerable in either case, owing to the small quantity of food absorbed. Obstruction of the duodenum from the cicatrization of an ulcer and subsequent dilatation of the pylorus is a condition practically indistinguishable from pyloric obstruction (*see* ABDOMINAL TUMORS).

Prognosis.—If the obstruction be of cancerous origin, the condition is necessarily fatal: if it be due to cicatrices or fibrous thickening and is partial only, careful feeding combined with washing out of the stomach may enable the patient to live in comfort; but if it be complete, operative means can alone give permanent relief.

Treatment.—An attempt must be made to utilize the stomach to the extent of its power without overloading it. To this end, some fluid food, as plain soup, milk, arrowroot, or gruel, should be given in quantities not exceeding $\frac{1}{2}$ pint, at three-hour intervals. If this be tolerated the quantity may be cautiously increased, and a little bland, solid food, such as bread soaked in milk or finely minced meat, may be experimentally added, until the limit of the digestive power of the stomach has been ascertained.

To remove, as far as possible, the risk of distention by gas, fermentation should at the same time be checked by the administration of 1 grain of carbolic acid or 1 minim of creosote, or $\frac{1}{2}$ grain of thymol, in pill, or a dram of sulphurous acid in 3 ounces of water, or a teaspoonful of charcoal stirred up in water, once or twice a day.

Pain should also be relieved, and irritability of the gastric wall reduced, by morphine, belladonna, or hyoscyamus. Hydrocyanic acid is sometimes useful.

If tolerance of ordinary food cannot be established by the above means, artificially digested aliments may be substituted, but in the majority of cases it is necessary, sooner or later, to prepare the stomach for the reception of food by a systematic process of "washing out," and, as a rule, the earlier in the case this mode of treatment is adopted the better for the patient. The operation should be conducted at first half an hour before each meal.

The instrument used is a long, soft, india-rubber tube, fitted with a ball pump. The patient being seated, the tube is slowly passed into the stomach with a gentle rotary movement. The patient will very soon be able to do this for himself. Water is first injected into the stomach, the organ is then completely emptied of its contents and subsequently washed out with tepid water containing dilute sulphurous acid (a dram in 2 to 3 ounces of water). The meal taken half an hour later should be as "dry" and of as small a bulk as possible. After a week or so the washing may be done less frequently, once a day being soon sufficient, but care must be taken not to allow the stomach to become distended. Under this treatment vomiting ceases and nutrition markedly improves; in fact, it offers to the subject of pyloric obstruction immunity from some of the worst consequences of the condition.

Rectal feeding may, of course, be resorted to as an aid to other measures.

The operation of digital stretching of the pylorus (Loreta's operation) has been performed with success in a few cases, and is worth a trial if other means fail.

Another surgical procedure, known as "short-circuiting the duodenum," in which the stomach is united to the upper part of the jejunum, has been resorted to in a few cases.

ISAMBARD OWEN.

PYOMETRA.—Pus within the uterus. The condition is rare, and occurs almost exclusively in old women who have ceased to menstruate. The pus is the result of endometritis, and its escape may be prevented either by atresia of the cervix from cicatrization, by blocking of the cervix by fibroid or cancerous growth, by

fixation of the uterus in a bent shape by adhesions, or by "kinking" of the thin-walled uterine canal by flexion.

Symptoms.—Pyometra *per se* causes few symptoms, and those of a vague kind. It is usually discovered owing to advice being sought for the disease of which pyometra is an effect; and it has often been unexpectedly found post mortem.

The *treatment* is to open up the cervical canal and let out the pus.

G. E. HERMAN.

PYROSIS (Water-brash).—Strictly speaking, pyrosis means heartburn, but it is always used to indicate the ejection of a clear watery fluid from the mouth in certain forms of gastric disorder. An attack commences with severe spasmodic pain and a sense of constriction at the epigastrium, which is not relieved until this clear tasteless fluid is ejected. The quantity is generally small, two or three ounces, but may be a great deal more; it is non-albuminous, and has been found by some observers to contain sulphocyanide of potassium, a fact which would point to its consisting, in part at least, of saliva; others believe that it is produced in the stomach, chiefly near the pylorus. Pyrosis is a symptom of dyspepsia rather than of organic disease of the stomach, and is commoner in women than in men; it is met with much more frequently in some districts than in others, and is believed to be largely due to the coarse character of the diet adopted by those who suffer. The astringent vegetable infusions (gentian, orange, cinnamon, or any containing tannic acid) in ounce doses, combined, if need be, with small doses (5 to 10 minims) of laudanum, give the most satisfactory results in treatment.

PYURIA.—The presence of pus in the urine. This condition may depend upon disease of any portion of the urinary or genito-urinary tract. Increased frequency of micturition is the only symptom common to all the different forms, and even this is not constant.

Characters.—The urine is generally slightly albuminous. Its appearance varies with its reaction when passed. If *neutral* or *acid*, it is turbid, and gradually separates into an ivory-tinted sediment and clear supernatant urine. Urates may impart a pinkish tinge to the

deposit, but more often they occur as an upper stratum. The addition of an equal bulk of liquor potassa to a portion of the sediment dissolves the pus cells and renders the resulting mixture clear, and at the same time so tenacious that, when poured from the test-tube, it falls *en masse* like imperfectly set jelly. A deposit of triple phosphates may be distinguished from that of pus by the fact that it is whiter and more flocculent, is soluble in acetic acid, and occurs but rarely in acid urine. When the urine is *alkaline*, the sediment is less defined, but forms more rapidly. It is tenacious and ropy, while the supernatant fluid remains cloudy. The urine is often fetid, and generally contains a deposit of triple phosphates. The addition of liquor potassa to the deposit may slightly increase its tenacity; the less ropy and tenacious the sediment, the more marked will be the effect of the liquor potassa. If necessary, pus may be distinguished from mucus by the addition of corrosive sublimate, which precipitates pyin but not mucin. Under the microscope, pus cells will, in any case, be seen as globular bodies, somewhat larger than red blood disks, and granular; the addition of acetic acid clears up the granular contents and brings the nuclei into view.

Causation.—(1) In renal abscess the pus is in small quantity, and some of the cells may be found imbedded in casts from the renal tubules. The urine generally contains blood, and is of acid reaction. (2) In the so-called surgical kidney (acute consecutive nephritis) the characters of the pus are much the same; cystitis often coexists, and the urine will vary accordingly, but the presence of pus casts would be conclusive evidence that the kidney was affected. (3) In pyelitis, owing to occasional temporary blocking of the ureter, the urine varies greatly; at one time there may be a copious deposit of pus, at another none at all. In the early stages red corpuscles may be found as well as swollen epithelial cells—spindle-shape, caudate or spheroidal—from the pelvis of the kidney. (4) In cystitis the urine is alkaline, and presents the characters already described. (5) In urethritis or inflamed prostate the pus is small in amount and imperfectly mixed with urine, forming small shreds. A drop or two can generally be squeezed from the orifice of the urethra. (6) In leucor-

rhœa or vaginitis, the quantity is small, and vaginal pavement epithelium abounds in the deposit. (7) If an abscess burst into any portion of the urinary tract, the pus is at first passed in large quantities, and then either disappears altogether, or a small quantity is passed daily. In gouty subjects, or those who have suffered from previous attacks, a very slight cause, such as a trifling error of diet or a chill, may produce a transient pyuria.

H. MONTAGUE MURRAY.

QUINSY.—See TONSILITIS.

QUINSY, MALIGNANT—See DIPHTHERIA.

RACHITIS.—See RICKETS.

RADIUS, FRACTURE OF.—See FRACTURES.

RANULA.—See MOUTH, DISEASES OF.

RAYNAUD'S DISEASE (Symmetrical Gangrene).—This affection, named after Maurice Raynaud, includes three fairly defined diseased states, which probably correspond to different stages of the same morbid process.

These are, in order of increasing severity, **Local Syncope**, **Local Asphyxia**, and **Local Gangrene** (*Symmetrical Gangrene*).

The essential factor in the disease appears to be a narrowing (vasomotor spasm) of the small arteries and capillaries in certain parts of the body, notably the extremities, attended by great retardation or arrest of the capillary circulation; while the general character and symptoms of individual cases are chiefly dependent on the situation, extent, and nature of the effects of the vascular disturbance on the nutrition of the affected areas. The symmetrical arrangement of the lesions is often very striking, and constitutes a diagnostic point of some importance.

Local Syncope.—The phenomenon familiarly known as “dead finger” is essentially local and compatible with perfect health. Females suffer more than males. The commonest determining cause is cold, but a degree of cold which would produce no effect on individuals not predisposed. This statement applies equally to the other forms of the disease. Sudden emotion and mental shock are mentioned as causes, and the coldness of the hands

which accompanies nervousness is suggestive in this connection. The condition is also sometimes observed after meals. The affected fingers or toes become cold, dead-white, and bloodless; cutaneous sensibility is blunted or abolished; and motor power may be temporarily lessened. The attack is transient, and is succeeded by a period of reaction, which is often painful.

Local Asphyxia.—In this form of the disease the affected parts become cold and cyanotic. The skin assumes a bluish-white, violet, slate-colored, or blue black tint not unlike an ink stain. The lesions are symmetrical in the large majority of cases, and most often affect the extremities. In some cases they are limited to one or more fingers or toes, while in others a segment or even an entire limb may be involved. The severity of any given case does not necessarily stand in any definite relation to the surface extent of the lesions. Next to the limbs the ears are most frequently involved, and less commonly the tip of the nose also suffers. Much more rarely the appearance of symmetrical livid patches on the backs of the hands or some other part of the arms, legs, or trunk, constitutes the only deviation from health. There is often slight œdema of the affected parts, and livid venous marblings above the level of the discolored areas are common. The capillary circulation in the livid patches is always much retarded, so that the dead-white mark caused by pressure with the finger-tip is always slow to disappear. Pain is a very frequent, but not invariable, symptom. It may be localized in the livid extremity or radiate through the affected limbs. It is at times of an excruciating character, and may precede the appearance of the lividity. There is generally more or less complete cutaneous anæsthesia, which interferes considerably with the performance of fine movements, and there is nearly always some loss of motor power. The period of the reaction is usually attended by irritating, tingling sensations.

The *progress* of local asphyxia is mostly paroxysmal, periodicity being often well marked and frequently of quotidian type. In such cases each attack commences in the same region and follows the same order of development, the blueness lasting from a few minutes to several hours.

As the attack passes off, less livid patches make their appearance in the affected region, and gradually coalesce; at the same time, a zone of vermilion color invades the blue skin from the proximal side, eventually giving place to the normal pink color of the skin. When the asphyxia is limited to the fingers or toes, there is no appreciable disturbance of the arterial circulation; but when it occupies the whole of a limb, the pulse may become small and feeble at the commencement of the attack, the beats recovering their usual strength and volume as the asphyxia subsides.

In course of time a sort of flabby false œdema of the affected digits may become established, but is by no means common. More often the fingers gradually acquire tapering extremities. The general health, as a rule, is good. A few of the subjects of this disorder, however, are chlorotic and hysterical.

The differential *diagnosis* from cyanosis due to other causes is easy; the absence of organic heart or lung disease; the occurrence of local pain or tingling, the intermittent character of the affection, and the absence of clubbing of the fingers are some of the more important diagnostic signs of the disease.

The ultimate *prognosis* is usually favorable; but local asphyxia may eventuate in local gangrene, although the symptoms of this condition do not invariably precede those of the graver disease.

Local or Symmetrical Gangrene.—In this form of the affection the extremities become first exsanguine and then blue, or from the first assume a purple or reddish livid hue. At the onset the affected areas are often the seat of itching or tingling sensations, and the patient commonly believe they have chilblains. These early pains are often relieved temporarily by the application of cold, but in the course of a few days increase greatly in severity, while the deepening violet color and icy coldness of the parts leave little doubt as to the nature of the affection. At this period livid marblings usually make their appearance in the neighborhood of the affected parts, extending for a varying distance up the limb. Beyond this stage the progress of events varies in different cases. In some, one or more digits become entirely black and insensitive; small blisters form on the tips of the fingers, break, and even-

tually heal up in the course of a few days, as the vitality of the parts becomes restored. Such a recovery is often but temporary, being followed at intervals by a series of similar attacks affecting the same or other digits. In such cases, at an advanced stage of the disease, a number of small, hard, white, depressed scars may be seen on the pulp of all the fingers. The affected digits tend to become conical, shriveled, and tough, resembling parchment. The digits, however, may become mummified without the previous occurrence of blisters.

In other cases the gangrene develops more rapidly. The extremity of a digit or an entire phalanx rapidly becomes black and icy cold. Blisters do not form, but the affected part is sometimes covered with beads of sweat. In the course of a few days a line of demarcation forms at the proximal side of the necrosed tissues, which are then gradually thrown off by suppuration. The slough is often not more than one or two millimeters in thickness, although the aspect of the part before its separation might lead one to expect much deeper destruction. Sometimes, however, the process results in the loss of part or the whole of the ungual phalanx, or of the whole digit, and in cases of exceptional severity whole segments of limbs may separate. The remaining stump is covered with granulations, which generally heal rapidly. Not rarely the several stages of the process occur simultaneously in the same patient.

Although the gangrene commonly affects the extremities, a good many cases are recorded in which other parts of the body were attacked. Thus, in several instances, gangrenous patches have appeared on the heels, malleoli, calves, tibiæ, etc.; parts, be it observed, which have a counterpart on the other side of the body. More rarely mortification attacks the nose, and has been known to destroy it almost entirely, while considerable damage may result to the helix of both ears from repeated attacks of the disease.

When the extremities are the seat of the disease, the growth of the nails is always arrested during an attack. Sometimes the nails are shed; at others, when they have grown again, a transverse depression indicates the period of arrest.

Pain is the dominating symptom of the disease; the numbness which accompanies

local syncope is here replaced by darting or burning pains, either limited to the affected parts or radiating through the limbs. These pains may be prolonged for weeks, and are often excruciating. The affected parts are insensitive and their motility is always more or less impaired. A true motor paralysis may become established from the association of peripheral neuritis. As regards the circulation, there may be an initial rise in the pulse-rate without elevation of temperature. Livid venous marblings are often present, and the capillary circulation is always slowed. The arterial pulse in the affected limb may diminish temporarily in volume, but never becomes altogether obliterated. The general health of the patient is usually good.

The *progress* of local gangrene may be continuous or intermittent, but the continuous type is relatively rare. Speaking generally, the most profound gangrenes present regularity in their development. Raynaud describes three stages: (1) The period of invasion, during which symptoms of local asphyxia predominate; (2) the stage of painful crises, during which the gangrene becomes limited and complete; and (3) the period of elimination, which is of varying duration; generally from three to four months, sometimes longer.

Diagnosis.—In the earliest stages there may be some difficulty in distinguishing from chilblains. Gangrene once established, the diagnosis from senile gangrene rests mainly on the age of the patient (the average of over 120 cases was about twenty-seven years), the symmetrical or multiple character of the lesions, their incomplete and limited nature, their non-progressive character, and the previous state of the vessels leading to the affected areas. From gangrenous ergotism, the chief diagnostic sign is supplied by the history.

The *prognosis* is grave, but not unfavorable. Patients seldom die of the uncomplicated disease, and experience shows that the actual amount of destruction is nearly always far short of what the earlier stages of the process (asphyxia, coldness, etc., seem to foreshadow. In very young children, however, the disease may assume an acute and destructive type. There are on record several such acute cases, in which symptoms of asphyxia and gangrene have progressed uniformly and uninterruptedly to a fatal

issue in from two to four days. If gangrenous patches make their appearance within fourteen days of the date of invasion, there is a reasonable hope of recovery in four or five months. The immediate prognosis is, however, less good in the milder cases of intermittent type with recurring blisters and cyanosis. Although not dangerous to life, this form of the disease often exposes the patient to long continued and intolerable pain.

Pathology and Ætiology.—This somewhat rare disease is relatively frequent among children, and a considerable portion of the cases occur between fifteen and thirty, but after that age the liability to the affection diminishes. The oldest well authenticated case was fifty-nine, while a child of eight months presented a well marked local asphyxia of paroxysmal type. Women appear to be more liable to the disease than men, and it shows a decided preference for persons of a nervous or excitable disposition.

Exciting Causes.—The effect of lowering of the external temperature has been alluded to. Whether suppression of the menses should find a place here appears doubtful, although Raynaud attached considerable importance to this accident.

Attacks of local asphyxia may be ushered in by a fit of passion or follow close upon some sudden mental shock. A considerable number of cases has occurred in lunatics, and it may be observed in this connection that symptoms of hysteria of every grade may accompany the attacks of Raynaud's disease. In one recorded case there was acute mania. A condition of unstable nervous equilibrium thus appears to be an important predisposing factor. Raynaud mentions a case in which a blow on the outer part of the arm in a man was followed by a profound local syncope of that extremity, lasting continuously for ten days. In a boy of nine, a series of well marked paroxysms of local asphyxia affecting the left hand was determined by a dog-bite in that situation. This patient was at the time suffering from syphilitic ulceration of the pharynx.

Associated Diseases.—**Intermittent hemoglobinuria** is often associated with local asphyxia and symmetrical gangrene. The clinical features presented by such cases vary considerably. In some, dark urine is passed during or shortly after attacks of local asphyxia;

or a typical attack of hemoglobinuria may take the place of a typical paroxysm of local asphyxia.

Or again, a patient suffering from symmetrical gangrene will pass smoky or dark urine at intervals, or suffer from attacks of temporary albuminuria or oxaluria. In other cases patients suffering from paroxysmal hemoglobinuria spontaneously develop symmetrical or asymmetrical gangrene of the extremities or of the nose or ears.

A study of the recorded cases shows that the alliance is a very close one, and a consideration of the two diseases reveals a marked parallelism between them. Both are essentially paroxysmal in nature, and stand in the same relation to changes of temperature. In the large majority of cases both diseases occur primarily in cold weather, and tend to diminish in warm weather. In both the attacks may be accompanied by some abdominal pain, and be followed by drowsiness and some sallowness of the complexion and conjunctiva. The alterations present in the blood obtained from the finger of a patient during an attack of hemoglobinuria—crenation, disinclination to form rouleaux, presence of granular masses in serum, etc.,—have also been observed in the blood drawn from an extremity affected with local asphyxia. It has been observed that "the two conditions seem so to approach each other and mingle as to make it impossible to draw a distinct demarcation between them." And the view has been put forward that the two diseases are one and the same, *i. e.*, that hemoglobinuria is a symptom of the more general affection. On the other hand, whereas Raynaud's disease is more common among females, hemoglobinuria appears to affect a decided preference for the male sex. Malaria, which is an ætiological factor of considerable importance in hemoglobinuria, has hitherto been comparatively rarely found in association with the allied condition. Lastly, abdominal symptoms, such as epigastric pain, hiccough, colicky pains, nausea, and vomiting are usually more prominent symptoms of hemoglobinuria than of Raynaud's disease.

Affections of the skin.—The chilblains are rare, but there are cases of localized subcutaneous purple mottlings, permanent for a time and then gradually fading, with or without pigmentation, which are

closely related to local asphyxia. Urticaria—sometimes painful—has been known to occur during the paroxysms of Raynaud's disease. The parchment-like condition of the fingers has been alluded to. A case is on record in which scleroderma of the chest-wall developed in the wake of Raynaud's disease. Two patients suffering from scleroderma of the hands and feet had long been subject to dead hands and feet, and in one of the mild attacks of local asphyxia continued after the onset of the scleroderma. A man who suffered from extensive scleroderma of the trunk and extremities ultimately developed gangrene of the fingers and toes for which no gross lesion could be discovered post mortem.

Joint affections.—Effusions into joints—knee, elbow, shoulder, and wrist—have been observed. Fibrous ankylosis of the terminal phalangeal joints, and thickening of the palmar fascia, may also occur.

Ague.—In several instances the disease has developed during or shortly after recovery from ague.

Syphilis, congenital or acquired, has been observed in several cases. Its precise bearing, if any, is as yet undetermined; but the well-known vascular and nervous lesions of this disease suggest the possibility of a causal relationship in some instances.

The relation to **peripheral neuritis** is still undetermined. A few cases of symmetrical gangrene are recorded in which unmistakable post-mortem evidence of inflammation of the nerves of the affected extremities was obtained, and in one or two others clinical signs suggestive of neuritis, such as wrist-drop, diminished faradic irritability, etc., have been observed.

On the whole it appears doubtful whether peripheral neuritis should be regarded as an essential factor in this variety of spontaneous gangrene, and at all events it may safely be asserted that alone it is altogether inadequate to explain the early and paroxysmal stages of the affection (local asphyxia).

As regards the changes in the vessels, the view propounded by Raynaud has been generally accepted, viz., spasm of the capillary vessels, dependent on a reflex exaggeration of the excito-motor energy of the gray matter of the cord which controls vaso-motor innervation (spinal vaso-motor centers).

It appears probable that during pro-

found local syncope arteries, capillaries, and minute venules are all in a state of spasm, and it has been suggested that the supervention of asphyxia may be due to a dilatation of the venules. It is generally admitted that simple spasm is sufficient to account for the phenomena of local syncope and some cases of local asphyxia, but some authorities seem disposed to invoke the aid of another factor to explain the more inveterate cases of asphyxia and production of gangrene, viz., a degradation of the vitality of the tissues involved, over and above that which must necessarily result from the slowing or temporary arrest of the circulation in the affected area.

The **retinal changes** described by Raynaud and other observers may be referred to. In one of Raynaud's patients "the sight at times became troubled and confused. When the eyes were examined on these occasions, the central artery of the retina and the arteries which proceeded from it presented very clear contours, and it was established very definitely that they were narrower in their commencement near the papilla than at the periphery; here and there was observed a sort of partial strangulation." Another of his patients complained of dimness of vision at the commencement of some of his attacks of asphyxia.

Some rare epiphenomena of the disease have been attributed to similar disturbance of the cerebral circulation. Such are mental hebetude on awaking from sleep, accompanied by a loss of the notion of time and of position in space, temporary aphasia, temporary loss of consciousness, and epileptiform seizures.

Treatment.—The affected parts should be protected from the external air by wrapping in cotton-wool. The local application of warmth often relieves the painful crises, but in some cases cold applications have proved more efficacious. Galvanism of the affected limbs has often been attended with good results. This is most conveniently done by immersing the hand or foot in a basin of hot water containing the negative electrode, while the other electrode of the constant-current battery is applied over the upper part of the limb or over the spine, due care being taken to thoroughly moisten the skin and the electrode before the latter is applied.

The current employed should be of such strength as the patient can comfortably

endure, and it should be frequently interrupted so as to cause moderate contractions of the limb. This mode of stimulation is usually better borne by the patient than is friction with the hand.

The current may also be applied by simply "painting" with two sponge electrodes applied to the limb at a short distance from each other. It will often diminish pain to such an extent as to enable the patient to bear shampooing afterward.

In chronic cases the good effects of galvanism are less obvious, but it is of value in maintaining nutrition and averting gangrene. Shampooing is of especial value in these cases, particularly where atrophy of the extremity and contraction and fibrous ankylosis are taking place.

Quinine has been used with good results in cases associated with malaria. In the case of the boy before referred to, the paroxysms ceased with the cure of the syphilitic ulceration from which he was suffering. Nitrite of amyl has been recommended on theoretical grounds, but has not, so far, achieved success. Among sedatives, opium and morphine are the best to combat pain. Careful attention to the general health and the exhibition of plenty of nutritious food are of importance. Among internal remedies, iron in some form is very often indicated. In cases of gangrene of the limited form, the expectant method recommended by Raynaud has been repeatedly justified; but, with deeper involvement of tissues, amputation has been performed with advantage.

W. PASTEUR.

RECTOCELE.—Prolapse of the posterior vaginal wall with the rectum.

The posterior vaginal wall may become inverted and protrude at the vulva, without the rectum. But often it drags the anterior wall of the rectum with it, so that a pouch is formed in the front of this viscus, in which fæces may lodge, and thus the emptying of the rectum becomes difficult or impossible until the prolapsed vaginal wall has been pushed up. Rectocele is usually associated with uterine prolapse, but it may occur by itself.

Treatment.—When associated with uterine prolapse, the treatment is to keep the uterus well supported by a proper pessary. If rectocele exist by itself, or if support of the uterus fail to give relief, a plastic operation to contract the posterior

vaginal wall is best. In the case of a woman young enough for subsequent child-bearing to be likely, treatment by mechanical support is preferable to an operation on the vagina, which, if extensive enough to be effective, will either much obstruct delivery, or will render delivery only possible by considerable tearing of the parts.

G. E. HERMAN.

RECTUM, DISEASES OF THE.—**Congenital Malformations.**—Rectal malformation results from arrest of development in early fetal life. The chief varieties: 1. The anus more or less clearly defined, terminating in a cul-de-sac, at a certain distance from the orifice. 2. The complete absence of the anus, the fold of the scrotum extending back in an unbroken line to the coccyx. 3. The anus and rectum well formed, and of normal caliber, but the latter obstructed by a delicate fold of membrane stretching across its interior. 4. The anus perfectly formed, but the outlet obstructed by a tail-like fold of skin, containing muscular fiber, extending from the scrotum to the coccyx; a small opening existing on one or both sides of the fold. 5. The bowel opening into some portion of the genito-urinary tract. In the female this is by a communication through the posterior wall of the vagina; in the male, usually by an opening between the rectum and the base of the bladder or prostatic portion of the urethra.

Symptoms.—The symptoms of congenital obstruction are generally too clear to admit of error in diagnosis. Nevertheless, a difficulty will sometimes arise. I have made a post mortem on an infant, in whom Littré's operation had been performed for supposed imperforation, and found that the symptoms had not been due to an imperforate rectum, but to a volvulus of the small intestine. Several similar mistakes have been recorded.

Treatment.—When a mere membranous septum occludes the bowel, it is proper to perforate the obstruction with a narrow knife; but, in the majority of instances, the practice of thrusting a knife or trocar blindly into the cul-de-sac is generally futile, and always dangerous. The child being placed in the lithotomy position, a longitudinal incision should be made exactly in the middle line over the

site of the absent anus. In cases where the bowel is near the surface, after making the incision it will bulge into the wound, and can be opened sufficiently freely to admit a moderate-sized little finger. If there is no indication of the immediate presence of the bowel, the incision may be carried back to the tip of the coccyx. After this incision the bleeding vessels should be at once tied. The bowel may now be carefully sought by continuing the dissection slowly upward in the middle line. In the majority of cases the bowel will be found within an inch or an inch and a half from the surface. It should be freely opened; but no attempt to drag it down and stitch it to the skin should be made. If, after careful dissection *in situ*, the operator fails to find the bowel, he may perform Littré's operation. In the female, when the bowel communicates with the posterior wall of the vagina, provided the fistulous communication be of sufficient extent to allow a fair passage, operative interference may be advantageously deferred for a few months.

Great care is required, after operation for imperforate rectum, to prevent the new opening from contracting. A conical vulcanite bougie should be passed daily. As the child increases in age the tendency to contract diminishes, and some of those cases that have lived to adult age have shown scarcely a trace of their infantile obstruction.

Prolapse.—Is the descent of a portion of the bowel in a healthy state, and must not be confused with the prolapse which sometimes complicates piles. Prolapse is called partial when the mucous membrane alone is involved; complete, when affecting all the coats. The mucous coat is normally but loosely attached to the muscular coat, and the submucous tissue between the two may become so yielding as to admit of the mucous coat sliding for an inch or more on the external coats. Partial prolapse is of a limited extent. In complete prolapse any length of the bowel may be involved. The disorder is most common in children or in advanced life. It is generally the result of undue straining, though occasionally caused by polypoid growths. In children, stone in the bladder, phimosis, or straining from constipation, may be frequently noted as the cause of prolapse.

Diagnosis.—When the prolapse is

actually down, it is easily recognized, but a little care may be necessary not to mistake it for polypus or piles. From the former it may be distinguished by its softer feel, uniformly smooth surface, and, above all, by the absence of a pedicle; while the uniform smooth rolls of bright red membrane in prolapse are distinguishable from the bunched arrangement of piles.

Treatment.—(a) The reduction of the bowel when prolapsed or strangulated. In a child the buttocks should be raised by laying it across its mother's knee. The protruded part, being covered with vaseline, should be evenly pressed with the tips of the fingers. If but recently come down, a few seconds' pressure will serve for reduction. If the protrusion has become swollen it is not so easy, but firm pressure for five or ten minutes with a soft sponge generally succeeds. If this fails, the index finger, being lightly wrapped round with a piece of lint, the tip is introduced into the protruded canal, pressing it gently upward. The lint, being dry, will stick to the membrane, and after the reduction the finger can be withdrawn, leaving the lint inside.

All manipulation should be very gentle, or laceration of the bowel may occur.

(b) To prevent recurrence. The patient should on no account be allowed to pass a motion in the sitting posture, but should do so lying on the side; and if the anus be drawn by the fingers a little to one side as the motion is passing, it will generally prevent the descent of the bowel. After the motion it is a good plan, in children, to forcibly compress the nates together by a piece of strapping laid transversely across them. A teaspoonful of cod-liver oil three times a day may be given to children, which, besides its nutritive effects, tends to soften the motion. By persistence in this line of treatment for a few months the tendency to prolapse may often disappear, provided any obvious cause such as phimosis, etc., be removed.

In the adult careful regulation of the bowels, and astringent ointments, such as gall ointment or tannic acid, half a dram to the ounce, may prevent the prolapse becoming troublesome. Should an operation become necessary, in slight cases portions of the protrusion may be removed by a cautery or ligature. In

more extensive cases the plan of artificially exciting inflammation between the muscular and mucous coats, so as to bind them more firmly to each other, is often effectual. A large speculum being introduced into the rectum, four lines of cautery, three to four inches in length, and an equal distance apart, are drawn along the bowel in its long axis, terminating at the anus. A small cautery iron, with the bulb bent at a right angle, and at a black heat, is the most convenient form of cautery to employ. The bowels should be kept confined for a week, and great care taken when they are moved, by position and pressure, to prevent the prolapse from recurring.

Rectal abscess.—There are four situations in which matter forms in the neighborhood of the rectum:

1. Marginal abscess, situated in one of the cutaneous folds of the anus.
2. Ischio-rectal abscess, situated in the fossa.
3. Intermural abscess, situated in the bowel, between the mucous and muscular coats.
4. Perirectal abscess, formed in the pelvis around the rectum.

In the majority of cases the abscesses are traumatic, that is, secondary to some slight puncture or injury inflicted by a fish-bone, husk, or other foreign body, during its passage. Abscess is very liable to form from slight causes in debilitated patients, especially when suffering from tubercular disease. Abscesses may be acute, forming in a few days; or subacute, lasting over weeks.

Symptoms and diagnosis.—The symptoms generally commence with a sharp pricking sensation, soon followed by an aching, throbbing pain. As the abscess progresses the pain increases, often becoming very acute. If the abscess be in the ischio-rectal fossa, a hard swelling will be felt over the neighborhood. As the pus advances toward the surface, the skin becomes red, and fluctuation can be detected.

The intermural abscess and perirectal abscess cause much less pain than the other two varieties, and are apt, therefore, to be overlooked till they burst into the bowel, suddenly discharging a quantity of pus. A sense of weight and uneasiness, combined with some signs of obstruction, are often the only symptoms complained of; but when the finger is introduced, fluctuating swelling can easily

be detected. The perirectal abscess is often chronic, and sometimes complicates a rectal stricture. If undetected it is always dangerous.

Treatment.—Rectal abscesses should be opened as early as possible; for, if left to burst of themselves, the skin becomes undermined, and extensive fistulæ may result.

In opening the abscess, owing to the exquisite tenderness of the part, and the importance of making the incision freely, an anæsthetic should be administered. A free opening should then be made through the skin over the most prominent part of the swelling, and after the matter has been let out a drainage-tube introduced. If great care be taken, both with the subsequent drainage and keeping the external orifice open, the part may heal without the formation of a fistula.

Gangrenous inflammation about the rectum.—In those who have spoilt their tissues by prolonged indulgence in drink, phlegmonous inflammation may attack the parts around the rectum, and the inflammation may run on to sloughing, or even gangrene of the skin and subcutaneous tissue. Sometimes, from this form of diffuse cellulitis, the rectum is left almost isolated by the destruction of the surrounding tissue. These cases are dangerous. The patient's strength must be supported by beef essence and other forms of concentrated foods. The part should be covered by a warm charcoal poultice, and cold should on no account be applied.

Ulceration of anus and rectum.—Many cases owe their origin to a syphilitic tubercular diathesis, while others result from the part being badly nourished either from local or general causes.

Syphilitic ulceration.—Syphilitic ulceration about the anus generally appears from three months to a year after infection. It is usually confined to the anal margin. The more extensive ulcerations higher up the bowel are met with at a later period of the disease; and probably result from the breaking down of the tertiary gummata. Syphilitic ulcers are often multiple. Sometimes several fissure-like cracks exist between the anal folds. These folds have a whitish, slightly sodden appearance, the whole part being moistened by a thin fetid secretion.

Congenital syphilitic ulceration.—

This is a common affection in infancy, but seldom occurs until three or four months after birth. The anus is surrounded by a dull copper-colored zone, half an inch or more in width. This zone, near the anal margin, has a coarse, granular appearance, the surface being raw and bathed with a moist secretion. On separating the anal margins, some fissures may be seen extending a short distance into the bowel. The infant is fretful and generally wasted, while other specific manifestations are probably present.

Tubercular ulceration.—This may take the form of extensive ulceration, commencing at the anus and spreading upward, but more frequently it begins at several points about the rectum, resembling the follicular ulceration observed in other parts of the intestine. It occasionally commences as an intermural abscess.

Other symptoms of phthisis are usually present.

Ulceration in Bright's disease.—An ulceration of the rectum, of a superficial nature, but extending over a large area of the bowel, is sometimes observed in advanced cases of albuminuria.

Senile ulceration is occasionally noticed about the bowel in old people, which seems to be the result of chronic venous congestion, and is probably analogous to the varicose ulceration of the legs.

A form of ulceration is found about the anus consisting of small shallow excavations, often multiple. They are specially liable to form in women who suffer from leucorrhœa or other vaginal discharge. At times they produce swelling and œdema of the neighboring skin, which in chronic cases may end in permanent hypertrophy of the anal folds.

Symptoms.—The symptoms of rectal ulceration are often mistaken for dysentery. Pain, tenesmus, diarrhea, and discharge are present. The amount of pain is no indication of the severity of the disease, and depends more on the situation than on the extent of the ulceration; the smallest fissure near the anal margin causing more suffering than an extensive ulceration higher up the bowel. There is a frequent desire to go to the closet, but, instead of a proper motion, only a few teaspoonfuls of discharge come away.

The discharge at first may be of a mucoid character, resembling a mixture of sago and yeast. Later, the discharge

generally becomes darker, having a "coffee ground" appearance. Control over the sphincter may be partly lost.

As the ulceration heals in places, cicatricial tissue is irregularly produced, and the bowel, losing its normal supple feel, becomes hard and rough, while a certain amount of tubular stricture is produced.

A speculum is of great service in confirming the diagnosis.

Treatment.—Syphilitic ulcerations, while still confined to the anal margin, are usually curable without operation.

The part must be kept extremely clean, being washed twice a day with soft warm water, and then well bathed with lotio-nigra. After it has been thoroughly dried the part may be sprinkled with the following powder: Pulv. hydrarg. subchlor., grs. xx; pulv. zinci ox., 3 ss; pulv. amyli, 3 ij.

If the discharge be very fetid, grs. xx of iodoform powder may be added. The old powder must be carefully washed off before fresh is applied. General antisiphilitic treatment must be at the same time adopted.

If a tubercular origin of the disease be suspected, appropriate constitutional treatment must be tried. In some obstinate cases of ulcerations it is well to try for a time an absolutely milk diet. Cod-liver oil is often beneficial, while, if there be much reflex irritability of the bowel, the following prescription may be tried: Liq. opii, 3 j; liq. bismuthi, 3 iij; tinct. catechu 3 j; mist. cretæ ad 3 vj; dose, a tablespoonful three times a day. The local treatment is important. The patient should be kept as much as possible in the recumbent position, which prevents congestion and does much to promote healing. Night and morning the bowel may be gently washed out with warm water, to which half an ounce of boroglyceride has been added to the pint. After the evening washing an ounce of warm thin starch, containing twenty drops of laudanum, injected well up the bowel with a soft tube, gives much relief. A simple, unirritating ointment, made with ten grains of calomel to the ounce of vaseline, may be applied twice a day by means of an ointment introducer.

If the ulceration be situated low down in the rectum, and the sphincter muscle be strong and irritable, and if the disease has resisted simpler methods of treatment, it may be divided. In severe cases,

after the failure of other plans, colotomy may be performed.

Stricture of the rectum.—*Fibrous strictures.*—The pathological changes in the bowel consist of a thickening and blending together of the coats at the site of stricture. On section the cause of thickening is observed to be partly new fibrous tissue developed between the tunics of the bowel, and partly a great thickening of the fibrous trabeculæ of the muscular coats, while the muscular fiber itself has partially or completely disappeared.

The mucous membrane, both of the strictured part and that lying between it and the anus, is often destroyed by ulceration, though by no means universally so. In a few rare cases of narrow annular stricture the contraction appears to be confined to the mucous and internal muscular coats only, taking the form of a permanently reduplicated fold of mucous membrane.

There are two pathological conditions in which these fibrous strictures originate: (1) chronic inflammation; (2) the tendency of muscular fiber, when subject to undue and persistent irritation, to undergo a fibroid degeneration, with permanent atrophic contraction of its fibrous element.

Chronic inflammation.—This leads to the production of new fibrous tissue, which, together with the old fibrous framework of the inflamed part, has a subsequent tendency to contraction. Remembering the circular arrangement of the fibrous tissue of the bowel, it can be readily understood how an inflammation affecting even a limited area of its circumference may, by drawing the circular fibers like a knot toward one point, produce a stricture of the canal. And, further, it can be seen how inflammations external to the bowel, such as pelvic cellulitis, may occasionally produce a similar result from the continuity of some of the rectal fibers with the pelvic fascia.

Muscular atrophic contraction.—That a temporary stricture can be produced by muscular spasm I have no doubt, for I have felt a marked contraction of the bowel slowly relax to the gentle pressure of the finger if continued for some minutes, and the finger palpably grasped again on moving it roughly. The spasm appears to be reflex from the irritation caused by the touching of an ulcerated or tender mucous membrane, and either affects the

circular muscular fibers of the bowel or the levatores ani external to it. Permanent spasm, either of voluntary or involuntary muscular fiber, is an impossibility, but the relationship between these spasmodic and permanent contractions can probably be explained by analogy.

Take, for instance, the case of an untreated chronic disease of the knee-joint, where it will be found that the hamstring muscles have dislocated the tibia from the femur. At first it can be shown, by the startings of the limb and other evidence, that the muscular spasm is a pure reflex action, but after a while the muscles thus irritated suffer an atrophy of their muscular fiber, and the subsequent contraction of their remaining fibrous tissue element renders the condition permanent.

It will be gathered from the foregoing remarks that any morbid processes giving rise to ulcerations or inflammations may terminate in stricture. Thus, ulcerations, simple or syphilitic, pelvic inflammations following childbirth, dysentery, fistulæ, operations for piles, etc., may be reckoned among the causes of stricture.

Syphilis, from its producing ulceration or chronic inflammation, not uncommonly precedes stricture, but there is no justification whatever in attributing the majority of fibrous strictures to this disease.

Fibrous strictures are conveniently divided into *annular* and *tubular*, according to the extent of bowel involved. There is no arbitrary division between the two. Any stricture involving less than an inch of the bowel should be described as annular, reserving the term tubular stricture for cases in which a greater length of the bowel is implicated. "Annular" strictures, if neglected, will gradually extend and thus become tubular.

Symptoms.—Vary widely according to the stage of the disorder. The amount of contraction may be so slight as to cause little trouble, or so tight as to lead to complete occlusion. Again, such complications as ulceration and inflammation materially alter the character of the disorder. The disease, too, is chronic, with a tendency to get worse, so that symptoms develop at the later stage which are absent at the beginning. Stricture frequently following upon ulceration will often be preceded by symptoms of the latter disease. Owing to the insidious

manner in which contraction commences, it has made considerable progress before the attention of the patient is attracted to the part. The first symptom may be a difficulty in passing the motions, attributed by the patient to constipation. This difficulty slowly increases, and relief is sought from purgative medicine. At this time the motions are noticed to be smaller than natural, being described as resembling pipe stems, or passed in small shapeless fragments. It must be borne in mind that ribbon-like motions are not necessarily due to stricture, for an irritable sphincter may produce a similar result. There is a feeling after going to closet as if the bowels had not been completely relieved, and women especially complain of a certain amount of "bearing-down pain." As the disease advances, and probably coincident with some ulceration of the part, its character alters, all the symptoms increasing in severity. Diarrhea alternates with constipation, the former becoming perhaps the more prominent symptom of the two. The diarrhea is of a very teasing character, requiring the patient to visit the closet a dozen times a day or more. On these occasions only a little solid material is passed, with some teaspoonfuls of a yeasty-looking discharge. In more advanced cases the discharge is of a darker color, somewhat resembling coffee-grounds. The desire for a motion seems quickly to follow taking anything to eat or drink. Wind is often a source of great trouble, and this the patient dare not expel except at stool, for the effort to do so is followed by a liquid discharge. At this time abscesses may form in the neighborhood of the stricture, resulting in the formation of fistulæ. In women it is not uncommon for a recto-vaginal fistula to form, so that fæces are passed by the vagina.

The anus becomes excoriated and inflamed by the discharges, and around its margin may be seen œdematous folds of skin having a pink, shiny appearance. Albumen is often found in the urine.

When affairs get to this condition the state of the patient is very distressing, much of the day being passed in ineffectual attempts to procure an evacuation; while the discharge, over which she has lost all control, is nearly constant. If unrelieved, there is an increasing tendency toward death, albumen appears in the

urine, the patient becomes hectic and emaciated, and the scene not unfrequently closes with an acute attack of peritonitis or intestinal obstruction.

It must be borne in mind, however, that many of these symptoms, which are mentioned in the sequence in which they generally occur, are common to other diseases of the bowel besides stricture; nevertheless, collectively, they afford almost certain evidence of its presence. If the stricture be in the lower four inches of the bowel, the diagnosis can be established by digital examination. On passing the finger through the anus there is often a marked absence of contractile power in the sphincter. The bowel below the stricture is seldom normal, and, instead of being soft, conveys a harsh creaking sensation to the finger. The mucous membrane may be irregular, sacculated in some places, and nodulated in others, and adherent to the subjacent tissues.

The strictured portion may commence abruptly, the finger-tip passing into a narrow orifice in the center of a kind of diaphragm, or the contraction may be more gradual, being cone-shaped with the base downward. If the stricture be annular, the finger may pass through it; but on the first examination it is not generally possible to do more than pass the tip of the finger into the stricture. Any attempt to forcibly pass the finger through a stricture is very dangerous.

It is certainly most desirable to know if the stricture be of a tubular or annular nature, and, by means of a properly shaped acorn-headed sound, this can be generally ascertained.

Stricture situated high up the rectum, and beyond the reach of the finger, is extremely difficult to diagnose. Obstinate constipation, alternating with diarrhea and discharge, and other general symptoms have to be relied upon. Occasionally, the careful use of a bougie may be of value; but, by catching against the promontory of the sacrum, or being arrested by a fold of mucous membrane, it is very liable to mislead. Fibrous stricture is far more common in women than in men.

Treatment.—Annular strictures can always be relieved, and sometimes cured, by local treatment; but many cases of tubular stricture are beyond the hope of local remedy.

Forcible dilatation should never be tried. It is a proceeding fraught with the greatest danger.

Gradual dilatation.—The forms of bougie I have found most useful for the purpose of dilatation are six inches in length, of a slightly coniform shape, and of uniform taper from apex to base, and are supplied in twelve sizes.

Treatment should be commenced with such a size as will pass through the stricture with a moderate amount of pressure. It should be passed daily, and retained from five minutes to an hour or more, according to the strength of the patient to bear it. An advance can be made in the size every third or fourth day, always provided no pain is produced by this increase. The patient should be kept in bed, or, at least, in the recumbent position, during the first few weeks of treatment. By perseverance and taking care not to produce inflammatory trouble by too rapid stretching, in many cases, after a month or two, the patient will be greatly relieved. To prevent retraction the patient must be taught to pass the bougie for herself once or twice a week, as occasion may require.

Operative treatment.—Unfortunately it sometimes happens that but little progress can be made with bougies, or that, from ulceration and inflammation, the treatment has to be discontinued. In these circumstances the stricture must be divided. In the rare cases in which the stricture is confined to a mere narrow diaphragm of contracted mucous membrane, it will suffice to divide the obstructing band. Internal division is not to be recommended for more extensive cases. A deep cut would be necessary, and, owing to the retention of purulent discharge and fecal matter in this wound, suppuration is excited and matter burrows, giving rise to troublesome, if not dangerous, complications. By far the best treatment is a linear proctotomy with a complete division of the external parts. A long, curved, sharp-pointed bistoury, guided by a director, is passed well through the stricture, and the point made to transfix the rectal wall behind the contraction, coming out through the skin by the tip or side of the coccyx. The parts are then cleanly divided by cutting out toward the anus. It is an essential point in this operation that the whole thickness of the stricture be divided.

By the tenth day the use of the bougie must be commenced, and passed daily during the whole of the healing process, otherwise, as the wound cicatrizes, the contraction is reproduced.

Treatment of tubular strictures.—These are seldom amenable to any form of local treatment. If the stricture be not very extensive, it is possible that some benefit may be derived from bougies, but they rarely do much good. Division of the stricture is generally impracticable from the extent of bowel involved. In such cases a colotomy is the only form of treatment that is likely to save the patient's life, and, if not deferred until the sufferer is too weak and exhausted, it generally affords most favorable results.

Foreign bodies.—Owing to the mechanism of the sphincter, it is common for foreign bodies which have safely passed the rest of the alimentary canal to become arrested in the rectum. Foreign bodies are sometimes introduced by the anus, and an extraordinary variety of articles have been thus mislaid. Within my own knowledge, a good-sized jam-pot was found and removed from the bowel. The method of removal must depend on the nature of the article. Fish-bones and similar small objects can generally be taken out without difficulty by the finger and thumb; but, if the body be large or firmly impacted, the patient should be placed under an anæsthetic, and the sphincters carefully dilated. By doing this, the risk of tearing or damaging the mucous membrane is much diminished.

Impacted fæces.—In elderly people it is not uncommon to find the rectum above the sphincter dilated into a considerable pouch. Occasionally in this pouch fæces are allowed to accumulate until they form a hard, compact mass incapable of expulsion. The symptoms, such as constipation, distention, and pain, generally point clearly to the nature of the disorder, but sometimes, owing to a kind of spurious diarrhea, a mistake in the diagnosis is made. The rectum being full of solid fæces, its mucous membrane becomes irritable, giving rise to a mucoid discharge, which, being darkly stained by the fecal mass, is mistaken for diarrhea. In treating these cases purgatives should not be employed, for the obstruction is purely mechanical, and must be remedied by local means. The lower portion of the

collection is best removed with the handle of a spoon, after which the remainder can be washed away by copious warm-water injections.

Polypus.—Two forms of polypi are found in the rectum, viz., the fibrous polypus and the adenoid polypus; as rare pathological curiosities, dermoid and cystic polypi have been observed.

Fibrous polypus.—This is composed of fibro-cellular tissue, covered by a thin layer of mucous membrane. It commences as a small tumor in the submucous tissue, at first being merely embedded in the rectal wall, but as it grows it becomes gradually extruded into the bowel, pushing the mucous membrane in front of it. After awhile, from the constant dragging on the tumor, the mucous membrane forms a kind of pedicle. These polypi grow occasionally to a large size, and have been removed weighing a pound or more.

Adenoid polypus.—This springs from the mucous membrane, with which its structure is identical. The head, seldom larger than a raspberry, which it much resembles, is finely lobulated; the pedicle, no thicker than a crow quill, is often an inch or two in length. Under the microscope it can be seen that the stalk contains the vessels, and is composed of fibrous tissue. This fibrous tissue, on entering the head of the polypus, expands, forming a central nodule. Radiating from the center are fibrous branches, which, subdividing ultimately, form twigs of retiform tissue. Upon these twigs is arranged, in a bipenniform manner, a single layer of columnar epithelium, which thus forms the surface of the growth.

Adenoid polypi are generally single, though occasionally multiple; sometimes forming a grape-like bunch, while at others they are disseminated over a large area of the gut.

Symptoms.—Polypi may occur at any age, being, however, more common in childhood. Such cases are usually brought for advice with the notion that the "body comes down," the polypus protruded at stool being mistaken for prolapse. There is seldom much pain, but hemorrhage after stool is often observed. An examination for polypus should always be made after an injection, which, even if it does not cause the polypus to protrude, renders its detection with the finger easy.

Treatment.—The sphincter being dilated, the polypus is gently drawn down, and, after the pedicle has been tied as near the base as possible with thick, soft silk, is cut off. If the silk used be too fine, it is apt to cut through the pedicle, and troublesome bleeding may ensue. After removal there is no recurrence.

Villous tumor.—These growths stand on the boundary line between the innocent polypus and the malignant adenoid tumor; differing from the former in having a far shorter and broader pedicle, from the latter, by their growing as a tumor into the cavity of the bowel, and not spreading along the submucous tissue. Their minute structure is identical with the adenoid polypus. Their clinical features are usually those of an innocent growth, though cases are recorded in which they have recurred after removal, and have eventually developed all the characteristics of malignant disease.

Symptoms.—Owing to the innocent nature of the growth, the symptoms may have lasted a considerable period, often for years. There is a sensation of the bowels not being completely relieved, hemorrhage from time to time, and, above all, what is a characteristic feature of the disease, a thin mucoid discharge of a very glutinous nature. This discharge is at times very copious. Occasionally small fragments of the tissue are broken off and passed per anum, aiding the diagnosis if the disease be high up. To the finger the tumor feels finely lobulated, while the surface has a peculiar soft, velvety feel. The growth can be readily moved about within the bowel, and in this respect differs markedly from a fungating cancer, the only disease for which it is liable to be mistaken.

Treatment.—This consists in complete and free removal.

Cancer of the rectum.—The form of cancer invading the rectum is almost invariably the adenoid or cylindrical epithelioma. Occasionally the disease is complicated by colloid degeneration. Scirrhus cancer is said to occur in the rectum, but seldom does so unless preceded by the adenoid growth. Very rarely the disease takes the form of melanotic sarcoma. The adenoid cancer presents two well marked varieties, the chief characteristic of the one being its tendency to spread as a thin layer between the mucous and muscular coats of the bowel,

while that of the other is to increase more uniformly in all directions, thus producing a distinct tumor. The former is the commoner, and it is often not more than a quarter of an inch in thickness, while its area may extend over several square inches. The growth is firmly attached both to the mucous membrane and to the muscular coat. At first it is slightly more raised in the center than at the circumference, but after awhile the center becomes depressed and excavated by ulceration.

The ulceration commences in the mucous covering, which it soon destroys, and then eats into the subjacent growths. At first the base of the ulcer consists of the new adenoid growth, but, as this becomes destroyed, the base is formed by the remains of the muscular coats blended into a firm, hard, cicatricial mass by the great hypertrophy of the fibrous bands; prolongations from which extend into the surrounding fatty tissue, and by their contraction draw it toward the disease. Toward the edge of the ulcer the new growth with the hypertrophied, disintegrating mucous membrane is apparent. As the layer of disease spreads it is not always in a regular manner; it usually extends more rapidly laterally than in the long axis of the bowel. The result of the lateral extension is often seen in the whole circumference of the bowel being affected by a comparatively narrow ring of growth. It sometimes happens that, after the destruction of the mucous membrane, instead of the subjacent adenoid growth sharing the same fate, it continues to increase, especially in certain points, and projects as a fungoid mass into the bowel cavity.

In the second variety the disease forms more or less of a distinct tumor. It commences in a similar manner, but instead of spreading as a thin layer it increases in size pretty regularly in all directions, forming a distinct tumor projecting into the bowel cavity. Such a nodule may attain the size of a pigeon's egg or even larger, yet still retain an intact mucous membrane over its surface. But the mucous membrane after awhile gives way, and the growth, released from pressure, quickly forms a fungating mass projecting into the rectum.

Generally the tumor is single, though occasionally there are several nodules sprinkled over a considerable area.

These tumors vary much in their consistency; some being so soft as to break down on the slightest pressure, while others are fairly firm. It will be generally found that the firmness of the tumor is in inverse proportion to the rapidity of its growth. It may be gathered from this sketch of the disease how the appearances under the microscope differ according to the portion of tumor examined, and the length of time it has been growing. Sections involving the older portions of the disease, and in which the adenoid growth has been destroyed by ulceration, will show little more than dense fibrous tissue, while those from the growing margin will show the cellular growth in varying stages of development toward adenoid structure. It seems probable that, notwithstanding that the tumor is first observed in the submucous tissue, it in reality originates from some morbid influence affecting the epithelial cells lining the Lieberkujnian follicles. The new growth can be seen by the microscope to be nothing more than a vast development of a gland tissue, nearly identical in structure with the tubular glands of the mucous membrane.

If the new adenoid growth be rapid, both the cells and retiform tissue composing it are embryonic and ill developed, while in some of the more chronic cases the gland structure is so perfect as closely to resemble the natural follicles.

Symptoms.—The disease commences insidiously, the earliest symptom being little more than a slight uneasiness about the part, just sufficient to irritate the patient from time to time without amounting to actual pain. As the disease advances more definite symptoms appear; these are very varied, the more important being pain, bleeding, discharge, diarrhea, constipation, and cachexia.

Pain is seldom an early symptom, and is commonly the result of morbid changes in an advanced stage of the disease. At first discomfort merely is experienced, especially after walking or sitting long in a constrained position. There is often an uncomfortable feeling of wanting to stool, yet upon trial nothing but a little mucus is passed. As the disease advances pain generally increases, but it depends greatly upon the situation of the disease. When the growth is near the anal margin, the suffering is greater than when situated higher up the

bowel; indeed, I have more than once been astonished at finding a considerable mass of cancer high up the bowel in cases where the disease had not been suspected on account of the little pain experienced. When ulceration and stricture are present there is always much distress, and the part is liable to attacks of inflammation, at which time the pain is very severe.

Bleeding is almost sure to take place at some period. In the early stage it is slight, and is furnished by the congested mucous membrane in the neighborhood of the growth. The severe hemorrhage which sometimes occurs in the latter stage of the disease is the result of ulceration of a hemorrhoidal vessel.

Discharge of a muco-purulent nature from the anus generally exists; at first but slight, consisting of simple mucus, and only passed at stool; but it becomes purulent after ulceration has taken place, while at a further stage of the disease it becomes dark and highly offensive; forming the "coffee-ground discharge" so often described.

Diarrhea is an intermittent symptom. The sufferer often has a sensation as if requiring to stool, especially in the morning, and after a little straining, passes a small quantity of fæces, as well as some muco-purulent material. He does not feel, however, as if the bowel had been emptied, and may have recourse to the closet many times, passing a muco-purulent discharge rather than any true fecal evacuation. In using the term diarrhea, the surgeon must not be misled by regarding the evacuation as a simple looseness of the bowels. Indeed, when there is any stricture present, the so-called diarrhea is often but a symptom of extensive fecal collection behind the contraction. What the patient passes in these cases is a purulent mucoid discharge, stained by small particles of fæces washed from the surface of the collected mass.

Constipation is a symptom of the utmost importance as a means of diagnosis, if the disease be too high for digital detection. It may exist to almost any extent, from a slight trouble at the commencement to a grave complication later. The motions are often small and narrow, or passed in small fragments after much straining. Complete obstruction is not uncommon in the later stages of the disease.

Cachexia, loss of strength and weight, are always present after a while, although often not particularly marked at the commencement.

The foregoing symptoms are of the highest importance in calling attention to the probable existence of cancer, and have to be relied upon if the disease is high up the bowel, but in the lower part of the rectum a positive diagnosis can be established by a digital examination.

The margin of the anus should be carefully scrutinized for any portion of growth that may be in sight. Sometimes a fungating projection from the anus at once shows the nature of the disease. More commonly the anus is normal, or merely red and œdematous from the irritation of the discharge. Upon introducing the finger, the condition of the part will depend upon the time the disease has existed, the portion of bowel implicated, and the physical characters of the growth. Commonly a certain interval of healthy bowel exists between the anal margin and the lower border of the disease. The growth is generally situated about two or three inches from the anal outlet.

The extent of the disease varies from the smallest patch to the whole caliber of the bowel, for several inches. At an early period an induration alone may be detected, being rather a thickening of the bowel coats than a distinct tumor. At this time the mucous membrane is not ulcerated, but is somewhat pushed into the bowel cavity. Generally, by the time the case comes under clinical observation, considerable ulceration has occurred, and the finger can distinctly feel the firm base of an ulcer, with abrupt, hard, everted edges, the disease apparently terminating somewhat abruptly in the healthy tissue. If the disease has extended so as to form a distinct tumor in the submucous tissue, the lump or lumps can be felt projecting into the bowel cavity. More rarely the rectum seems studded with hard small nodules. Occasionally a soft fungoid mass can be felt blocking up the bowel. Very commonly a stricture exists, around which is a hard nodular deposit.

Differential diagnosis.—With ordinary skill in examination, and from careful consideration of symptoms, there are few disorders liable to be confounded with rectal cancer, yet, at times, considerable difficulty may be experienced in forming

an accurate diagnosis. The diseases likely to be confused with cancer are villous tumor, fibrous stricture, and fibrous growths from the prostate.

Villous tumor.—This can only be mistaken for the soft fungating masses occasionally springing from a malignant growth. Here the duration of the disease helps the diagnosis. When cancer forms a fungating tumor in the rectum, its course is always very rapid. Villous tumor, on the other hand, is chronic, and may remain for months or years with but little change. The discharge differs materially in the two diseases, that from a villous tumor, though very free, resembles normal mucus, being viscid and fairly clear; in cancer it is purulent and darkly stained. To the finger a different sensation is communicated by the two diseases. The villous tumor has a peculiarly soft and velvety feeling, while at the same time it gives the impression of being fairly tough and resistant. The cancer, though soft, is very friable, and bits readily break off on slight pressure with the finger-nail, while the surface of the growth feels harsh, as if from an absence of secretion. In fungating cancer, although the mass itself is soft, the walls of the bowel from which it springs are always indurated. Lastly, a large villous growth may be present in the rectum, with very little disturbance to the general health, which is not the case in cancer.

Fibrous stricture.—In the majority of instances, by paying attention to a few points, there is very little difficulty in recognizing the distinction between fibrous and malignant stricture, but occasionally the diagnosis is extremely difficult. In malignant stricture, the portion of mucous membrane between the stricture and anus is generally fairly healthy, that is to say, the mucous membrane is soft and unulcerated; in fibrous stricture it more frequently happens that this part of the bowel has lost its soft and supple condition, being rough and fasciculated, the mucous membrane being partly replaced by cicatricial tissue. In cancer the bowel is often firmly fixed, so that it cannot be made to move when the finger is introduced. The hard, abrupt, nodular edge, so common at the lower border of the stricture in cancer, is generally absent in fibrous stricture, the entrance into which either presents a thin edge or is funnel-shaped. The duration of the disease is

also important; cancer, when it has advanced so far as to produce stricture, running a rapid course.

Fibrous enlargements of the prostate. These, by encroaching on the rectum, occasionally produce symptoms of obstruction which have been mistaken for cancer.

Treatment.—Excision.—The question of excision of the rectum is one of great gravity. When the disease is limited so that it can be removed without much danger, the operation is of great value; but when extending widely the chance of permanent good is too small to justify the increased risk involved by the operation. It is not possible to lay down any arbitrary rules as to the cases suitable for excision, but speaking generally, the following points serve as a reliable guide: 1. The height of the disease. 2. Its position. 3. The implication of neighboring structures. 4. The general constitutional condition of the patient.

The height of the disease.—If, after a thorough examination under an anæsthetic, the finger cannot be passed beyond the growth, an operation should not be undertaken. Four inches I consider to be the limit that can be explored by the finger. It cannot be said that it is impossible to remove a greater extent of bowel; but when once beyond the reach of the finger, it is impossible to know accurately how high the disease extends, or what connections it has formed, so that, after an operation of great danger and severity, it would be very doubtful whether the disease had been removed.

The position of the disease.—When situated on the posterior wall the case is much more favorable than when in front.

The implications of neighboring structures.—If, when the finger is introduced, the bowel at the site of disease feels fairly movable upon the neighboring structures, it implies that the growth has not extended beyond the rectal walls, and can, therefore, be removed. On the other hand, should the bowel feel hard, rigid, and firmly bound to the surrounding structures, the case is an unfavorable one for operation. The rigidity and fixity of the bowel almost certainly imply an infiltration of cancer into the neighboring tissues, so that removal of the rectum does not mean the removal of the disease. The adhesion, which is commonly found between the diseased gut and the lower

part of the vagina, does not, however, prevent an operation, for the mucous membrane of the vagina can generally be peeled off the subjacent growth.

The general condition of the patient.—If the patient be feeble, with the general health much broken, it often implies secondary deposits in the abdominal viscera, the liver being especially liable to infection, in which circumstance no operation should be performed. Age is no necessary bar to the operation; but if the local conditions are only doubtfully favorable, it would be right to give a young patient the chance of an operation, which in an older person would be unjustifiable.

Taking all cases of rectal cancer, at the time of coming under the surgeon's observation, those which fulfill the conditions for successful extirpation are unfortunately exceptional, but that the operation in well-selected instances is of the utmost benefit admits of no question. A considerable period of fair health may be enjoyed before recurrence takes place, and I have known cases in which years have elapsed after operation without pain, discomfort, or symptoms of return; and it is just possible that a permanent cure may be occasionally effected, as sometimes occurs after the removal of cancer from other parts.

Method of operating.—The patient being placed in the lithotomy position, the bowel is divided in the middle line behind, from the anus to the coccyx. The rectum is then separated from the anal margin, by making deeply a crescentic incision, extending from the margin of the first cut, round the anus, to a point in the middle of the anterior margin. This cut should be made boldly, and of sufficient depth to extend well into the fat of the ischio-rectal fossa. The forefinger, thrust into this incision, will readily separate the bowel from the surrounding tissue, except at the insertion of the levator ani, which must be divided with scissors. The lateral and posterior portions of the bowel being then freed from their attachments, the next and most delicate step is to detach the bowel in front. This is accomplished by careful dissection with the knife, for it is too intimately adherent to be separated with the fingernail without greatly tearing the parts. When the bowel has been detached a sufficient distance beyond the disease, it must be drawn down and cut off with

strong curved scissors. No attempt is made to draw down and stitch the divided bowel to the skin. The subsequent treatment is of the simplest kind, consisting of keeping the wound clean with weak antiseptic washing, and covering it with a light pad of cotton-wool, dusted with iodoform powder. Care should be taken to let the wound heal over a full-sized bougie, or undue contraction will follow. Control over the bowel is generally regained in a couple of months.

Colotomy.—In cases unsuitable for excision, the question arises whether colotomy would afford relief. Rectal cancer at an early period often produces but slight distress. There may be neither pain nor constipation, and with the exception of a little morning diarrhea, the discomfort may be so slight as not to interfere with the daily avocations of the patient; in these circumstances there is no indication for colotomy.

When the symptoms of stricture once commence they are progressive. The frequent fluid stools, combined with advancing signs of obstruction, gradually exhaust the patient, while, not uncommonly, life is terminated more abruptly by complete obstruction, or by peritonitis resulting from perforation. When the symptoms of stricture, therefore, become prominent, I advise colotomy without delay. The benefit afforded is generally very great. Patients who have been harassed for months are at once relieved of their most distressing symptoms, and the closing period of life is passed in comparative rest.

Palliative treatment.—If colotomy has been deferred or refused, something may yet be done to render the patient more comfortable. The diet requires careful attention. It should be of a nourishing description, and taken as far as possible in a concentrated form, in order to diminish the amount of fecal material. If the bowel be very irritable, I have frequently seen much benefit follow a pure milk diet. Valentine's meat juice may be sometimes tried with advantage in conjunction with the milk. If it agrees with the patient a dessertspoonful of cod-liver oil three times daily seems to retard emaciation, while it certainly renders the motions easier. Purgative medicines must be avoided; they may set up a violent diarrhea difficult to control, while, if administered for obstruction, they are positively

dangerous. There is no objection to the occasional use of a mild laxative, such as a small quantity of Friedrichshall water or licorice powder. When the nights become restless and the pain considerable, opium is a valuable drug.

The local treatment is important. The parts must be kept scrupulously clean, great care being taken to prevent the collection of acrid discharges about the anus. The parts should be thoroughly washed with soft water, dried with a towel, and dusted with oxide of zinc and starch powder (grs. xx to 3 j). The diarrhea and tenesmus, so troublesome a symptom in the later stages, seems sometimes to be caused by the ulcerated surface of the growth, but in some of the more troublesome cases it results from a considerable mass of fecal material accumulating above the stricture. The bowel is thus never properly evacuated, only a portion of the mass coming away with the copious mucoid discharge its presence occasions. In these cases great comfort and relief follow the daily use of a warm-water injection; it clears the bowel above the disease, thus removing the source of irritation. To be effective a bulb syringe should be attached to the half of a No. 8 black soft catheter. The catheter must be gently passed well beyond the disease. After the injection has all come away, half an ounce of warm thin starch, to which twenty drops of liquor opii have been added, thrown up the bowel and retained, is very soothing.

HARRISON CRIPPS.

Symptomatic Indications.—*Podophyllum* in acute proctitis is very valuable, especially when there is much tenesmus; and for prolapsus in children. *Belladonna* in fissure and irritable ulcers does excellent service, reducing the inflammation and relieving pain; downward pressure in rectum; lancinating pains. *Ignatia* controls spasms; often removes prolapses. *Arsenium iod.*, in old irritable ulcers in scrofulous patients, corrosive discharges, is often useful. In chronic inflammation *phosphorus* gives good results. In spasmodic stricture *nux vomica* is the principal remedy and will frequently cure; after *nux vomica*, *belladonna* may be useful. In permanent stricture, *belladonna*, *nux vomica*, and *ignatia*, in connection with dilatation, are frequently serviceable. Fissures and ulceration about the anus frequently yield to *graph-*

ites or *nitric acid*. In cancer of the rectum, *arsenicum*, *conium*, and *lachesis* will frequently relieve the most distressing symptoms.

REFLEX DISORDERS.—The mechanism by which reflex disorders are produced is the same as that which is required for the performance of reflex actions; indeed, the former often consist of nothing more than reflex action carried to an inordinate and pathological degree. Each case requires the integrity of the reflex arc, *i. e.*, the afferent sensory fibers, the ganglionic center, and the efferent motor or secretory fibers. This is all that is necessary for the production of reflex action, and in some cases (such as renal colic, caused by a calculus in the ureter) is probably the whole of the mechanism required to induce a reflex disorder. Usually, however, the brain plays an important part, for it undoubtedly exercises a controlling power over reflex action, and the various emotional states have a great effect upon reflex action, and may themselves take the place of, and produce the same result as, peripheral afferent impulses. A good example of these modes of action is afforded by laryngismus stridulus, which is essentially a respiratory spasm. This may be excited by peripheral irritation, *e. g.*, laryngitis or exposure to wind, and also by certain emotional states, such as sobbing and passion.

Varieties.—Efferent fibers are distributed to glands, voluntary and involuntary muscular fibers, and hence any of these may be modified under abnormal reflex conditions; and as the secretory functions of the glands may be by these means excited or suspended, so there may be overaction (spasm) or suspension (paralysis) of the muscular functions.

1. Modified secretions.—These may be the result of emotional states or of reflex irritation. The most striking examples of the latter are found in the disturbances of the functions of the kidney under certain conditions. Complete suppression of urine is a common result of severe injuries to the abdominal viscera, and sometimes occurs after such slight irritation as attends the passage of a catheter or after the performance of Holt's operation. Physical states may profoundly influence secretion, as is

shown by the occasional suppression of saliva as a result of fear and of the urine in hysteria, but more often they are attended by increased secretion, and give rise to an increased flow of pale urine of very low specific gravity, and sometimes even to diarrhea.

2. Spasm of involuntary muscle.—

This forms a large group of cases, more purely reflex than those just considered, because in most of them cerebral influence may be neglected. Renal, biliary, and intestinal colic belongs to this class, and result from the irritation of mucous membrane by some abnormal substance. Vaginismus and esophagismus sometimes arise in the same manner, and asthmatic attacks (due probably to spasm of the bronchial muscles) may result from the pressure of an aneurism on the trachea, or from some abnormal condition of the nasal mucous membrane. Micturition has been known to be invariably excited by pressure over the bladder, and a fluid stool to be evacuated after dressing a bed-sore. The occurrence of premature labor from some great nervous shock, and the constriction and dilatation of arterioles from emotion, afford illustrations of the influence of the brain upon unstriped muscular fiber.

3. Disorders of voluntary muscles.—

It is well known that epilepsy and the convulsions of infancy are occasionally due to the peripheral irritation, such as the presence of ascarides in the intestine. The removal of the exciting cause in time may be sufficient to prevent the recurrence of any more attacks; but not infrequently the affected centers develop a habit of discharging, and convulsions afterward appear to occur spontaneously. The reflex character of the fit is very clear in those rare cases in which there is an undoubted epilepto-genetic zone. The writer had under his care a boy of very nervous temperament; he patted him on the head to give him confidence, and there immediately ensued an epileptic attack, which inevitably followed irritation of that area of scalp. Tremor of the hand and arm, closely simulating that of paralysis agitans, is sometimes caused by some constant irritation of the upper extremity, such, for instance, as the presence of a piece of glass in the palm of the hand. The removal of the source of irritation is soon followed by the re-

lief and ultimate cure of the symptoms. It was formerly believed that reflex paralysis was comparatively frequent, but it is very probable that most of the cases described were really of organic origin. Nevertheless, it is impossible to doubt that instances of it sometimes occur, for how otherwise are such cases to be explained as sudden cure of a paraplegia following expulsion of ascarides, inability to pass water for some days after an operation on the anus, and the almost immediate return of power to a paretic arm after the extraction of a decayed wisdom tooth? Such cases are probably due to reflex inhibition of the spinal centers by some peripheral irritation; but another view refers them to the agency of the vasomotor nerves, which are reflexly irritated, and contract to such an extent, in certain regions of the cord, as to suspend its functions in those areas.

Closely allied to ordinary reflex action is the reflexion of pain from the source of irritation to some more distant region, as in cases of renal calculus, in which pain is referred to the testicle. In the same manner a carious tooth may excite neuralgia in some distant branch of the fifth nerve, and, it is said, even in the cervico-brachial region. Irritation in the course of the fifth nerve sometimes induces an impairment of vision, consisting of a concentric contraction of the field of vision on the same side, and in some cases a slighter contraction of the opposite field. The removal of the exciting cause, often a decayed tooth, is generally followed by an improvement in the symptoms.

WM. GAY.

REFLEXES, SPINAL.—There are two varieties of spinal reflexes: (1) The superficial or skin reflexes; (2) the deep or tendon reflexes.

Superficial reflexes.—The following are the most important superficial reflexes, with the method of exciting them, the character of the movement induced, and the level of the cord on which the reaction depends.

The *plantar* reflex, obtained by tickling the sole of the foot, the result being usually a slight movement of the toes; and sometimes of the foot and leg. This reflex depends on the spinal center corresponding to the first, second, and third sacral nerves.

The *gluteal* reflex obtained by stimulating the skin of the buttock, the result being a contraction of the glutei muscles. This reflex takes place through the fourth and fifth lumbar nerves.

The *cremasteric* reflex, obtained by stimulating the skin of the upper and inner part of the thigh, the result being retraction of the testicle. This reflex takes place through the first and second lumbar nerves.

The *abdominal* reflex, obtained by stimulating the skin on the side of the abdomen from the ribs downward, the result being a contraction of the abdominal muscles. This reflex takes place through the eighth, ninth, tenth, eleventh, and twelfth dorsal nerves.

The *epigastric* reflex, obtained by stimulating the skin of the chest over the fifth and sixth intercostal spaces, the result being a dimpling of the epigastrium on the side stimulated, from contraction of the upper part of the rectus abdominis. This reflex takes place through the fourth, fifth, sixth, and sometimes the seventh dorsal nerves.

The *scapular* reflex, obtained by stimulating the skin in the interscapular region, the result being contraction of the scapular muscles and of the posterior axillary fold. This reflex takes place through the lower two or three cervical and the upper two or three dorsal nerves.

These reflexes are liable to considerable variations in health, sometimes being easily elicited, sometimes sluggish or absent. They are obtained more readily in children than in adults, and variations may also be ascribed to other causes, such as obesity and temperament.

The condition of these skin reflexes is sometimes of service in determining the localization of spinal lesions or their vertical extent. Considerable caution, however, should be exercised in drawing inferences from the state of the cutaneous reflexes, and it is especially important to bear in mind that some or all may be absent, even in health. The plantar reflex is probably less often wanting than the others, and on this account is of more importance.

The plantar reflex and the knee-jerk are not always similarly affected in disease. In hemiplegia, the former is usually diminished or absent on the paralyzed side, whereas the latter is exaggerated. Again, in locomotor ataxia,

the plantar reflex is often present, the knee-jerk being absent. The superficial reflexes are increased in those cases of paraplegia in which there is rigidity with exalted tendon reflexes; diminished or absent in most destructive affections of the gray matter of the cord, such as acute myelitis.

Deep or tendon reflexes.—Of the deep or so-called tendon reflexes, the *knee-jerk patellar tendon reflex* requires special consideration. The knee-jerk depends on the integrity of the cord at the level of the second and third lumbar nerves, as well as on that of the motor and sensory nerves of the reflex arc. That a reflex action is concerned in production of the knee-jerk, and that conditions which heighten or depress the reflex function of the spinal cord exert an identical influence upon the deep reflexes is indisputable.

The knee-jerk, though liable to considerable variations, is probably always present in health. It is a moot point whether the reaction may be wanting in the normal individual.

It is well to bear in mind that absence of the knee-jerk may be the sole indication of structural changes in the nervous centers. It is sometimes important, therefore, to take special precautions to overcome involuntary effort before assuming that the reaction is really absent. By the ordinary method the patient is made to cross one leg over the other, and then the tendon is percussed with the ulnar border of the right hand. Care should be taken that the leg hangs loosely. In a doubtful case, the patient should be seated on a high chair or table with the lower limbs bare, hanging freely, and off the ground. The tendon is then struck smartly just below the lower border of the patella, the patient at the same time being directed to interlock the semi-flexed digits of the hand into those of the other and to pull strongly. The knee-jerk is often difficult to obtain in very fat people, in highly muscular individuals, and in children. In the last named the reaction may often be obtained with more facility if the knee be semi-flexed and the sole allowed to rest on the observer's palm.

In children, in whom the tendon is short, it is often difficult to percuss smartly with the ulnar border of the right hand in the usual way, and hence a per-

cussion hammer is useful. In adults, however, a specially constructed instrument is not essential. The knee-jerk varies much in health, sometimes being very feeble and obtained with difficulty, at other times brisk and elicited with great ease. However slight the knee-jerk may be, provided the reactions are equal on each side, it is not justifiable to infer the existence of an abnormal condition of the nervous centers; on the other hand, it should be borne in mind that when the briskness in the knee-jerk is abnormal there is often inequality in the reactions, and ankle- or knee-clonus is commonly present on one or both sides.

Loss of the knee-jerk may occur in the following conditions: local injuries, such as fractured patella and rupture of the quadriceps femoris; disease of the quadriceps, as in pseudo-hypertrophic paralysis; disease of the anterior crural nerve, as in peripheral neuritis, such as commonly results from alcohol; in lesions involving the anterior or posterior nerve-roots, such as meningitis or tumors, and more commonly in locomotor ataxia, in which the posterior root zones are involved; in destructive affections of the gray matter of the cord involving the center which presides over the knee-jerk, such as infantile paralysis and acute myelitis; the reaction is often wanting in diphtheritic paralysis, the morbid anatomy of which is still uncertain, and sometimes absence of the knee-jerk occurs in diabetes, in disease of the cerebellum and immediately after an epileptic seizure.

Exaggeration of the knee-jerk is present in the following states: in the early stage of hemiplegia, from the withdrawal of the controlling cerebral influence; in the later stages of hemiplegia when rigidity is present, from descending degeneration of the pyramidal tract; in all diseases in which the lateral columns of the cord are affected, whether primarily or secondarily. Among such affections are primary lateral sclerosis, amyotrophic lateral sclerosis, disseminated sclerosis, and paraplegia from pressure; occasionally in hysterical paraplegia, in typhoid fever, phthisis, and other debilitating conditions; sometimes immediately after an epileptic seizure, and frequently in persons under the influence of anæsthetics. Exaggeration of the knee-jerk is often, but not necessarily, associated with clonus.

Ankle- or foot-clonus is obtained by sud-

denly pointing the foot upward so as to stretch the calf muscles, and then keeping up the pressure against the sole. The knee should be slightly flexed. The resulting clonic contractions are rhythmic and vary from six to nine per second. The level of the cord on which ankle-clonus depends corresponds to the first three sacral nerves. A knee-clonus may sometimes be obtained by forcibly pushing down the patella and then keeping up the pressure, the knee being extended. Another method is by pressing the left middle finger firmly against the upper edge of the patella, and percussing downward with the fingers of the right hand. Clonus may occasionally be obtained in other muscles, such as the flexors and extensors of the wrist and sometimes in the lower jaw. Ankle-clonus never occurs in health; it is associated with an exaggerated degree of knee-jerk, and usually indicates structural changes in the lateral column of the cord. The phenomenon, however, may be obtained together with exaggerated knee-jerks, in such debilitating conditions as typhoid fever and phthisis, in persons under the influence of anæsthetics, after an epileptic seizure, in chronic rheumatoid arthritis, and probably in hysterical paraplegia. It is important to bear in mind, therefore, that ankle-clonus does not invariably indicate organic change in the cord.

Front-tap contraction.—This name has been given by Dr. Gowers to a phenomenon often obtained when the knee-jerk is exaggerated, and which is a delicate test of increased irritability. The foot is placed at a right angle to the leg, and the muscles in the front of the leg are tapped, the result being extension of the foot from contraction of the gastrocnemius. The front-tap contraction does not always point to actual structural change in the cord, but its presence on one side only is of diagnostic significance. Muscular contractions are sometimes to be obtained in the upper limbs, on percussion of the tendons of the flexors and extensors of the wrist and of the tendons of the triceps. Percussion of the lower end of the radius (radial tap) may be followed by contraction of the biceps and supinator longus; and percussion of the lower end of the ulna by contraction of the triceps. These phenomena are usually well marked in hemiplegia with

rigidity, but in health they are commonly feeble or wanting, and hence their diagnostic importance is limited.

W. B. HADDEN.

RELAPSING FEVER.—An acute specific disease characterized by a short febrile paroxysm ending in crisis, followed by a well-marked remission, and that by a relapse on or about the fourteenth day.

Symptoms.—After an interval of about five days following exposure to infection, chilliness or a rigor, accompanied by headache, pain in the back and limbs, and, especially in children, by nausea and vomiting. The temperature rises rapidly, reaching 103° or 105° F. or higher in the first twenty-four hours; the pulse also becomes rapid, thirst is extreme, and there is complete anorexia. The patient is restless rather than prostrate, and may not apply for treatment until the second or third day of illness.

The symptoms of a fully developed attack are very pronounced. The face is flushed and the eyes suffused; severe headache, generally frontal with pains, often described as rheumatics in the muscles and joints, and very commonly giddiness, which may be so extreme that relief is only obtained when lying absolutely still in the recumbent posture. The mind is, as a rule, quite clear, though noisy delirium is occasionally observed toward the end of the paroxysm. Insomnia is frequently very persistent and distressing. There is no characteristic eruption; but in a small proportion of cases there may be a slight roseolar rash with subcuticular mottling. Petechiæ are very easily produced. Profuse perspiration is a marked symptom, and sudamina are of common occurrence. A peculiar musty odor, resembling burning straw, is often present. The temperature is high, generally over 104° F., but is not uncommonly much higher, even 108° F.; these high temperatures, however, are not attended by grave nervous symptoms, and are not necessarily of bad prognosis; a slight remission occurs daily, generally in the morning. The pulse is full, bounding and rapid, from 100 to 140; the degree of acceleration presenting, as a rule, a general correspondence with the height of the temperature. A hæmic murmur may be heard at the base of the heart. Respiration also is hurried, but the pulse-respiration ratio is generally maintained.

The tongue is moist, large, indented by the teeth, and covered by a white fur, which, after the second day, tends to clear from the tip and edges, leaving a clean red surface. Appetite is completely destroyed, but thirst is constant and intense. Nausea is almost always present, and vomiting may be severe, the vomited matter being bile-stained, or consisting only of glairy mucus tinged with bile; occasionally there is hematemesis. The spleen and liver are enlarged, the bowels tend to be loose. Jaundice has been frequently observed in some epidemics. Epistaxis is not uncommon, and may be profuse. The quantity of urine passed during the paroxysm varies in different cases, but it may not be diminished; the urea is increased, and bile pigments may be present if jaundice exists; in some cases albumin, with or without casts, is found.

The symptoms continue to increase in severity for from four to eleven days, when the crisis occurs and terminates the first paroxysm. This crisis, which in a large proportion of cases occurs on the seventh day, is characterized by a fall in the temperature more rapid and extensive than is observed in any other disease; the decline may be at first at the rate of 1.5° F. to 2° F. an hour, and may amount to as much as 12° , 13° , or even more in the course of twelve hours, so that the body temperature becomes subnormal, the reading of 95° F. being frequently observed. Coincidentally the frequency of pulse also in most cases rapidly diminishes, decreasing from 140 or 150 to 80, 70, or even 60 or 50. The character of the pulse also alters, becoming compressible and dicrotic. This rapid defervescence is nearly always attended by some critical discharge, usually sweating, though metrostaxis, epistaxis, diarrhea, and vomiting may take its place. The critical urine is pale, and of low specific gravity; and the total urea is at this period rather below than above the normal quality.

The patient now begins to improve, the temperature falls, the pulse regains tone, the urine, after remaining pale and copious for two or three days, again becomes natural; the appetite returns, the enlargements of the liver and spleen disappear, and the patient seems to be recovering from his disorder, but is really passing through the period of *intermis-*

sion. The *relapse* occurs after seven days, or a day or two earlier or later; all the symptoms of the primary attack return with the suddenness which characterized its onset. The temperature again rises to 104° or 105° F., but seldom attains the highest point touched during the last day or two of the primary paroxysm. The duration of the relapse varies from a few hours to seven days or even longer, the average being three or four days; it usually terminates by crisis, which may be as well marked as that which ends the first paroxysm. There may be three, four, or even more relapses, but each tends to be shorter and slighter than its predecessor. During convalescence desquamation may occur, generally in small flakes.

An abortive form of relapsing fever has been described in which no relapse occurs. It should, however, be borne in mind that the relapse may be of very short duration, and thus escape observation unless carefully looked for. In the so-called bilious typhoid or congestive form of relapsing fever the symptoms assume the adynamic type—there is jaundice, marked enlargement of liver and spleen, epistaxis or metrostaxis, dry brown tongue, hiccough, diminished or suppressed secretion of urine, low delirium, and an imperfect crisis, which is not followed by a complete intermission, but by a fluctuating temperature.

Complications.—In the congestive form pneumonia is frequently present, but it may also occur in typical cases of relapsing fever and materially modify the course of the pyrexia. Among other respiratory complications may be mentioned laryngitis, bronchitis, and pleurisy; while phthisis is a not uncommon sequela. The enlargement of the spleen may be so extreme as to end in rupture, and is frequently accompanied by peritonitis; copious hematemesis may be observed. Diarrhea occurs with varying frequency in different epidemics, but is only rarely so severe as to be a determining cause of death. The stools do not present any characteristic appearances; they are not infrequently dark or black from altered blood. Albumin occurs in the urine more frequently in some epidemics than in others, and, when present in small quantity only, does not appear to have any specially unfavorable significance. The passage of highly

concentrated albuminous urine, with perhaps tube casts, is a serious symptom, though recovery may occur after even total suppression. Hematuria is also a serious complication. The pains in the joints are occasionally accompanied by swelling. A frequent cause of death is sudden collapse, which may occur at the crisis, may be secondary to copious hemorrhage, or associated with the hyperpyrexia, or be due to cardiac thrombosis. Purulent otorrhœa and parotitis are frequent complications. Paralysis of certain muscles, of the forearm, or of one upper or lower limb is sometimes observed, and in some epidemics post-febrile ophthalmia is frequent. Pregnant women attacked by this fever almost invariably abort; the child, if viable, is either stillborn or dies after a few hours, but in the majority of cases the mother recovers.

Diagnosis.—Relapsing fever is not easy to distinguish until the fact of its epidemic prevalence has been recognized. It is to be diagnosed from typhus fever mainly by the sudden onset of the initial symptoms, the very rapid rise of temperature, the severity of the gastric symptoms, the absence of delirium, the presence of vertigo, of pains in the joints, of jaundice, and the absence of rash; later, by the occurrence of the characteristic crisis, intermission, and relapse. The specific spirillum may be discovered by microscopical examination of the blood. Its mode of onset presents a striking contrast to that ordinarily observed in enteric fever, the temperature curve is throughout different, and the abdominal distention and pea-soup diarrhea of enteric are not observed in relapsing fever. The congestive form of the latter disease, however, more nearly resembles the former, and has probably often been confounded with it. The same form of the disease, when complicated by marked jaundice, has been mistaken for yellow fever; the presence of enlargement of the spleen, the infrequency of albuminuria, and the great rapidity with which the temperature rises, taken together with the general circumstances of the locality as to epidemics, generally enable a diagnosis to be made. Relapsing fever may be confounded with grave forms of remittent fever, but the character of the pyrexia and the course of the disease are not the same; remittent fever only occurs

in malarial regions, while relapsing fever is contracted from a previous case; and quinine, while exercising a notable controlling effect over the former, has little or no influence over the latter. Examination of the blood may reveal the characteristic pigment bodies or spirillum respectively. Cases of relapsing fever, where perspiration and pain and tenderness of the joints are marked symptoms, may be confounded with acute rheumatism, the discovery of a cardiac murmur may make the resemblance more exact, and the very high temperature may excite a fear of hyperpyrexia. In relapsing fever, however, nausea and vomiting are generally present, with enlargement of the spleen and liver; there is insomnia, but no delirium; and there is a decided tendency to hemorrhage. The invasion of smallpox somewhat resembles that of relapsing fever, and, if both diseases are epidemic, it may be necessary to reserve a diagnosis until the fourth day. In every case, in fact, the general circumstances of the locality as to prevalence of epidemic disease within it must have great weight in forming a diagnosis in the early stage of the disease. Typhus and relapsing fevers, however, are liable to be epidemic contemporaneously.

Prognosis.—The mortality from relapsing fever is low, about five or seven per cent., so that the prognosis is generally favorable. Unfavorable symptoms are the occurrence of convulsions or prostration and low delirium, of deep jaundice or suppression of urine, and of collapse. Pneumonia, which is, perhaps, the most frequent, is also the most fatal complication. A previous history of alcoholism is a most serious element in prognosis.

Morbid anatomy.—The morbid appearances after death are not characteristic; the spleen is notably enlarged; there may be some surrounding peritonitis, and the capsule of the spleen may be perforated; the malpighian bodies are enlarged, and the parenchyma presents numerous infarcts due to venous thrombosis. These at a later stage break down and form abscesses. The liver is enlarged from congestion; its epithelium is in the condition of cloudy swelling, and there may be small infarcts, which later give place to minute abscesses. The kidneys are enlarged from congestion, the capsules may present ecchymoses, and the

cortex infarcts; the epithelium is in the condition of cloudy swelling. The medulla ossium is softened, almost puriform, owing to proliferation and subsequent degeneration of the lymphoid cells. The number of white corpuscles in the blood also is increased. Cloudy swelling of the cardiac and voluntary muscles is followed by granular degeneration.

Ætiology and pathology.—Relapsing fever has been generally regarded, on very insufficient grounds, as standing in some intimate causal relation with famine. It is, however, a specific disorder, due to a specific contagium, and becomes epidemic under circumstances of the same nature as those which favor the epidemic prevalence of typhus fever—the accumulation of decomposing filth, and overcrowding of ill-ventilated rooms. It is independent of climate, is little influenced by weather, and has no relation to the soil. It is believed to be endemic in Ireland and in Hindoostan, and it has occurred epidemically in Europe and America. It can be carried by travelers, and apparently by fomites, and can be transmitted by inoculation of the blood from man to man, and from man to monkeys.

A spirillum is found in the blood from a little before the first paroxysm, or at the least, shortly after its commencement, until shortly before the crisis, when it disappears; it is not discoverable during the remission until very shortly before the relapse commences, when it again appears in large numbers. From five to ten may be visible in a field (500 diameters), or they may be very much more numerous, and the number may vary from day to day. The spirillum is a homogeneous spiral filament, very thin; but in length it equals from one and a half to six times the breadth of a red blood corpuscle. In fresh blood it is in constant motion of rotation, flexion, and progression. The organism cannot survive for more than an hour at blood-heat; it has been found in certain cases at periodic dates, when, nevertheless, no pyrexia ensued, and it has not been found in certain cases during short febrile attacks lasting one day. For these and other reasons some prefer to believe that the spirillum is an epiphenomenon, and not the specific contagium of the disease, as is confidently affirmed by others.

Treatment.—Relapsing fever is very

little influenced by treatment. The pyrexia is not even modified by the free administration of quinine, arsenic, salicylates, or aconite, nor is the relapse postponed or rendered less severe. To relieve pain and procure sleep opium may be administered by the mouth, or preferably, morphine subcutaneously ($\frac{1}{4}$ grain every six hours). Light fluid food should be given, from the beginning, in small quantities at short intervals. Stimulants are well borne. The abdominal pain at the outset may be relieved by an emetic, and at a later stage persistent nausea may be treated by small doses of calomel (gr. $\frac{1}{8}$ — $\frac{1}{4}$ every two hours) or by subnitrate of bismuth. Strong aperients should be avoided. Diuretics have been recommended. Dr. Murchison's prescription was: Pot. nitratis, 3 j-3 ij; acid nitrici dil., 3 j; tinct. digitalis, 3 ss; aq. ad $\frac{7}{8}$ vj, in divided doses during the twenty-four hours. Relief may be obtained by sponging the surface with tepid or cold water, or by cold affusions to the head.

DAWSON WILLIAMS.

Symptomatic Indications.—In the early stage *aconite* is often useful; high fever, with quick, full, hard pulse; restlessness and anxiety; the entire body stiff and sore, with pain in the forehead and temples. Following *aconite* *bryonia* is useful, as soon as the inflammatory action is somewhat subdued, for the headache and pain in the limbs. *Bryonia* is also useful in cases complicated with pleuritis or pleuro-pneumonia. The pains of *bryonia* are particularly increased by motion, the patient wants to remain perfectly quiet. *Arsenicum* is next in value to *bryonia*, particularly when there is much prostration and weakness, ashy color of the face; great restlessness and anxiety; small, weak, quick pulse; vomiting and watery diarrhea. After *bryonia* *rhus tox.* is sometimes useful to complete the cure. When pneumonia or pleuro-pneumonia is present the best remedy is *phosphorus*; hard, dry cough, with oppression of the chest and difficult breathing. For cases attended with gastric irritation, nausea, soreness at epigastrium, dry and furred tongue, *nux vomica* is valuable.

RENAL CALCULUS AND GRAVEL.—See CALCULUS.

REPAIR, THE PROCESS OF.—As the result of an injury to any part of the

body, certain changes occur in the injured part. The injury may be so severe as to cause immediate death; or it may render recovery impossible, and death, local or general, ultimately takes place; or the patient may be able to withstand the effects of the injury, and recovery, more or less complete, takes place, certain local changes occurring at the seat of injury. These local changes constitute what is known in surgery as the *process of repair*.

During health there is constant change and interchange of material going on in the tissues. The blood circulating in the tissues conveys nutriment to them, while directly through the walls of the capillaries, or indirectly through the lymphatics, it receives various effete products, or unused material, from them. In health these two processes of addition and withdrawal balance each other; they are performed imperceptibly, and the tissue maintains its functional activity. After an injury, however, the balance in the injured part is lost. The blood still performs its functions, but there is now an increased afflux of blood to the injured part, and an increased deposit in its tissues. This increase is often associated with a diminished withdrawal of effete products, which accumulate in the injured part and interfere with its functional activity.

An injury is the result of an application of an irritant. The irritant may be applied directly to the part, or indirectly. In the latter case it acts through the nervous system. For example, abscess of one of the cervical glands may result directly from a twist or strain of the neck, or indirectly from the irritation of a carious tooth, one of the commonest causes of abscess in that region. Or, again, a swollen testicle may result directly from a kick, or indirectly from gonorrhea.

If the action of the irritant be slight, it may merely stimulate the tissues to increased activity; if more severe, the result may be a depression of the functional activity of the part; if still more severe, or sufficiently protracted, the irritant may give rise to a local death. These different effects vary in different people, for the result of the irritant depends not merely on its severity, but on the strength or power of resistance of the tissues to which it is applied, and this varies with the state of health of the individual at the time of

the injury. Thus we find bed-sores forming in patients suffering from some wasting disease. Here the irritant is the constant pressure of the body. In a case of fracture of the thigh they are not nearly so likely to form, because in such an accident the general vitality of the patient is not necessarily lowered. A mustard poultice in a healthy person gives rise to a temporary congestion. In a weakly child it may cause superficial destruction of the skin.

Phenomena observed in an injured part.—In this connection *three* elements require to be considered; the blood vessels, the blood, and the tissues surrounding the blood vessels.

The blood vessels in question are the arterioles, capillaries, and small veins; and the most important facts about them in this connection are that their walls are thin and membranous, the capillaries being formed merely of an elastic endothelium, and that free interchange is permitted through them between the blood and the surrounding tissues.

If a transparent membrane, such as the web of a frog's foot, be examined, it will be seen that in any particular vessel in health there are two streams, a lateral slower one and a central faster one. In the former the colorless corpuscles are seen moving slowly along, and adhering at times to the sides of the vessel. If an irritant now be applied, the first change that may be observed is a contraction of the vessel, but this is very momentary, and of little importance. The first important change is that of dilatation of the walls of the vessel, and this affects capillaries, arterioles, and small veins. Along with the dilatation the rate of flow in the capillaries is increased at first, owing to their not dilating to the same extent as the arterioles; but this increased rate of flow is of short duration, and, after a certain amount of oscillation, the current becomes slower, and finally ceases. In other words, *stasis* has occurred.

Along with the slowing of the current a change takes place in the lateral stream. It contains more colorless corpuscles. These attach themselves to the walls of the vessel, pass through them, and migrate into the surrounding tissues. To this emigration of the white corpuscles the term *diapedesis* is applied.

Still another change takes place: *excessive exudation*. Normally there is a

constant outflow of the blood plasma, or fluid portion of the blood, into the surrounding tissues. In an injured part this occurs to excess, and it is this that gives rise to the oedematous swelling of an injured part.

Causes of the dilatation and of the stasis.—It has been already stated that an irritant may act directly or indirectly. The irritant here probably acts in both ways: directly on the vessel walls, depressing their vitality, and lessening their power of contraction; and indirectly through the nervous system, causing a vasomotor paralysis, and thus producing dilatation. The main factor in the causation of the stasis is the viscosity of the blood, due to its contact with the depressed vessel walls.

We have, therefore, a stage of *increased deposit in the tissues*, consisting (a) of blood plasma or liquor sanguinis, due to the increased intravascular pressure, assisted by the thinning of the walls of the vessels; and (b) of colorless blood corpuscles. Certain changes may occur in this deposit. Normally, the blood consists of corpuscles in a fluid, the blood plasma. If blood be poured out from the body it rapidly passes through a series of changes. It first becomes viscid, then it clots, and lastly the clot contracts, squeezing out from itself as it does so a fluid termed serum. The clot consists of fibrin, entangling in its meshes blood corpuscles. Fibrin normally exists in a fluid state in the blood, and is then termed fibrinogen. Coagulation is caused by the action on this fibrinogen of a ferment, the "fibrin ferment," which under certain circumstances is evolved from the white, but possibly also from the colored corpuscles. The circumstances under which the fibrin ferment is evolved are contact with decaying or sufficiently depressed or dead matter.

In an injured part we have liquor sanguinis and white blood corpuscles together in the presence of depressed tissue; in other words, if the irritant have caused sufficient depression of the tissues, we have present all the elements necessary for the formation of a colorless clot. Such is the real nature of the so-called "coagulable lymph."

Thus there is (1) increased afflux of blood to the injured part; (2) an increased deposit in the part, which may undergo certain changes, and (3) there

may be increased production in the injured part.

The white blood corpuscles or leucocytes that have migrated multiply, and the cellular elements of the tissues themselves, especially in the less vascular parts of the body, undergo rapid proliferation. This is due to the overfeeding of the tissue. Normally the tissues grow and are maintained by the proliferation of their cell elements. In an injured part this occurs to an abnormal degree, *not* because of the increased vitality of the tissues, for their vitality is depressed, but because the normal balance of nutrition is lost. There is an increase in the amount produced, but the character of the products is inferior; and thus, instead of proliferating to produce normal tissue, the cell elements of the tissues proper, and the leucocytes that have migrated, may multiply into various aborted products, the chief of which is pus.

Process of recovery.—If the irritant be withdrawn, recovery more or less complete may occur at different stages in the series of events. If in the stage of active congestion of the vessels, or in that of stasis, the irritant be removed, the vessels begin to regain their tone, and recovery sets in, beginning at the venous extremities of the capillaries, or at the small veins themselves, when the corpuscles are seen to move onward and resume their normal course. If the process has gone on to effusion of the liquor sanguinis and migration of white blood corpuscles into the surrounding tissues, these may be absorbed again by the blood vessels and lymphatics, and the part be restored to its normal condition. *Resolution*, as it is termed, occurs. Should, however, the so-called “coagulable lymph” have formed, occupying a definite area, recovery, if it take place, must be by a new method, and certain changes occur, varying with the size of the clot, its surroundings, its situation, and its treatment.

Hitherto, for the sake of simplicity, we have considered a case where the irritation has not been so severe as to produce a rupture of any vessel; but practically, owing to the great vascularity of the tissues, rupture of some vessels, however small, almost always takes place, and hence, hemorrhage.

Process of repair in a wounded artery.—If the surface of a wound, in which no large artery has been divided,

be examined, at first a general bleeding from the whole surface will be seen. Then, after a time, the capillary flow ceases, and the hemorrhage becomes limited to certain spots, where it occurs in jets of bright red blood, that issue from some small arteries. If attention be directed to any one of these jets, it will be seen to become smaller in size, and to come with less velocity, and, passing into a trickle, finally to cease altogether. This is termed the *natural arrest of hemorrhage*. In the case of the capillaries and arteries the vessel walls collapse, and the vitality of their cut ends being depressed, coagulation speedily occurs. If an artery of ordinary size be cut across, the process is somewhat more complicated. The vessel contracts in virtue of the circular fibers in its middle or muscular coat. It at the same time is retracted within its sheath by the longitudinal and oblique fibers of its external coat. The sheath collapses, and so helps to make the opening still smaller. A clot forms, beginning at the sides of the sheath and extending till the channel between the retracted cut end of the vessel and the cut end of the sheath is filled. This is the *external* clot, and it acts as a temporary means of arrest.

But the process of clotting extends farther, and passes into the lumen of the cut vessel, generally as far as the first branch. This is known as the *internal* clot. It is pyriform in shape, and acts as a sort of buttress protecting the external clot, and allowing changes to take place in it which bring about the permanent closure of the vessel. Such changes are necessary, for the clot is a rudimentary structure, and is formed, too, at a time when the blood pressure is lower than it is as soon as the bleeding is arrested. The moment this occurs the weakened circulation begins to recover, and any sudden increase in the blood pressure would easily sweep the clot away. The changes that now occur in the clot are, in essence, the same as those that occur in the repair of the tissues in an injured part, and a knowledge of them is of the greatest importance in practical surgery.

1. The internal clot becomes adherent to the sides of the vessel.

2. At its junction with the external clot a change in color begins, and extends throughout the whole clot. It becomes of a lighter tint, due to the breaking down

and absorption of the colored corpuscles. Their function is gone; they are no longer of use, but in the way, and they are got rid of.

3. The clot becomes loaded with cells like white blood corpuscles, due in part to proliferation of the cell elements of the surrounding tissues, especially the epithelium of the cut artery, and in part to the migration into it of white blood corpuscles.

4. The next step is the *vascularization* of the clot, vessels shooting into it chiefly from the vasa vasorum.

5. The clot then loses its vascularity, while at the same time general contraction takes place. Fibrous tissue is formed in it, and ultimately all that remains of the original blood clot is a fibrous cord, sealing the mouth of the vessel, and tapering off into the surrounding tissues.

The process of repair in other injured tissues is practically identical in substance with that which occurs in a wounded vessel. In other words, repair in every wound takes place by means of blood clot. The formation of "coagulable lymph" or the colorless clot, in an injured part where there has been no rupture of the blood vessels, has been considered. The process of repair is the same, whether the clot be colored or whether it be colorless. The colored corpuscles may practically be regarded as inert, and acting rather as obstacles to the contraction and organization of the clot than anything else.

What are the changes, then, that may take place in a clot in the tissues? They depend on its surroundings, its size, its situation, and its treatment. These factors determine whether the result shall be one of recovery, or whether disintegration and death of the part shall ensue.

Given healthy tissues for surroundings, a clot occupying not too large an area, not exposed, and not irritated in any way, it will pass through the changes described in connection with the repair of a wounded vessel, and the place which it occupied will become filled with tissue resembling its surroundings.

RETROPHARYNGEAL ABSCESS.—Inflammation terminating in suppuration in the connective tissue between the spinal column and the pharynx.

Symptoms.—In idiopathic cases the

symptoms come on rapidly, dysphagia being the first to be noticed; there is acute pain, rapid pulse, and fever. As the abscess enlarges, difficulty in breathing occurs and the respiration is stertorous, and there is usually a croupy cough. When secondary to disease of the cervical vertebræ, the affection is preceded by stiffness of the neck and deformity of the cervical vertebræ, the symptoms come on more gradually, and there may be an entire absence of fever. On examination, a projection of the posterior wall of the pharynx may be found, and on palpation this may be felt to be elastic and fluctuating. Externally, a swelling may be seen and felt at the angle of the lower jaw. If it can be used, the laryngoscope is the best means of ascertaining the size and situation of the abscess.

Diagnosis.—The disease may be confounded with diphtheria, but the result of an objective examination should suffice to clear up any doubt.

Prognosis.—This must in all cases be guarded, as death may occur from complete closure of the glottis by pressure, or from the occurrence of œdema, or the abscess may burst during sleep and the contents enter the larynx and suffocate the patient. In secondary abscesses the prognosis is very grave on account of the nature of the diseases which cause them.

Pathology.—Lymphadenitis, as a result of extension of inflammation from the mucous membrane, seems to be the cause of the abscess; two lymphatic glands at the level of the second and third cervical vertebræ being the starting-point of the suppuration.

Ætiology.—This is especially a disease of infancy and childhood. It may be idiopathic, being met with in connection with oral and pharyngeal catarrh, or it may be caused by caries of the spine, or occur as a result of measles, scarlet fever, and septicæmic conditions.

Treatment.—The abscess should be opened as soon as possible, and the head held forward to prevent the pus entering the larynx. The after-treatment should be of a supporting nature.

F. DE HAVILLAND HALL.

RHEUMATIC ARTHRITIS (Chronic Rheumatoid Arthritis; Osteoarthritis; Rheumatic Gout; Nodular Rheumatism; Arthritis Deformans.)—A

joint disease of chronic course, characterized by inflammatory overgrowth of the articular cartilages and synovial membrane, with destruction of those parts of the cartilages subject to intra-articular pressure and progressive deformity.

Symptoms and progress.—The disease begins—often not long after the subsidence of an attack of ordinary rheumatism—with painful swelling, redness, and stiffness of one or more of the smaller joints, usually of the hands. The acute symptoms subside after a while, but generally recur in the same joints before these have quite recovered their normal size and shape; at the same time other joints are apt to be affected in the same way. Thus the articular pain and swelling tend to recur, at progressively shorter intervals, in all the joints previously attacked, and, upon each recurrence, to invade other articulations which had previously escaped. While the exacerbations become somewhat less acute in character, the intervals between them become so shortened as to be practically absent, and ultimately every joint in the body exhibits, more or less, the effects of the disease. The joints are swollen, nodulated, laterally expanded, stiffened, and distorted; and some are never wholly free from pain. On movement, creaking may be heard and felt. In proportion as they become fixed, the muscles in connection with them waste, functional activity of all kinds is increasingly impaired, and, though the mind may be unaffected, bodily suffering increases. In extreme cases the patient presents the appearance of a pallid, helpless, pain-worn, deformed, and bed-ridden cripple, always sensitive to cold and painfully appreciative of changeable and inclement weather.

The disease may possibly be arrested in its early stages by appropriate and energetic treatment, but later it is practically incurable; and, though very rarely fatal *per se*, it necessarily predisposes the subject to risks of serious complications, especially to those of a pulmonary nature.

Pathology.—Anatomically examined, the affected joints in the early stage of the malady exhibit enlargement and general distention by an excessive effusion of serum. The synovial membrane is thickened and hyperæmic, its fringes becoming hypertrophied and developing lumpy and pyriform excrescences, at first fibrous and later cartilaginous in texture. The

articular cartilages likewise increase by cell-enlargement and proliferation. In their central portions, where the intra-articular pressure is severe and constant, the cavities which contain the proliferating cells break into one another, so as to form vertical linear tubules, opening on to the free surface and discharging their cell-contents within the synovial cavity. Hence the articular cartilages, owing to this vertical striation, appear velvety and pitted. By an extension of the same process they become partially eroded, until the osseous surfaces are exposed, and these finally become, by mutual attrition, worn to an ivory-like smoothness. Coincidentally, at the periphery of the joint, and where freed from pressure, this hypertrophy of the cartilages and synovial fringes leads to a lateral expansion of the joint surfaces. The effusion is absorbed, and the joint becomes dry and creaking; the irregular ecchondroses become more or less separated from their original site of growth, form new attachments, and ossify. Thus are gradually produced the lateral expansion, the irregular distortion and nodulation, the rigidity, the dislocations, and the (usually false) anchyloses which are so characteristic of marked rheumatic arthritis. The sterno-clavicular joints usually appear to be only simply enlarged; the temporo-maxillary exhibit enlargement in front of the ear, often with some distortion of the jaw and chin. The chief symptom in connection with the vertebral column is rigidity. In the hip-joint the disease may simulate simple dislocation, Charcot's disease, and intracapsular fracture.

Considerable bilateral symmetry is often observable in the distribution of the joint affections of rheumatic arthritis.

Ætiology.—The tendency to rheumatic arthritis is frequently hereditary. The disease is common in those who have at some time previously suffered from other forms of rheumatism—with which it has an intimate pathological connection. All depressing and debiliating influences predispose to it, and women at the climacteric age are frequent sufferers. Although mainly a disease of the declining period of life, young persons are not exempt from it, and cases of its occurrence in infancy have been recorded.

Treatment.—The general treatment of rheumatic arthritis is essentially that proper to other forms of rheumatism.

Cod-liver oil, iron, and arsenic are always useful, together with warm woolen clothing, careful attention to the general health and to the hygiene of the skin, free exposure to direct sunshine, and residence in a warm, dry, bracing climate whenever possible. Tincture of iodine, in doses of 5 to 10 minims thrice daily, occasionally proves of service.

Local treatment is important, and may be of great service in arresting the disease in its early stages. The most useful measures are repeated hot fomentations of the affected joints, followed by painting with equal parts of the liniment and tincture of iodine, continued to the verge of blistering; the frequent inunction of iodine or of mercurial preparations of plain oil, or of lanolin and of sulphur; burying the joint thrice daily, for two or three hours at a time, in a sand bath at 140° to 150° F., friction, massage, and galvanism.

Courses of anti-rheumatic thermal baths, and prolonged tropical or subtropical sea voyages, are of service. Whatever be the measures adopted, they must be followed out with continuous perseverance.

In the advanced forms of the disease treatment can be little more than palliative; yet much can often be done to allay pain and discomfort, to improve the general health, and to prevent the further progress of the malady by such means as are indicated above, and under RHEUMATISM, CHRONIC.

C. E. SHELLY.

Symptomatic Indications.—*Aconite* is valuable when the joints are painful and stiff; *cimicifuga*, when the joints are enlarged and much stiffened, especially when associated with uterine derangement; pains worse in wet and windy weather. *Arnica*, tearing pains; fear of being touched. *Dulcamara*, when induced by exposure to dampness. *Pulsatilla*, in acute form; disordered digestion; melancholy. *Iodine*, when due to syphilitic, mercurial, or mineral poisoning.

RHEUMATISM.—A general disease affecting chiefly the joints, the fibrous structures, and the muscles of the body, the acute form being marked by fever, profuse, sour-smelling sweats, and shifting inflammation of the joints and fibrous textures.

RHEUMATISM, ACUTE (Rheumatic Fever).—*Symptoms and course.*—

The disease may arise suddenly, but usually a few days of malaise, with stiffness and intermittent aching in the joints and limbs, a sense of chilliness, and some sore throat or tonsillitis precede the onset of marked pyrexia. By this time one or more of the larger joints (ankles, wrists, knees, or elbows) are found to be swollen, hot, extremely tender, more or less painful, and somewhat reddened. The patient is prostrate and the cheeks are flushed; the tongue is foul, furred, and moist; the pulse frequent, weak, and soft. There is anorexia, with great thirst, and some irregularity of the bowels, the motions being commonly offensive; the urine is febrile and excessively acid; and the skin is bathed in an abundant, sour-smelling sweat, frequently attended with a development of sudamina and miliaria. While the general febrile condition persists with only slight and occasional diminutions of its intensity, in the course of a day or two, or even within a few hours, the inflammation commonly rapidly subsides in the joints first attacked, leaving them merely weak, feeble, and slightly swollen; but coincidently with this local improvement, other joints become similarly affected with the characteristic pain and swelling, which, again, subside as yet other articulations are attacked in their turn, the joint symptoms thus irregularly shifting hither and thither, and, often again affecting joints which had apparently recovered. This state of things usually lasts for about a fortnight, but may continue indefinitely, until, with a gradual subsidence of the local and general inflammatory symptoms, the patient, much weakened and emaciated, begins a somewhat tedious convalescence, or the disease declines into a chronic form. In either case a *relapse*, in which all the more acute symptoms may again appear, is very apt to interrupt the course of what promised to be a satisfactory recovery.

Complications.—Simple acute rheumatism, as such, is never fatal, but the malady is apt to be attended by complications, of which those involving the heart and the respiratory organs respectively, and an excessive degree of fever, are especially dangerous. Inflammation of the sclerotic and of the conjunctiva—"rheumatic ophthalmia"—sometimes occurs during, or subsequently to, the acute articular form of the disease.

Cardiac disease.—This, in the form of either pericarditis or endocarditis, occurs in about one-half of all cases. The affections commonly develop early in the course of an acute attack, but may do so at any time. Youth, and childhood especially, is prone to these complications, which are comparatively rare in persons over thirty. The liability to endocarditis increases directly in proportion to the severity of the attack, and women suffer more frequently than men. Changes in the myocardium are probably present in all severe cases, and are possibly the cause of the functional derangements, such as palpitation and distress, which may arise in the course of, or as a sequence of, acute rheumatism.

Diseases of the *respiratory organs*—pleuro-pneumonia, pleuritis, pneumonia, bronchitis, pulmonary congestion—often complicate the primary disease and add greatly to its fatality; they usually arise during the later period of the malady.

Hyperpyrexia is a rare, but very fatal, complication, and may occur at any period. Its onset is indicated by a flushed face and excited manner, passing into delirium, subsidence of the articular pain and swelling, cessation of the perspiration, and a body temperature of over 103° F., which continues rapidly to rise, in fatal cases reaching 108° or even 112° . The condition is generally accompanied by symptoms of acute cerebral excitement.

Rheumatic nodules.—Attention has of late years been directed to the frequent occurrence, as a complication of rheumatism, of small subcutaneous nodules in connection with fibrous structures, such as tendons, the deep fasciæ, and the pericranium.

The most common situations of the nodules are on the limbs, the fingers, the backs of the hands, wrists and elbows, the trochanters, the margins of the patellæ, and the malleoli. They may also occur on the pericranium, pinna of the ear, spines of the vertebræ and scapular spines, the crista ilii, and the ischial tuberosities. The skin over them is usually normal, but may be a little reddened. They vary in size from that of a pin's head to an almond, are movable on the underlying structures, and are not, as a rule, either painful or tender, but in some cases both pain and tenderness have been noted, the latter more often than the former. The nodules are arranged singly or in groups,

their distribution being often absolutely symmetrical; they can generally be more easily felt than seen. They may appear in a crop or singly, and may, after their discovery, increase in size or remain unaltered; after attaining their maximum they may continue unchanged for a few days only, or for months (fourteen months in one case), but, as a rule, they ultimately either diminish in size or disappear completely, though after diminishing in size they may again enlarge.

The nodules have been observed much more frequently in children than in adults, and, as regards sex, girls are observed to be affected far oftener than boys.

They are not necessarily associated with pyrexia, but whenever present in a child they constitute an undoubted evidence of rheumatism, but similar nodules have been observed in adults in whom no rheumatic history could be obtained.

In children the nodules have, in nearly all cases, been present in association with endocarditis, often of a serious and progressive character; pericarditis and pericardial adhesion have also been noted, while chorea and other rheumatic manifestations have naturally been present in a large number of recorded cases.

Microscopically, the growths are found to consist of wavy strands of fibrous tissue, with cells of various shapes, caudate, spindle-shaped, and nucleated, and numerous blood vessels.

The nodules require no treatment, but their presence adds somewhat to the gravity of the prognosis in rheumatism in children, owing to their frequent association with endocardial changes.

The more acute *nervous symptoms* observed in some cases are usually attendant on hyperpyrexia. But *chorea*, a common sequel, may also arise during an attack of rheumatism. Rheumatism is frequently associated with *erythema* and *erythema nodosum*, and occasionally with remarkable purpuric eruptions—*purpura vel peliosis rheumatica*. The disease also occurs in the course of, or as a sequel of, *scarlatina*. *Glycosuria* is sometimes developed during an attack of acute rheumatism.

Cases of **Subacute Rheumatism** present symptoms differing from those of the acute disease mainly in their greater mildness and their more varied grouping, but they often display a persistent tendency

to the recurrence of the joint affection in a subacute form.

Pathology.—The precise cause and origin of rheumatism are unknown. Various theories exist which explain the disease as being due to an excessive production or accumulation of *lactic acid* within the system; the influence of *chill*, either causing retention of lactic acid or evoking trophic and vasomotor neuroses and arthropathies; the action of *micrococci*, producing an endocarditis to which the joint symptoms are secondary; presence of a specific vegetable microbe, *zymotosis translucens*; and a miasmatic, malarial poison. The blood in acute rheumatism contains an excess of fibrin, but no abnormal principle has been discovered in it.

The chief tissue changes observable in fatal cases are, in the affected joints, swelling and hyperæmia of the synovial membrane and of the neighboring tendons, ligaments, etc., with patches of swelling, softening, and even of erosion (due to rapid cell-proliferation and consequent vertical striation) in the articular cartilages. The joint cavity is occupied by an alkaline, albuminous fluid, occasionally turbid with flakes of lymph, but rarely purulent.

Ætiology.—The disease is common in young persons from sixteen to twenty-five years of age, as a first attack, but a liability to the disease is increased by a previous attack and by the influence of heredity, which is traceable in over twenty-five per cent. of all cases. Social position and occupation, as influencing exposure, poverty, and exhaustion, may act as potent predisposing cases.

Diagnosis in completely developed cases of acute rheumatism is easy; it may be for some time uncertain during the stage of invasion. The acute disease for which it is perhaps most often mistaken is *pyæmia*, secondary to acute osteo-myelitis; but in *pyæmia* the joint affection is persistent and may proceed to suppuration, the fever is notably remittent, the sweating is neither continuous nor sour-smelling, and the subsequent history of the case will still more distinctly declare its nature (*see SEPTIC DISEASES*).

Gout is distinguished by its more sudden invasion, by its preference for the smaller joints, by the special characteristics of the joint symptoms, by the

previous history, and by the presence of uric acid in the blood.

Simple *Synovitis*, whether traumatic or constitutional in origin, is persistent, rarely multiple, never migratory, and owns a definite cause.

Rheumatic Arthritis exhibits the characteristic deformity, with a different ætiology and method of progress.

In *Gonorrheal Rheumatism* the joint trouble is more persistent, especially in the knees, and is associated with the specific urethral discharge or with a history of recent gonorrhea.

Glanders may resemble rheumatism in its early stage, but the disease soon displays marked differential characteristics.

It must not be forgotten that either the pyrexia or the joint symptoms, or both, may be very slightly marked, and even completely absent, in some cases of rheumatism, especially those occurring in young children, and yet such cases are not the less liable to develop cardiac complications.

Treatment is directed to securing general and local rest, the avoidance of any check to the cutaneous secretion, the relief of acute symptoms, the prevention of complications, and the correction of their effects.

The patient must be placed on a firm, narrow bed, protected from draughts, in a warm, well-ventilated room, and should lie between the blankets, clothed in a long flannel bedgown opening all down the front, the sleeves being cut open along the outer seam and refastened by tapes fixed at suitable intervals. This gown and the blankets should be changed as frequently as the patient's condition will admit. It is well to wrap *all* the larger joints, whether inflamed or not, in a thick layer of cotton-wool, kept in place by the firm and even application of a many-tailed bandage of soft and porous texture, and this cotton-wool should be renewed occasionally, until its employment is gradually relinquished during the progress of convalescence. The joints should be lightly sponged with warm soap and water before the cotton-wool is applied. When pain is severe, the affected joints may be incased in a single thickness of lint, saturated with a weak alkaline lotion containing tinct. opii, 3 ss; extr. belladon., gr. xx; chloral hydrat., grs. ij, or lin. aconiti, 3 ss, to the fluid ounce, covered with oiled silk and inclosed in

cotton-wool as above. The whole surface may be sponged piecemeal with tepid soap and water, and immediately dried by another warm sponge or soft cloth, night and morning.

The *diet* must be fluid, sustaining, and unstimulating. Milk, diluted, if necessary, with an alkaline mineral water, may be given freely; toast and water, barley-water, and water—plain or aerated—may be taken (like the milk, by sips) to quench thirst; small quantities of weak chicken-broth are allowable, and “egg lemonade” (the whites of two eggs, the juice of half a lemon, and a little glycerine, mixed with half a tumbler of water, but not beaten to a froth) is both refreshing and nourishing; but beef-tea and strong soups are undesirable, except when their stimulating qualities are specially required. All food must be given at short and regular intervals, and stimulants may be indicated by great prostration and in the event of serious cardiac or respiratory complications. As convalescence becomes established, small quantities of fish, custard, fowl, and the like may be gradually added to the dietary, but meat, if taken within a week after the complete subsidence of all rheumatic pain, is almost certain to provoke a recrudescence of the more acute symptoms. Ale, stout, and the stronger wines should be forbidden for a considerably longer period.

If seen at the outset, and before the disease has definitely declared itself, the administration of a calomel purge, and tr. aconiti, m. j in a little aq. camph., every hour for the first twenty-four hours, may do much to lessen discomfort and even to abate the severity of later symptoms. The most generally successful treatment of acute rheumatism consists in the administration of sodium salicylate (grs. xx for an adult) with pot. bicarb. (grs. xv) or of salicin (grs. xv in wafer-paper) or of salicylic acid (grs. xx in milk, or with liq. ammon. acet.) every two or three hours until the pain is subdued and the temperature becomes normal, after which the remedy must be continued in diminished doses or at longer intervals for several days—otherwise the acute symptoms recur. Or a rather smaller dose of the salicylate may usefully be combined with 10, 15, or 20 grains of citrate of potash, especially if the urine be excessively acid. If each dose be guarded by about 5 minims of tinct. nucis vom. the

effects known as “salicysm” (deafness, ringing in the ears, sickness, cardiac depression, and delirium) are less frequent. These symptoms, however, now that salicylic acid can be obtained free from impurities, are rarely met with. When the salicylates disagree, full doses of the alkaline citrates, bicarbonates, or tartrates may be given at short intervals until the urine becomes distinctly alkaline, after which the same medicine is to be given in such doses and so often as will just serve to maintain the alkalinity of this secretion. Or quinine may be given, alone or with alkalies, in doses of 3 to 5 grains every four hours. Calomel occasionally, and in moderate doses, may be given with advantage during the administration of the salicylates.

Opium, in the form of pulv. ipecac. co., is often useful as an anodyne hypnotic—when not contra-indicated by respiratory or renal complications.

Antipyrin, in doses of 15 or 20 grains every few hours, will sometimes relieve acute symptoms when other measures have failed.

The salicylates and the alkalies usually need to be given well on into convalescence, and gradually withdrawn as a more tonic medication is adopted. But as rheumatic pain gives place to mere aching, quinine becomes of marked value, and—especially if the urine be found of low specific gravity—iron is also indicated; in this stage, also, the tincture of bryonia iodica, in 3 to 5 minim doses, is often serviceable. A regular and sufficient action of the bowels must be maintained throughout the illness. If rheumatic joints continue stiff, swollen, and weak, they may be lightly blistered, or painted with iodine, and shampooed, while guaiacum and potassic iodide are given internally. Change of air, especially to a warm, dry climate, does much toward completing the cure, but the convalescent must be careful in respect of clothing and of exposure. His underclothing, from throat to wrists and ankles, and his socks, must be woolen, and changed at least once a week, and he should be warned how greatly one attack of rheumatism predisposes to a second.

The prevention, detection, and treatment of *complications* is most important. The heart must be carefully examined at the onset, and its condition observed daily throughout the course of the dis-

ease, while care is taken to avoid all heedless and too frequent exposure of the chest wall. Should signs of inflammation of the heart or pericardium be detected, the treatment proper to these conditions, including a succession of flying blisters, must be promptly adopted. The greatest caution should be observed in allowing such patients to leave their beds; and, indeed, there can be little doubt that, if all cases of acute rheumatism, however slight, were kept in bed for at least four to six weeks, the later cardiac symptoms would be much more rarely developed, or would at least be much mitigated in severity, as they would also be more certainly detected in their initial stages.

The various respiratory complications demand their appropriate treatment, and, like those referable to the heart, often call for free stimulation.

Hyperpyrexia, when slight, may be treated by frequent sponging of the whole surface with cold water; in its more acute form it is best combated by placing the patient in a bath at a temperature of about 98° F., and cooling this down by the addition of cold water to about 60° or 70°. When the patient's rectal temperature is reduced to 99°, or should he begin to shiver, he must be at once dried, removed from the bath, replaced in bed, and kept lightly covered. The cold bath, or the cold pack in milder cases, may be repeated if the temperature again rise rapidly or to an abnormal height. The glycosuria commonly yields to the administration of salicylates.

Rheumatism occurring in gouty subjects must be treated with due regard to the dominant diathesis. Potassic iodide, in combination with ammoniac chloride and salicylate of potash, is often useful; and colchicum may be of service in relieving pain.

C. E. SHELLY.

Symptomatic Indications.—*Aconite* is the principal remedy in the beginning, when there is much heat and dry skin; it subdues the pain in the inflamed joints, reduces the fever, and will often prevent permanent organic disease. *Arnica* lowers the pulse and the temperature, relieves articular pain and swelling; especially valuable in rheumatism of muscles formerly injured by a sprain, blow, or overuse. Following *aconite* *bryonia* is frequently useful in articular rheumatism with in-

tolerance of motion, and when pneumonia and serous inflammations occur as complications. *Dulcamara* is useful when the disease has been induced by exposure to dampness, especially in persons subject to catarrhal affections in cold and damp weather; *spigelia*, in rheumatic pericarditis and endocarditis; rheumatic fever with pain shifting from joint to joint. *Mercurius* may replace *bryonia* when the inflammation is obstinate in one joint, pain worse at night, profuse, sour perspiration; *caulophyllum* in inflammatory rheumatism of the joints of the hands and fingers, pain shifting from joint to joint. *Belladonna* replaces *aconite* when pain is intense, with red swelling of affected part; headache; insomnia. *Cactus*, when heart is involved.

RHEUMATISM, CHRONIC.—This affection is intimately associated with the acute form of the disease, being sometimes developed either subsequently to it, or as its final stage, and commonly appearing among those who inherit the rheumatic diathesis.

Chronic rheumatism is a disease more of middle than of early life, but is apt to be provoked by the same causes, hardship, exposure, damp, cold, etc., as those which predispose to the acute form; and its progress is marked by anatomical appearances and pathological changes which do not differ from those observable in ordinary subacute articular rheumatism, save in those extreme examples of the chronic form which merge into, and are practically indistinguishable from, rheumatoid or chronic osteo-arthritis.

Symptoms.—The salient features of chronic rheumatism are associated with the joints, and comprise essentially two symptoms, viz., *stiffness*—accompanied with a sense of dryness and with audible creaking on movement—and *pain*; the latter is mostly severe, heavy, and wearing in character, and often involves the contiguous muscular and bony structures of the limb. Both symptoms are generally relieved by local friction and by free and persevering movement within moderate limits, are aggravated by overexertion, as well as in cold, damp, and sunless weather; and are apt to be excited by local strain or injury. Although prone to shift from joint to joint, and in time to implicate a gradually increasing number of articulations, the symptoms are more persistent,

and more often recur in the joints first attacked than is the case in acute rheumatism.

Beyond the effects of pain and of the impediment to exercise and locomotion, the general health is not appreciably impaired in the milder class of cases. But in those of a more severe type, the frequent recurrence of pain and swelling in certain joints—particularly in those of the hands—becomes associated with a gradually increasing enlargement and deformity of those structures. As the disease progresses, other joints, great and small, become successively invaded; the exacerbations of local pain and swelling recur at still shorter intervals, until at last they are practically continuous, though then often less acute. The general health suffers in proportion, and the several joints may become irregularly swollen, dislocated, ankylosed, and variously distorted to an extreme degree. It is in these, the more severe cases, that cardiac complications are most usually met with; they are commonly the sequel of an endocarditis due to an attack of acute rheumatism which has preceded, or occurred in the course of, the chronic malady.

In all its forms the disease is very persistent; except under the most favorable conditions difficult to arrest, and extremely prone to recur on very slight provocation.

Diagnosis.—The aching and swelling associated with varicose veins of the leg and thigh, the reflected pains of early hip disease, and the pains sometimes complained of in commencing popliteal aneurism, may simulate mild chronic rheumatism; the differential diagnosis is easily made by physical examination. The non-affection of such articulations as the temporo-maxillary, the sterno-clavicular, and the intervertebral is considered to distinguish severe chronic articular rheumatism from advanced rheumatoid arthritis; but such distinction must be regarded as little more than arbitrary. The pains of syphilitic periostitis are mostly experienced in the shin, the parietal, and the frontal bones; are greatly aggravated by pressure, almost invariably more severe during the night, and are apt to be associated with local bosses—syphilitic nodes.

Treatment.—Change of residence to a drier, more sunny, and less variable cli-

mate—for the colder part of each year at all events—is a most valuable measure whenever it can be adopted. A temporary submission to the local regimen of Hot Springs Bath, Buxton, Droitwich; or of Aix-les-Bains, Baden, and other similar health-resorts is also useful. The Turkish and the ordinary vapor bath give good results in suitable cases. Warm woolen underclothing, frequently changed; sufficient regular exercise, short of fatigue; early hours, warmth, and efficient ventilation of living and sleeping rooms are all useful measures. The diet should be rich in fats and poor in sugar, the food being eaten slowly and at regular intervals. The stronger wines and ale should be avoided. Freedom from all mental and physical excess and from worry are important points in the general hygiene of rheumatic subjects. Medicinal treatment includes the administration of cod-liver oil; of a long-continued course of potassic iodide and arsenic, in fairly large doses, in infusion of broom; together with alkalies, bark, iron, and strychnine, as indicated by the condition of the general health; and careful attention to the hygiene of the skin, teeth, bowels, and kidneys. The ammoniated tincture of guaiacum, with bromide of ammonium and a hepatic stimulant, such as podophyllin or euonymin, is sometimes serviceable. Sulphur in lozenge or pill, or in the old-fashioned prescription of an abundance of freshly prepared mustard taken at each meal, is undoubtedly of value. And some cases, otherwise intractable, have markedly improved during the administration of a strong infusion of common horse-radish (a large stem scraped into a pint of sound whisky or gin or old ale; one or two ounces of the infusion, after standing for twenty-four hours, to be taken night and morning for a month), and of extract. conii., grs. iij in pill, night and morning, with a diuretic alkaline mixture. Chronic rheumatism occurring in the syphilitic and in the gouty is favorably influenced by the iodides and by colchicum respectively.

Local treatment is always called for, and often affords great relief. It includes counter-irritation by iodine or blisters; friction with stimulating and anodyne liniments, especially after hot bathing or fomentation; the continued application of a hot saturated solution of common salt in vinegar, friction with flowers of

sulphur; local steaming of the affected joints; passive motion, and massage.

C. E. SHELLY.

RHEUMATISM, GONORRHEAL (Gonorrheal Synovitis; Urethral Rheumatism).—See JOINTS, DISEASES OF.

Symptomatic Indications.—*Aconite* in rheumatism of shoulder and large joints is generally useful, when there is not much rigidity; also in rheumatism of the heart, with congestion and anguish; particularly valuable in rheumatism of the hip joints. *Bryonia*, heat and swelling of the joints; pain on movement. *Kali iod.* is valuable in periosteal form, especially when syphilitic; pains come at night. *Mercurius* in the sub-acute form; profuse perspiration.

RHEUMATISM.—*Local treatment.*—The local treatment with dry hot air by means of a cylinder, by which hot air up to 400° F. can be applied directly to the affected part and the desired temperature maintained as long as necessary, has been used with much success in the treatment of cases which have defied the usual methods of treatment (see p. 1558).

RHEUMATISM, MUSCULAR.—This form of the disease affects single muscles or groups of muscles, with their associated tendinous expansions, in various parts of the body.

Symptoms.—Local pain, severe and often lancinating in character, aggravated by movement and by slight or irregular pressure, but relieved by firm support and by complete relaxation of the affected muscle. It is usually accompanied with more or less general febrile disturbance, which may closely resemble that noted in the milder cases of acute rheumatism, and sometimes with a catarrhal (rheumatic) conjunctivitis, but pain is often the only symptom of any note. Even in mild cases, the more acute symptoms may last for many days, or even weeks; they decline gradually in severity, are liable to sudden and severe exacerbations if the affected part be again exposed to any exciting cause, and are, for a long time after their apparent cure, prone to recur upon slight provocation. In its most chronic form the disease never entirely leaves the patient, who suffers from an increase of his habitual pain in the affected muscles or tendons with every recurrence of cold

or damp or snow, and especially with the onset of east and northeast winds.

Local varieties of the malady have been distinguished by special titles. Thus, a rheumatic condition of the muscles of the neck, notably of the sterno-mastoid and trapezius, constitutes muscular *torticollis*, *wry-neck*, or *stiff-neck*; of a part of the intercostal, pectoral, or serratus muscles, *pleurodynia*—this is frequently excited by coughing, sneezing, etc.—it is not accompanied by the auscultatory and other physical signs indicating disease of the lungs, pleura, or heart, or by the three *points douloureux* which are pathognomonic of intercostal neuralgia. *Lumbago* affects the muscles of the loins and their fibrous attachment, on one or both sides; it compels a more or less stooping posture, and is much aggravated by any attempt to bend, twist, or straighten the back. The symptoms are usually very characteristic, but care must always be taken to exclude other possible causes of lumbar pain, especially disease of the kidney, bladder, uterus, and rectum, perinephritis and perityphlitis, abdominal aneurysm, caries of the spine and lumbar abscess, spinal meningitis, hip disease (rheumatic or other), sciatica, etc. *Lumbago* sometimes coexists with a similar rheumatic affection of the abdominal muscles; and this, again, may be observed without any associated pain in the loins. *Dorsodyn timeria*, *omodyn timeria*, or *scapulodyn timeria* signifies rheumatism of the muscles of the shoulders and upper back; and *cephalodyn timeria* affects the occipito-frontalis muscle, the pain being chiefly experienced in the forehead or occiput and sometimes involving the eyeballs.

Muscular rheumatism, in any form, may appear suddenly, or the muscular pains may be preceded by a day or two of moderate febrile malaise, sometimes accompanied with sore throat.

Pathology.—No special pathological changes—beyond those which necessarily result from impaired motion of the structures involved—have been recognized in this disease.

Ætiology.—The disease is most frequent in persons of the rheumatic diathesis, and its development is favored by causes identical with those which predispose to the acute disease; the directly exciting cause is frequently the exposure of a muscular surface to local cold or draught

immediately after active exertion and during free perspiration; or, again, the sudden or awkward execution of some unusual or excessive muscular effort. It is not limited to any special period of life, but torticollis is common in childhood, pleurodynia in adolescence, and lumbago is more usually met with in the adult and aged.

Treatment, prophylactic and general, is essentially that of the rheumatic diathesis (see RHEUMATISM, ACUTE, and CHRONIC). An effective purge at the outset should be followed by alkalies and salines; the iodides, with arsenic and guaiacum, are serviceable when the symptoms are protracted or obstinately recurrent, and debilitated subjects require iron, quinine, and a more generous dietary, often with a fair proportion of bland, sound stimulants.

Local treatment is important, and includes local rest and support, as by strapping, and counter-irritant applications, *e.g.*, turpentine stupes, mustard plasters, hot fomentations, and stimulating liniments; and anodynes, such as belladonna liniment and plaster, morphine *sub cute*, etc. Immediate recourse to a vapor bath sometimes cuts short an attack; as also will a hypodermic injection of atropine (gr. $\frac{1}{100}$ to gr. $\frac{1}{80}$), this latter often proving effective in lumbago. Local warmth and protection from cold and damp are highly necessary. Cases otherwise intractable are benefited by a change of climate, and by the use of such thermal and mineral waters as are recommended in the articles RHEUMATISM, ACUTE, and CHRONIC.

C. E. SHELLY.

Symptomatic Indications.—The principal remedy is *cimicifuga*, which is useful in many forms; particularly when the large muscles are affected: sudden onset; acute and chronic forms; severe pain; lameness; pleurodynia; lumbago. *Arnica* when from injury or fatigue. *Gelsemium* in the acute form, with fever; deep-seated muscular pains. *Veratrum viride* with prostration of the muscular system; pains renewed by damp, cold weather. *Bryonia*, when pains are better during rest, worse from motion. *Rhus tox.*, stiffness more than tenderness; the tendons and fasciæ are mostly affected; pain increased on first morning, better from continued motion; restless-

ness. *Phytolacca* syphilitic, and rheumatism of the fibrous tissues.

RHINITIS, ACUTE (Acute Nasal Catarrh; Coryza).—See CATARRH.

RHINITIS, CHRONIC ATROPHIC (Ozæna).—See NOSE, DISEASES OF.

RHINOSCLEROMA.—An extremely rare form of granulation tumor which arises from the anterior nares or adjacent parts.

Only very few cases have been observed, all in foreigners. The majority of reported cases have occurred in Austria and Italy, but the disease is said not to be very rare in Brazil.

Symptoms.—It first shows itself in the form of raised tubercles of bony hardness, isolated or conglomerate, arising from the septum or alæ of the nose, the upper lip, or palate. The color of the skin may be unaltered or deep brown. Soon the surface cracks, viscid fluid oozes forth and dries up to form scabs. The nose becomes flattened out, finally the nostrils are occluded. Pain is complained of only when the growth is pressed upon. No secondary growths occur, but rapid return of the disease has always followed its extirpation.

Pathology.—The growth consists of a dense small-celled infiltration with very little stroma. As in the closely related granulomata—lupus and lepra—characteristic bacilli have been conclusively demonstrated.

Diagnosis.—The differential diagnosis must be established from syphilis, keloid, and epithelioma.

Treatment.—Injections of a two per cent. solution of salicylate of soda, combined with douches, snuffs, and ointments of salicylic acid, are said to have brought about some improvement.

J. J. PRINGLE.

RHINOSCOPY.—The examination of the nose. That of the anterior nares is termed anterior rhinoscopy; that of the posterior nares, posterior rhinoscopy; for both kinds the reflector and light used for making a laryngoscopic examination are employed.

In order to appreciate what is seen, the observer must habituate himself to the examination of noses both in health and disease, for it is only by comparison that it is possible to distinguish the normal

from the abnormal, as the arrangement of the turbinated bodies, the direction of the meatuses, and the position of the septum, vary very much.

For **Anterior Rhinoscopy** the specula usually employed are Thudichum's, Fraenkel's fenestrated instrument, and Duplay's bivalve speculum. Duplay's speculum is most suitable for general use, the others being only necessary in exceptional cases.

By anterior rhinoscopy the inferior turbinated, and most of the middle turbinated, can be seen; and occasionally a glimpse is obtained of the upper turbinated bodies. The condition of the passages between them and the state of the septum can also be inspected.

Posterior Rhinoscopy.—Posterior rhinoscopy is a much more difficult task than making a laryngoscopic examination, as there are a number of persons in whom, on account of the conformation of the naso-pharynx, it is impossible to obtain a satisfactory view of the posterior nares, or in some cases any view at all. The best mirror for posterior rhinoscopy is Fraenkel's; the mirror is attached to the shank by a hinge, and is so arranged that by pressing a trigger the mirror may be placed at any angle with the shank. Before commencing the examination the patient is told to hold the breath, or else to breathe quietly through the nose, and to say "hang" if requested. The object of this advice is to arrange that the soft palate may hang down in a relaxed condition, and not be drawn up tightly against the pharynx. The tongue is then gently depressed by a suitable spatula held in the left hand, and the rhinoscopic mirror, well warmed, is introduced behind the soft palate, on one side or the other of the uvula. When it is in position the trigger is pressed so as to elevate the mirror, and by this means a view of the posterior nares may be obtained. Should the soft palate be very irritable, both it and the pharynx and tongue may be sprayed with a twenty per cent. solution of cocaine, or the solution may be applied by means of a brush. This will facilitate the view of the posterior nares, both by causing contraction of the mucous membrane, and thereby increasing the size of the passage, and also by abolishing the sensibility of the palate, and thus permitting the speculum to be opened wider than could otherwise have been the case.

Various hooks and snares have been recommended for pulling the soft palate forward, but men of great experience in this method of examination do not employ them, and say that more is to be done by patience than by instrumental assistance. Beyond stating the bare facts that on a rhinoscopic examination (or rather, on repeated examinations, because, on account of the smallness of the mirror and the anatomical arrangement of the parts, they cannot all be brought into view at the same time) the septum nasi, the posterior extremities of the superior, middle, and inferior turbinated bodies, with the superior, middle, and inferior meatuses, and the orifice of the eustachian tube should be seen, it is useless, without the aid of a diagram, to describe the appearances met with in such an examination.

F. DE HAVILLAND HALL.

RICKETS.—A disease of the whole of the tissues of the body, having its most characteristic manifestations in the bones.

Symptoms and Course.—The earliest symptoms are referable to the nervous system: restlessness—chiefly nocturnal, the bed-clothes being kicked off, and sweating, also chiefly nocturnal, and occurring most abundantly about the head. Tenderness is another symptom, but often absent, and has probably been confounded with the "touchiness" or irritable weakness of the nervous system. Beading of the ribs and enlargement of the wrists are the earliest bony signs of rickets. The body changes may be of the slightest kind, or of the most marked degree. The cranium presents different changes in different cases. It may be brachycephalic or dolichocephalic or asymmetrical; there may be "bossing" of the parietals and frontals and cranio-tabes (*q. v.*) may be found. A square, broad forehead, and overhanging brow, is regarded as of rachitic origin; but such protuberance below the frontal eminences, and sometimes of those parts, may certainly be due to syphilis, and may accompany brain defects without syphilis, or evident rickets. The anterior fontanel is often larger than natural, and may not be closed till long after the usual period—eighteen months of age. The face and jaws are small by comparison. The teeth are often cut late; there may be but one tooth in the jaws at the age of eighteen

months. The growth of the skeleton generally is usually much retarded, and the long bones become curved, but not always in the same direction. The fore-arms become convex backward; the humerus convex outward above the deltoid insertion; the femur convex outward and forward; the tibia convex forward, or else bent at a right angle (saber-shaped tibia) at the junction of the middle and lower thirds. The ligaments become weakened and elongated, so that deformities of the joints may appear. The thorax may show lateral grooves passing downward and outward, usually external to the beadings, at the junction of the cartilages with the ribs; the sternum is convex forward—anterior convexity. The outline of a transverse section is fiddle-shaped, and so also is the shape of the trunk, as made up of the thorax and abdomen; the latter being large and globular, corresponds to the wide part of the belly of the violin. Rickety children are very prone to catarrh of the respiratory and alimentary tracts; also to convulsions, tetany, and laryngismus (*q. v.*).

Diagnosis.—This is easy if the beading of the ribs be perceptible to the touch; but in slight cases the failure of the child's health may not be attended by any recognizable bone change. It is very common in feeble infants a few weeks or months old to note the sign of craniotabes. When the wrists are enlarged and the bones curved, the merest tyro may diagnose rickets. Excessive irritability of the muscles and nerves and chronic catarrh are seldom due to anything else than rickets during the first months of life. The knee-jerks are always exaggerated; ankle-clonus may rarely be obtained.

Prognosis.—As a rule is good; but a few cases may persist or pass on to the stage of late rickets, but not if suitable treatment be carefully carried out. The dangers to life come rather from the nervous pulmonary complications or accompaniments of rickets. The prognosis, therefore, varies with the prominence of such symptoms, and with the general state of health. Bronchitis and diarrhea do not usually fail to yield to judicious treatment.

Pathology.—Rickets affects all the tissues, but especially those which are growing most rapidly—the nervous system and the bones. Infants are prone to

catarrh of the mucous membranes and have very excitable nervous organs.

Rickets promotes both these tendencies by debilitating and irritating these tissues. The bone changes and osteal neoplasia, though often most evident, are far less important as regards the life of the child than the catarrhal complications, the muscular debility, and the neurosal liabilities. A rickety infant is liable to universal convulsions; to tetany, especially of the extremities; and to tonic spasm of the larynx (eclampsia, tetany, laryngismus stridulus). It is prone to naso-bronchial, gastric, and enteric catarrh, rickety bronchitis, and diarrhea. Rickets is credited with the power of causing splenic, hepatic, and lymphatic enlargement; but some hold that in these cases congenital syphilis is co-operative and chiefly causative. Bossing of the frontal bones more than the parietal bones is probably of rachitic origin: if the parietals are more thickened than the frontals, the chief cause of the bone change is syphilis. Craniotabes, localized atrophy of bone, producing the so-called "parchment cracking," is believed to be due to rickets as well as syphilis. It is doubtful whether rickets causes true tenderness of the muscles; there is in bad cases a general hyperæsthesia and "touchiness"—a rachitic neurasthenia: and there are some grounds for believing that rickets may induce peripheral neuritis. But true tenderness should suggest the coexistence of scurvy, with hemorrhages in the periosteum of bones, or of syphilis with inflammatory new growths about the periosteum and the area where the shaft and epiphysis join.

The beaded ribs (rickety rosary) are common effects of rickets, the thickening being most evident at the junction of the ribs with their cartilages; the fifth, sixth, and seventh are most affected, and the visceral aspect much more than the subcutaneous. Situate about the angles of the ribs behind, there may be found, especially at necropsies, posterior beadings, or nodosities, which perhaps commence as spontaneous fractures; or the great strain on these parts may excite a new formation of bone.

An infiltration of the frontal lobes of the brain with an albuminoid-looking material, as described by Sir William Jenner, is, in the opinion of the writer, due to simple œdema and anæmia. The edges

of the frontal and other flat bones of the skull are said to be thickened at the cranial sutures, the sutures appearing as furrows, but close observation shows that the furrows are not precisely at the sutures, and are really grooves in the bones, in which dilated veins run.

The relationship of rickets to osteomalacia is obscure. In some cases of rickets there is bone-softening, resulting from a sort of rarefying osteitis, and there may be a growth of new limeless bone having but little consistence. Billroth has called osteomalacia a fungous, fatty osteomyelitis, the hard mineral bone disappearing before the advance of fungoid granulations, some of which have become fattily infiltrated. But Rindfleisch asserts that in osteomalacia the salts of the compact bones are first dissolved out, while the organic matrix remains longer, and the dentate or crenate outline of the bone around the fungating material is not found in that disease, there being a gradual thinning of the bone with retention of its smooth surface (*halisterischer bone atrophy of Volkmann*).

Microscopical Appearances. — The most characteristic histological change in rickets consists in the irregular overgrowth of the layer of proliferating cartilage at the area of junction of the shaft and epiphysis. This lamina is like a disc in healthy ossification, whereas in rickets it is very uneven, and sends roots or peninsulæ into the vascular shaft: sometimes islets of proliferating cartilage wholly detached from the parent growth are seen there. Around the bone at the junction of the shaft and epiphysis, and beneath the periosteum, a spongy soft vascular overgrowth takes place (spongoid tissue).

Instead of there being a regular neat conversion of cartilage into bone, there is irregular overproduction of cartilage and of a soft granulation tissue which fails to grow into Haversian systems of lamellar bone. In microscopic section of the excessively overgrown red medulla a network composed of irregular fibrillated tissue, containing angular corpuscles, may be seen: the perverted representatives of what would have been true bone corpuscles. In the meshes of the network there appears a small, round-celled, highly vascular growth; this is like the new formation beneath or in the periosteum.

The changes at the epiphysial lines curtail the growth of the bone in length, but

the wealth of medullary tissue entails an excessive production of compact tissue, hence the stunted dense bones of completed rickets. During the active period of rickets it is obvious that there must be a great defect of mineral matters; in Kassowitz's view, the new formation of blood-vessels and the hyperæmia are the real causes which melt away the bone and prevent deposition of lime.

The blood changes in rickets are like those found in anæmia; it is possible that this impoverishment and poor formation of the blood is the agency which determines the rachitic changes in the nervous system, bones, and other tissue. Altered blood may also cause fibroid growth in the spleen, liver, and lymphatic glands, such as may be found in some cases in which true rachitic changes occur.

Ætiology. — The combination of bad air, bad feeling, bad light, and want of cleanliness and sleep is the one most likely to produce rickets. Excessive feeding with starchy compounds is a more effective factor during the early months of life than the giving of fats and proteids; but any method of feeding which throws upon the digestive and assimilative organs work of an unnatural kind tends to produce rickets.

It may certainly date from fetal life, but the so-called fetal rickets is frequently not identical in essential changes with ordinary rickets.

It chiefly affects infants during the first two years of life, and is in some form or other the commonest infantile disease of populous towns.

Treatment. — This requires minute attention to details, but two broad principles have to be kept in view: rectification of the hygiene, especially of the dietary, and the use of tonic measures. Not only may the food given be of the wrong description, but it is often also indigestible; hence the necessity for careful consideration of the diet. The fact that the gastric juice does its work best when the surface on which it has to act is most extensive is the reason for insuring a fine division of the curd of milk and of any other food. Minced meat, pounded chicken, and fish, cream, and milk, may be safely recommended. A little wine just before, or with the chief meal, may prove of great service. As a rule, sugary and starchy foods are given in excess. Food should be taken at regular intervals.

The castor-oil mixture is very service-

able in cases of slimy diarrhea of rachitic origin: \mathcal{R} Olei ricini mv, mucilag. tragacanth mxv, syrupi 3 ss, aq. menth. pip. 3 j; to be taken three times a day.

The diarrhea and its congener bronchitis require protection of the chest and abdomen by means of woolen garments, which should envelop the whole of the body except the head and hands.

Correction of excessive acidity of the food and of the contents of the stomach and intestines is important. If fats agree, cod-liver oil, bacon fat, and cream may be given. Most children take well a mixture of cod-liver oil and vinum ferri.

Other tonics may be tried, such as hypophosphites, lactophosphate, acid phosphate, or pyrophosphate. Phosphorus in doses of $\frac{1}{100}$ grain dissolved in sweet almond oil, a minim of the phosphate of oil, three times a day; phosphate of lime in 2-grain doses; syrup of the phosphate of iron, or of the hypophosphites, or of the iodide of iron, are valuable preparations. Letting the child sleep in a hammock is a suggested mode of preventing chills due to perspirations, which for some reason are most copious during sleep and about the forehead. Frequent exposure to the fresh air is a most valuable tonic. "Send the child out six times a day for ten minutes at the time," is a good prescription, and this may be done in almost any weather, if due precautions are adopted against cold.

Late Rickets would appear to be fairly well named, since in these cases occurring in children after the period of infancy (after two years) there is over-production of cartilage at the epiphysial line. But the disease may be only a recrudescence of infantile rickets. It may follow acute illnesses, especially measles and scarlatina. Whether it be really identical with rickets is a pathological problem; and, with regard to congenital and fetal rickets, the same be said.

Fetal Rickets is often fetal cretinism. Its main features are: Large head, large belly, thick stunted limbs, depressed nose root, and abundant overgrowth of subcutaneous tissue. The thyroid gland may be normal or enlarged, but the "cartilaginous digitation" of rickets is absent; in its place a fibrous lamina intervenes between the shaft and epiphysis. A premature ankylosis of the basi-sphenoid and basi-occipital bones is found as in cretins; the membrane bones are well

grown or overgrown. The brain may be deformed owing to the shortening of the basis cranii and the over-development of the cranial vault, and sometimes dropsy of the ventricles is present. The heart may be malformed, but such cases usually succumb at birth.

Infantile Osteomalacia may be associated with rickets or occur separately. Cases have been described in which the whole skeleton, but especially the long bones, was softened, friable, and thinned; fractures occurred easily, and cranio-tabes was present. Occasionally rachitic digitation of the growing cartilage was noted, and other alleged rachitic signs—*e. g.*, sweating without fever, splenic enlargement, anæmia, emaciation, restlessness, and sleeplessness. The bones exhibited in some cases buttresses of massive spongy osteoid tissue beneath the periosteum, as may occur in rickets, especially where green-stick fractures exist. The children were under two years of age; the cases frequently ended favorably after lasting a few months. The treatment of such cases is that of rickets.

Congenital debility may be assumed to exist.

ANGEL MONEY.

Symptomatic Indications.—*Calcareæ carb.* is frequently useful, especially when sour-smelling diarrhea is present; when evidence of deficient nervous energy is present *calcareæ* hypophosphites may be preferred: *acid phos.* is frequently useful when there is much weakness; diarrhea; pain in the limbs; hectic symptoms *ferrum phos.* is often valuable. *Silicea* when perspiration of the head; sensitiveness of surface; increased growth of cartilage.

RIGIDITY.—The term is applied to parts, which should be freely movable or distensible, but have become stiff and fixed.

It is used to designate the immovability of joints, the result of ankylosis, also the condition of the cervix uteri, when it does not dilate coincidently with the increase of uterine contractions. Arteries are said to be rigid, when they are no longer fully dilatable, on account of fibrotic changes in their coats, and the valves of the heart, when as the result of atheroma and other conditions they cease to be freely movable.

Muscular spasm is a frequent cause of rigidity, which often occurs in the course of paralysis, either of cerebral or spinal

origin. It is not necessarily, however, due to an organic lesion, nor is it always associated with paralysis. Rigidity frequently supervenes in the course of *hysterical or functional paralysis*. It is then usually hemiplegic or paraplegic in its distribution, but in some cases all four limbs are affected and in others only one. Various positions are assumed by the parts attacked, but commonly the elbow is semi-flexed, the thighs adducted, the knees extended, the heels drawn up, and the feet turned inward in the position of talipes equino-varus. This condition is maintained during sleep, and remains constant during the day. It generally ends in more or less sudden recovery, but it may persist for years. In the latter case the muscles undergo a certain amount of wasting. It is believed that secondary sclerotic changes may occur in the cord, and so render the condition permanent.

The rigidity which ensues *after hemiplegia* is called "early" or "late," according as it occurs a few days after the attack, or in the course of a few weeks.

The early variety is much the slighter, and consists usually of a flexion of the fingers and elbow on the paralyzed side, intermitting throughout the day, and usually disappearing during sleep. It is supposed to be due to irritation of the fibers in the neighborhood of the effused blood.

Late rigidity in the upper extremity generally consists of a state of flexion of the various joints. The elbow is bent at a right-angle, the wrist pronated and flexed, and the fingers curved in toward the palm of the hand. This condition is sometimes associated, especially in cases of incomplete paralysis dating from early life, with an irregular spasm, which has been termed *hemiplegia chorea* when it affects the whole limb, and *athetosis* when the thumb and fingers particularly suffer.

Sometimes, though rarely, the elbow is straightened, the wrist extended, and the hand and fingers assume the position of the griffin's claw. The leg is much less frequently affected with rigidity than the arm, but sometimes there occurs a certain amount of flexion of the hip, knee, and ankle. Mobile spasm is also much more uncommon in the leg. The muscular excitability is nearly always increased on the affected side, the various jerks (knee, wrist, and triceps) are exaggerated, and ankle clonus is obtainable. Not only may these expressions of increased irrita-

bility be transmitted to the healthy side, but rigidity itself has been described as occurring in the opposite leg.

It is commonly supposed that late rigidity is due to a secondary sclerosis of the lateral columns of the cord, its extent being determined by the degree of the irritative process.

Meningitis and various diseases of the spinal cord, *e. g.*, disseminated sclerosis, myelitis, etc., may cause rigidity of the lower extremities by inducing spasm. As a rule the thighs are strongly adducted, the knees extended, and the heels drawn up. The same condition often results from acute angular curvature of the spine, and in such cases recovery not infrequently occurs. Rigidity may also ensue in the late stages of atrophic spinal paralysis and peripheral neuritis. It is then due, not to spasm, but to changes in the muscles and the subsequent formation of adhesions in the joints and in the sheaths of tendons.

WILLIAM GAY.

RIGOR.—A fit of shivering indicated by tremulousness of the limbs and chattering of the teeth. The patient feels and looks very cold; his lips, cheeks, nose, and finger tips are livid; otherwise he is pale. In severe cases the fingers appear to be shriveled. The pulse is small and frequent, the respirations hurried and shallow.

The surface of the body is cold, but the internal temperature is raised. The sensation of cold, resulting in shivering, is due to the contraction of the peripheral arteries, which prevents the access of blood sufficient to warm the superficial tissues.

Rigors are common in all forms of malarial fever; and acute diseases, especially pneumonia and erysipelas, are apt to be ushered in by rigor. In children and persons of a neurotic tendency a convulsion may replace the initiatory rigor of acute disease. A rigor occurring in the course of an illness not due to malaria should always suggest the possibility of pus formation, or it may indicate the occurrence of thrombosis. During the rigor, warmth should be promoted by hot drinks, hot-water bottles to the feet, and by wrapping the patient in warm blankets; afterward, treatment will be directed against the disease which was the cause of the rigor.

RINGWORM (*Tinea Trichophytina*).—A contagious disease of the skin due to the presence of a vegetable parasite.

Ringworm of the Scalp (*Tinea Tonsurans*; *Herpes Tonsurans*).—One of the most common and troublesome diseases among children of all classes in this country.

Eruption.—The disease first shows itself on the scalp as single or multiple, circular or oval, irregularly distributed, reddish or grayish, scurfy spots, which may occasionally itch a little. In exceptional cases a little vesication may be present at the spreading edge, hence the misleading term, herpes tonsurans. The most striking feature of the spots is that the hairs over them are scanty, lusterless, stumpy, swollen at the root, with fringed or twisted ends, and often darker in color than the normal hairs. The hairs surrounding the patch are also opaque and brittle. In very young children, or in those whose hair is fine, fair, and scant, the ringed conformation of the patches is often marked, and the affected hairs, instead of sticking up from the surface of the skin, lie matted together. Generally, however, as the spots enlarge they lose their circular form, and by their coalescence form irregular patches which may finally involve the whole scalp.

The rate of extension varies greatly in different cases. In a certain proportion, severe inflammation of the follicles and deeper structures ensues, producing tender, boggy, livid, or red swellings, covered either with thick crusts and scabs or with numerous points of sticky, purulent fluid which correspond to the distended openings of suppurating hair follicles, from which pus can be easily expressed (*kerion*). This condition is not exclusively confined to cases of tinea tonsurans, but is infinitely rarer as an epiphenomenon of other inflammatory diseases of the scalp; it seems to depend rather upon some constitutional peculiarity of the individual than upon special virulence of the micro-organism.

As its consequence the fungus is destroyed, spontaneous cure occurs, but bald patches are very apt to result, from total destruction of the hair follicles.

In another class of cases—not rare—the hairs on the affected patches fall out with their root-sheaths attached, desquamation ceases, and absolutely bald, smooth, shining white patches, like those of alopecia areata, are produced (*bald ringworm*). Characteristic stumpy hairs can, however, almost always be found either at the margin of the patches or elsewhere upon the scalp; if one patch

become thus affected others invariably follow suit.

The most obstinate cases are those of old standing in which the whole scalp is involved, much scaliness and baldness being thereby produced. The condition closely resembles dry seborrhea or eczema of the scalp. Impetiginous inflammation may also arise either spontaneously or as the result of misdirected or too vigorous treatment; in either case it may play havoc with the scalp, causing the disease to spread both in extent and severity, destroying the hair follicles and producing permanent—albeit usually partial—baldness.

Diagnosis is in many cases easy, but in others careful and repeated microscopic examination is necessary for the detection of the cryptogam. If the head be covered with crusts, scales, or scabs, these must first be removed by poulticing or the continuous application of oil, after which the microscope will serve to differentiate the disease from impetigo, eczema, or the early stage of favus, with which it is readily confounded. Old-standing scurfy patches and cases supposed to be cured must be diagnosed from dry seborrhea and psoriasis, and bald ringworm patches from alopecia aureata. In dubious, or nearly cured cases, a useful adjunct or preliminary to microscopic examination is found in the application of pure chloroform, a drop of which, after evaporation, causes diseased hairs to become whitish, while healthy hairs retain their normal color.

Pathology.—The fungus is best seen by examining detached hairs under the microscope (200–300 diameters) in weak liquor potassæ, after the removal of fatty matters by soaking in ether; the preparation is much more satisfactory if the hairs are immersed in liquor potassæ for at least a quarter of an hour before mounting. Some practice is also necessary for the detection of proper hairs for examination, only those which are broken and easily detached, carrying with them the root-sheath, being suitable. The brush-like, distal extremity of the hairs is characteristic. The hair-shaft is seen to be split up longitudinally by innumerable minute round polymorphous spores ($\frac{1}{5000}$ to $\frac{1}{8000}$ inch in diameter) and by long, wavy, transparent tubes or threads of branching mycelium. The spores and mycelium do not, as a rule,

extend outside the inner root-sheath, a fact which explains the rapid cure of patches from which the hair falls spontaneously or which have been effectually epilated; but in very severe cases with perifollicular inflammation they have been described and figured outside the follicle and even throughout the papillæ and corium. The fungus probably finds entrance into the hair-shaft in two ways: after entering the orifice of the follicle and passing downward along the hair-shaft it may pass directly into it and from this point of entrance spread up and down the shaft, or it may be penetrate as deeply as the soft-hair bulb and pass upward with the growth of the hair. In ringworm of the scalp the mycelium is less abundant and less conspicuous than the spores.

Ætiology.—From its extreme contagiousness the disease frequently occurs in epidemic fashion in schools, villages, etc. Actual contact with an affected person, or with articles of toilet used by such, is probably necessary for its communication. As the result of infection from animals (cattle, horses, dogs, cats) it is much rarer than ringworm of the body, but when it does occur it assumes a specially virulent form. It is somewhat rare after puberty, and in the first year of life is only observed in much-neglected children, as repeated washing or any slightly irritant application (*e. g.*, ink) easily cures it when the hair is fine and scanty. Ill-nourished, delicate, and especially strumous children are popularly—but probably incorrectly—supposed to suffer more frequently and more severely than the robust. Second attacks after complete recovery are rare.

Treatment.—(1) *Preventive.*—This is important in large families, and if carefully carried out, is usually successful. In schools, however, it can seldom succeed; hence the necessity for the removal of affected children. The patient should be, as far as possible, isolated, should be furnished with separate brushes, towels, soap, etc., and should wear a light cap, loosely applied to the whole head, and lined with tissue-paper; the lining should be changed daily. Unaffected members of the family should have the hair cut short, washed night and morning with warm water and soft soap, carefully dried, and scrutinized.

(2) *Curative.*—When a case is seen

early, the hair is scanty and the distribution of the disease is ringed, parasiticide remedies prove readily efficacious. In young children strong remedies ought never to be resorted to, as severe dermatitis is liable to be set up. Tincture of iodine, sulphur, and white precipitate ointments are especially valuable and simple applications for such subjects. "Bald" ringworm and kerion undergo almost spontaneous cure, but permanent, patchy baldness is apt to result, especially in the latter case; for such, soothing applications—*e. g.*, ointments of calamine or lead—are indicated.

The great majority of cases, however, come under observation when the disease is diffuse and of old-standing, and their obstinacy depends upon the difficulty of directly attacking the parasite which lies, not on the surface of the skin, but deeply, at or near the bottom of the hair follicles. Mere irritation—*e. g.*, by blisters—which a view to shifting the micro-organism in inflammatory products, is distinctly less successful than the employment of direct parasiticides, which also have generally some irritant action that it is itself of service. Careful attention and considerable personal experience are always necessary to control the effects of treatment and to arrest inflammation at the point beyond which it is attended with dangerous consequences.

In every case the crusts, scabs, scales, or scurf, must be removed by poultices or rags soaked in oil, and by cutting the hair close with scissors. In severe diffuse cases shaving is imperative both for purposes of treatment and observation. Opinions differ as to the propriety of frequent washings; probably the rule laid down by Dr. Liveing is a good one, that the head ought to be washed with soap and warm water once a week if ointments are being applied, but daily if lotions are being used; in either case the scalp ought to be thoroughly dried after washing.

All remedies require careful watching, alteration according to circumstances, and persistence in their application whenever improvement, however slight, is being obtained from them.

The treatment of diffuse cases with much scaling is often beneficially initiated by vigorous washing with hot water and soft soap, the scales being carefully dried

afterward; pure turpentine is then poured over it till pain—usually described by the child as “nipping”—is complained of. The turpentine is then rapidly washed off, the head being again thoroughly dried. Colorless tincture of iodine is then painted over it. This treatment may be repeated in two or three days according to the amount of follicular dermatitis set up. Usually a large number of hairs with root-sheath attached are loosened by it, and may be removed by subsequent washing. One or the other of the following ointments, diluted or concentrated according to the results produced, may be vigorously rubbed into the scalp for ten minutes night and morning. In all lanolin is of special value as a basis, as it facilitates deep penetration of the active parasiticide ingredient, but it must be combined with olive or almond oil to obtain a workable and pleasant consistence. Salicylic acid (gr. x to 3 j ad 3 j) appears, perhaps, the most satisfactory and agreeable and manageable of all remedies. The pure oleates of copper (gr. xxx to 3 ij ad 3 j) and of mercury (3 j to 3 ij ad 3 j) are also very valuable. Although the former is possibly the more active parasiticide its bright green color is in many instances objected to, and it seems more prone to provoke unduly severe dermatitis than the latter. Another useful and popular ointment—the “compound citrine ointment”—is composed as follows: \mathcal{R} Acidi carbolici (Calvert's No. 2), ung. hydrargyri nitratis, ung. sulphuris aa. partes æquales; it must be made without the use of heat, the citrine ointment being rubbed into a mixture of the other two ingredients. It is best used to more limited areas of disease than the preceding.

In *active, spreading inflammatory ringworm* the following lotion is often useful by producing a sort of artificial seborrhea: \mathcal{R} Acidi boracici 3 j, ætheris 3 ss, spiritum vini rectificatum ad 3 vj. In similar circumstances washing the head with soft soap twice daily, carefully drying, then sponging on dilute acetic acid and, while the scalp is still wet, sopping it with the following lotion: \mathcal{R} Sodii hyposulphitis 3 vj, glycerini 3 jss, aquam destillatam ad 3 vj; the nascent sulphurous acid thereby produced seems to act with more certainty and vigor than an ordinary aqueous solution.

In *patchy cases* other methods of treatment are preferable. In quite recent cases blistering with acetic acid, liquor epispasticus, or a solution of corrosive sublimate (grs. iv ad 3 j) is often promptly curative, but the tendency of these remedies to provoke acute suppurative inflammation must always be borne in mind and due caution exercised in their application. In young children, where the hair is fine and patches ringed, speedy cure is generally easily affected by less severe measures—*e.g.*, ammoniated mercury ointment, diluted compound nitrate of mercury ointment, or tincture of iodine. To patchy cases, whether recent or old, the treatment by epilation is specially, or perhaps even exclusively applicable. As it is attended with considerable pain it cannot well be employed when dealing with young children, but above the age of six years they can generally be made to stand it. It is usually advisable to deaden the sensibility of the part by the previous prolonged application of glycerine of carbolic acid, or of a ten per cent. solution of cocaine in oil and lanolin. In other cases the ground may be prepared by ointment of the oleates already mentioned, carefully graduated so as to cause effusion into the follicles short of suppuration. After any of these preliminary measures, epilation may be effected either by attacking the hairs singly with fine forceps, a limited area—say half a square inch—being cleared daily, or with large forceps which extract several hairs at a time, but the latter process is the more painful and the less satisfactory. A parasiticide ointment ought subsequently to be well rubbed into the denuded area. Epilation on a large scale may be carried out, by painting on Coster's paste (\mathcal{R} Iodi 3 ij, olei terebinthinæ decolorati, vel creosoti, vel olei cadini 3 vj) with a hard brush for three or four days, after which a black crust forms; if this be removed with forceps, a large number of diseased hairs are detached. The method is, of course, a rough one, but it may be followed by instrumental epilation, the patch being further prepared by washing with flannel and soft soap. Sometimes excellent results are obtained by covering the patches daily with a solution of salicylic acid in collodion (3 ss to 3 j ad 3 j) after epilation, or independently of it.

In a certain number of very obstinate

localized or discrete patchy cases the only effectual means at our disposal is the artificial production of kerion, and this is best accomplished by plunging into each hair follicle a fine needle previously dipped in croton oil.

Impetiginous inflammation, whether it arise spontaneously or as the result of over-zealous treatment, must be treated on the usual lines, by the removal of scabs, and the use of ammoniated mercury ointment.

Finally, it must be reasserted that no case ought to be pronounced cured so long as any scaling remains, and until repeated microscopic examination fails to reveal the presence of trichophyton. Even then it is a wise precaution to continue the use of some mild parasiticide ointment for some weeks.

Ringworm of the beard (*Tinea Sycosis*; *Mentagra vel Sycosis Parasitica*; *Barber's Itch*) is the result of the irritating effect of trichophyton upon the follicles of the hairy portions of the face, the beard and whiskers being very much more frequently attacked than the mustache.

The disease is much commoner than is generally recognized. Sometimes, and especially in children suffering from ringworm of the scalp, it affects the eyebrows. Much more rarely in adults the pubes or other hairy portions of the trunk are attacked. It is especially common in countries where the inhabitants do not habitually shave themselves but patronize a barber for that purpose, the disease being communicated by the soap, shaving-brush, or towels rather than by the razor, and in either case some breach of surface (microscopic, it may be) is probably necessary for its communication. This also explains the comparative infrequency of infection from children to adults. In a few recorded cases the disease has been communicated from animals to man.

Eruption.—In persons who wash and shave regularly the disease usually presents itself as circular, scaly, itchy patches or rings in the beard, very rarely on the upper lip. These extend at the periphery, and coalesce to form gyrate patches with convex spreading margins often slightly vesicular. In this stage the condition is easily curable, like ringworm of the body. Should its nature not be recognized, or should it be allowed to extend, slight pustular folliculitis supervenes. In less cleanly persons the progress is very rapid;

glairy purulent discharge from the follicles becomes abundant, dries up on the surface to form thick crusts matting together the hairs, and violent peri-folliculitis ensues. This leads to the formation of large red or livid, boggy or brawny lumps practically identical with "kerion" of the scalp. Pus oozes from the dilated hair follicles of these lumps, and the loosened hairs can be painlessly extracted, this latter point being of diagnostic importance in differentiating the disease from simple follicular sycosis, in which, the inflammation being primarily peri-follicular, the hairs are not detached with the same facility. The frayed broken extremities of the hairs are not so marked a feature as in tinea of the scalp, but the other microscopic appearances are similar. Generally speaking, the spores are larger than in tinea of the scalp, and the mycelium more abundant.

Prognosis.—In cases seen early this is favorable, but old standing cases are remarkably obstinate, and the disease often breaks out afresh after apparent recovery. The cure is frequently followed by patchy baldness, the hair follicles having been irremediably destroyed. The microscope is necessary for absolute differentiation from simple follicular sycosis, eczema, and pustular syphiloderma, all of which occasionally closely simulate parasitic sycosis.

Treatment.—Epilation is by far the most important factor in treatment. It is generally advisable to clear an area of about one square inch daily, and the process is comparatively painless, for reasons already explained. After each epilation one of the parasitic ointments mentioned under tinea of the scalp is advantageously employed. A diluted ointment of the red oxide of mercury appears occasionally of special service. A point worthy of note is that poultices do much harm, by causing the disease to spread.

Ringworm of the body (*Tinea Corporis*; *T. Circinata*; *Herpes Circinatus*) is the condition produced by trichophyton, as it affects those parts of the skin which are only provided with lanugo hairs. It is, of course, of frequent occurrence in children suffering from ringworm of the scalp, and in them, as well as in the great preponderance of adult cases, recovery is easily brought about, and is frequently spontaneous, as

the fungus does not find a favorable nidus among the surface epidermic cells. In cases communicated from animals, however, and in the tropics, peculiar virulence is often manifested. The patches are most commonly situated on the neck, face, and hands, but may occur anywhere. They are at first sharply defined, circular, slightly raised, pinkish, and covered with fine gray scales. They partially clear up in the center, but extend peripherically to form rings, or even occasionally concentric rings, the margin of which is often faintly vesicular, and rarely bullous; this latter condition being commonest in young children and in regions (*e. g.*, flexures) where the skin is thin. By the coalescence of adjacent rings and the disappearance of active disease at the points of coalescence, extensive gyrate patches with festooned margins are formed, and may occupy large areas. Itching is seldom a prominent symptom.

Eczema Marginatum.—The disease described by Hebra under this name is the most severe form of ringworm of the body. It is rather rare in its most aggravated form, but moderately severe cases are not infrequent. Its seats are the groins, fork, axillæ, and occasionally the popliteal spaces, where the apposition of folds of delicate skin, heat, and moisture combine to afford the most suitable conditions for cryptogamic growth, and for the development of secondary dermatitis. The well defined, festooned, raised margin is usually diagnostic; and microscopic examination of scrapings seldom fails to reveal conidia and mycelium.

Diagnosis.—Ringworm of the body may be mistaken for multiform erythema, pityriasis rosea, psoriasis—especially in young people and of the gyrate form—dermato-syphilis or eczema seborrheicum corporis, to the separate description of which the reader is referred.

Treatment.—The great majority of mild cases are cured in a week or ten days by a sulphur or ammoniated mercury ointment, or a hyposulphite of soda lotion. The most severe form is, however, very obstinate; for such, salicylic acid is generally the most efficacious remedy, the solution in collodion being used. A five to fifteen per cent. solution of chrysarobin in liquor gutta perchæ (B. P.), similarly applied, is also very efficacious, but its action must be carefully watched, as it is apt to cause violent

dermatitis. Vigorous washing with soft soap, followed by ointments of the oleates of copper or mercury, is often curative in cases of intermediate severity.

J. J. PRINGLE.

Symptomatic Indications.—The main remedy for tinea tonsurans is *sepia*; for tinea capitis, *calcareæ mur.*; *antimonium tart.* is useful when there is much gastric derangement; nausea; vomiting; white-coating on the tongue. *Viola tricolor*, tinea capitis, with much distressing itching. *Silicea* is valuable when there is much suppuration; itching, humid eruption.

RODENT ULCER.—See ULCERS.

ROSACEA.—See ACNE ROSACEA.

ROSEOLA.—Much difference of opinion exists among dermatologists concerning the disease usually classed under this heading. Willan has described, under the name of roseola, a variety of rashes which are not recognized by all writers, and Hebra especially doubts their existence. There may be some difficulty in agreeing with Willan in the correctness of describing as separate affections *R. infantilis*, *R. æstiva*, *R. autumnalis*, *R. annulata*; but we shall mention a rash under the name of roseola which is by no means limited to one period of the year. A roseolous rash, occurring in association with some of the acute infectious diseases, has been described under the head of these diseases.

Definition.—Roseola is an acute disease characterized by the production on the body of small rose-colored papules, and attended by very slight constitutional symptoms, which make their appearance at the same time as the rash.

Symptoms.—The rash consists of minute red and slightly elevated spots, scattered over the chest and neck, less often extending over the face and arms. They disappear temporarily on pressure, last but a few days, and fade, leaving a discoloration of the skin, but are sometimes followed by slight desquamation. Feverishness, headache, and occasionally vomiting are present at the commencement of the rash.

The constitutional symptoms are, however, slight; the temperature is seldom as high as 102° F., and more often only just above normal. The fauces are frequently a little injected, but the red-

ness does not extend beyond the edge of the soft palate, and the tonsils are not swollen. The tongue is slightly furred, and the papillæ along its edge are often prominent.

Diagnosis.—Roseola is often mistaken for scarlatina, and the diagnosis between the two affections is frequently a matter of considerable difficulty. They differ in the fact that the papules in the former are more widely separated from each other than those in the latter, and the skin intervening between the papules does not become red in roseola, as it does in scarlatina. The constitutional symptoms in roseola appear at the same time as the rash, while in scarlatina they precede it. Roseola is not infectious, and occurs more frequently among young women and children than other persons.

Prognosis.—Roseola always ends in recovery in a few days.

Treatment.—Nothing is required beyond rest for a day or two.

MALCOLM MORRIS.

RÖTHELN (German Measles).—A specific and infectious eruptive fever, distinct and separate, neither a hybrid of scarlet fever and measles, nor a modified form of either of those diseases.

Rötheln is infectious, breeds true, and one attack of it affords great protection against a second one, but does not protect against scarlet fever or measles. Persons actually suffering from rötheln have been known to contract scarlet fever, and being exposed to the infection of measles have developed a well marked attack of that disease. The converse has also happened. In seasonal prevalence, also, it differs markedly from scarlet fever and more slightly from measles. The great majority of attacks occur during March, April, May, or June, agreeing in this with measles, but differing in that measles has a second period of prevalence in winter. The maximum prevalence of scarlet fever is in autumn.

Rötheln attacks both children and adults, but as the majority of cases are of a mild type, of which the infectiousness appears to be slight, many people escape until they have reached maturity, and very many seem to be insusceptible.

The *period of incubation* is most commonly eleven or twelve days, but it frequently extends to fourteen, and in some instances to seventeen days.

Symptoms.—In mild attacks there are often no premonitory symptoms, but those most commonly present are sneezing, lachrymation (which latter, however, more often follows, or is synchronous with the appearance of the rash than precedes it), and a more or less general enlargement of the superficial lymphatic glands, especially of those on the mastoid processes and behind the sterno-mastoid, and those of the posterior chain, of which the upper ones below the occipital protuberance are the more often perceptibly affected. The glands may be enlarged for some days (in a few instances for from eight to twelve days) before the appearance of the rash. The temperature seldom exceeds 100° F. at any stage of the attack, and is normal in many cases. The appetite for food is scarcely impaired.

Eruption.—This, which is often the earliest sign of the disease, appears first upon the face and scalp, but quickly spreads to the trunk and limbs, being frequently well marked on the palms of the hands. Its appearance is seldom delayed beyond the second day of the illness. It consists of very slightly raised rose-colored spots, varying in size from little more than a mere point to $\frac{1}{8}$ inch in diameter. They are scattered thickly, and may be arranged in crescents, rings, or masses. On their first appearance the spots are separated by intervals of white skin, and the rash is distinctly measly looking; but quickly, often within a few hours, a noteworthy change occurs in many cases. The spots upon the face, which had previously been visible quite up to the edge of the lips, become obscured and sometimes obliterated by an even pink flush, while those on the body are transformed into a more or less punctiform erythema, which may very easily be mistaken for the rash of scarlet fever. This change soon spreads to the limbs, and the rash quickly disappears, usually within three days. Slight itching is sometimes complained of. A very slight branny desquamation of the face and neck may follow.

In more severe attacks of rötheln the symptoms are much like those of measles, the prodromal period sometimes extending to three days, the catarrhal symptoms being more marked and soreness of the throat seldom absent; the tonsils being red and swollen, and the palate reddened

in small patches. The temperature may rise to 104° F., and there may be severe lumbar pain. The rash is darker in color, the spots are larger, remain separate and distinct, and may leave a brownish or even a purple stain. Bronco-pneumonia and laryngitis have been known to occur as complications.

Melancholia or mania may follow even a mild attack of r  theln, as of morbilli or scarlatina.

Diagnosis.—From scarlet fever it may be distinguished by the measly character of the rash at first, and by its appearing on the face and invading the oral circle; by the enlargement of the glands, by the coryza, and by the absence of the characteristic desquamation. In very young children the diagnosis is sometimes rendered difficult by the minuteness of the spots composing the rash.

From measles it is to be differentiated by the usually shorter prodromal period, the enlargement of the glands (nearly always), by the lighter color and smaller size of the spots. In some cases the diagnosis from measles is very difficult.

From variola, papular eczema, copaiba-rash, and urticaria the diagnosis is usually easy; but in a very small minority of cases of r  theln the spots are as much raised and as hard as are the papules of variola.

Prognosis is favorable.

Treatment, except of the rare complications above mentioned, is unnecessary. In severe cases the attack should be treated as if it were one of measles.

The enlarged glands soon shrink. If very tender, they should be shielded.

E. O. HOPWOOD.

Symptomatic Indications.—*Aconite* or *belladonna* may be useful in the beginning if the febrile symptoms are marked; *pulsatilla*, for catarrhal condition, diarrhea, and catarrh of the intestines. See MEASLES.

ROUND-WORMS.—The *ascaris lumbricoides*, or round-worm, is a nematode similar in shape to the common earth-worm. The head presents three labial papill  , the body is cylindrical, about $\frac{1}{4}$ inch in diameter, varies in length from 9 to 15 inches, and tapers at both ends, but especially toward the tail. The female is considerably longer than the male. The ova are very minute, elliptical, and of a dirty brown color, with a

thick nodulated covering, and often exist in immense quantities in the f  ces. There must be some intermediary host, presumably an animal that can live in water, for the drinking water has in many cases been proved to be the source of infection in man, but the complete life cycle is unknown. The round-worm lives in the jejunum and feeds on its contents; probably it does not remain more than a few months in the bowel and is then passed per anum; or, it may find its way into the stomach and be expelled by vomiting; occasionally it makes its way into the biliary passages, or even into the thoracic or abdominal cavity. It may escape at the nose, or pass into the larynx. A single worm or a large number may be present; usually, however, there are only a few. Children are much more commonly affected than adults.

The *symptoms* are not characteristic; dyspepsia, shooting pains, nasal or anal irritation, may be complained of, and sometimes nausea, vomiting, and diarrhea. When large numbers are present there may be nervous symptoms, such as twitchings or actual convulsions and delirium: these occur especially in neurotic subjects. Death may result from peritonitis, following perforation, or laryngeal obstruction. Not infrequently no symptoms are observed until the child passes the worm.

Treatment.—Santonin in doses of from 1 to 3 grains for a child, or double the dose for an adult, followed by a purge of aloes, scammony, rhubarb, or jalap constitutes the best treatment; the drug may be given every day, or occasionally, so long as any ova can be found in the f  ces by microscopical examination.

Santonin, in medicinal doses, occasionally produces symptoms of poisoning, the most prominent being yellow vision (xanthops) and high-colored urine; these are less likely to occur if a purgative be given after the drug, and, as a rule, they quickly subside when the treatment is suspended.

RUBEOLA.—See MEASLES.

RUPIA.—A superfluous term, but one still in current use to denote a variety of pustular syphiloderm, characterized by the formation of large, dirty brown, stratified, conical crusts, like limpet shells. This form of scab is due to the successive

hardening of purulent discharge from the ulcer which is invariably present beneath, and which exhibits the typical foul base and punched-out edge of syphilitic ulcerations. The condition generally occurs in old syphilis; but in a much greater proportion of cases than is usually recognized, it shows itself early within the first year. Its precocious development is an expression either of extreme virulence of the syphilitic virus, or of great constitutional depravity on the part of the patient. Scabs or crusts somewhat similar to those of rupia sometimes form in cases of impetigo, or of psoriasis (*P. rupioides*), but the presence and characters of the ulcer of syphilitic rupia easily determine the diagnosis. The scars left by the eruption are deep, at first much pigmented, and indelible. For details of treatment reference must be made to **SYPHILIS OF THE SKIN**.

J. J. PRINGLE.

SACRO-ILIAC DISEASE.—*Causes.*

—Either struma or injury, or both together.

Symptoms.—Local pain and tenderness. Pain during defecation, sometimes also during micturition. Peculiar posture. Patient bends his body over from the affected side, “for the purpose of removing pressure from the diseased structures by bringing the weight of the limb to bear upon the ilium.” Hence obliquity of the pelvis and apparent lengthening of limb on side of disease. When abscess forms, it may appear either over the articulation, or in the buttock, loin, groin, or even rectum.

Diagnosis.—From neuralgia, sciatica, and Pott’s disease, but, above all, from hip-disease. In sacro-iliac disease, if the pelvis be firmly fixed, the hip-joint can be moved normally and painlessly. In sufficiently advanced cases, the pelvis can be seen to be deformed; and when abscess has opened, a probe will often reach dead bone. Sayre’s vertebrated probe may be useful. When the pelvis is not fixed, either lateral compression of trochanters, or abduction of thigh causes pain.

Prognosis, bad.

Treatment.—Rest, extension, and counter-extension. Sayre puts a thick-soled shoe on the foot of sound side so that the affected side swings free of the ground when the patient moves out of

doors on crutches. Before suppuration takes place, use counter-irritation, especially the actual cautery. Dead bone, if detected by probe, should be removed, if possible. Cod-liver oil, iron. High, dry, and healthy localities.

C. B. KEETLEY.

SACRUM, FRACTURE OF.—See FRACTURES.

SARCINA.—A vegetable organism found in the vomit in gastric disorders of long standing, and especially where the food is retained owing to obstruction of the pylorus or dilatation of the stomach from atony of the muscular coats.

Sarcinæ are present when the contents of the stomach have undergone a certain amount of putrefactive change, and are not diagnostic of any particular condition or disease. Sarcinæ are also occasionally present in the urine in cases of stricture of the urethra or of enlargement of the prostate.

Under the microscope the organism presents an appearance which has been compared to a corded wool-pack, its component cells being arranged in squares of four, sixteen, or thirty-two. If a drop of liquor potassæ be added to some of the vomit on a slide, the recognition of the growth is facilitated.

SALIVATION.—Increased flow of saliva is a frequent and troublesome symptom, which may be brought on by a variety of causes. In some cases the secretion is not actually formed in excess, but is allowed to flow from the mouth instead of being swallowed, so that it appears to be produced in abnormal quantity. The amount discharged varies greatly, but it may be exceedingly large, either continually running from the mouth, or causing the patient to be perpetually spitting or swallowing, or to saturate several handkerchiefs daily. The fluid is not quite identical in composition with healthy saliva, and may be mixed with various morbid materials. It contains some mucus, with numerous epithelium cells. Its reaction is alkaline, and it yields a good portion of fat, but after a time little or no ptyalin or sulphocyanide of potassium can be detected. Albumin is sometimes present. Digestion is generally impaired, and marked emaciation may be produced.

Sometimes the fluid is ejected from the stomach in considerable quantity after having been swallowed.

Ætiology.—1. More or less salivation accompanies the various sources of local irritation in connection with the mouth already considered, such as stomatitis or ulcers; being also produced by irritating substances taken into the mouth. These act by causing reflex excitation. 2. Reflex irritation through other nerves often induces ptyalism. Thus it may be associated with throat inflammations, many diseases of the stomach and pancreas, or worms in the intestines; while it is a symptom very commonly observed in cases of pregnancy. 3. In certain nervous diseases salivation is not uncommon, as in various forms of insanity, hydrophobia, hysteria, paralysis, and neuralgia of the face. In some of these affections it is produced in a reflex manner; in others, as the result of some direct cerebral influence. 4. Certain metallic and vegetable substances, when taken for some time, induce ptyalism, by causing local irritation, and also by directly influencing the secretion of saliva. Of these the most important is mercury, but iodine and other substances have sometimes a similar action. 5. Critical salivation is observed in some cases of fever, but salivation in febrile diseases is not always connected with a crisis. 6. Infants and old people are liable to an excessive flow of saliva. In the former this is often associated with dentition. In both classes of subjects there is frequently no excess of secretion formed, but the saliva is allowed to escape from the mouth instead of being swallowed. 7. Idiopathic salivation is that form which occurs without any obvious cause.

Treatment.—1. The cause must be sought out, and, if possible, removed. In many cases this is all that is required. 2. Astringent mouth-washes are useful, such as solution of alum, tannic acid, oak bark, or weak mineral acids; or alum may be sucked. 3. Opium is recommended as a valuable internal remedy in obstinate cases of ptyalism.

FREDERICK T. ROBERTS.

Symptomatic Indications.—*Nitric acid* is the main remedy when of mercurial origin. *Mercurius*, when idiopathic. *Antimonium tartaricum*, when associated with gastric derangement, sponginess, and bleeding of the gums.

Sulphur, mercurius, and *arsenicum* in the salivation of pregnancy are valuable; the latter especially in obstinate cases.

SARCOCELE.—See TESTICLE, DISEASE OF.

SARCOMA, SARCOMATA.—See TUMORS.

SCABIES (Itch).—A contagious dermatitis, due to the presence of the arachnoid parasite—*sarcoptes* (vel *acarus*) *scabiei*.

Sarcoptes scabiei.—The female, visible to the naked eye, is of a pearly white color and considerably larger than the male, measuring from $\frac{1}{60}$ to $\frac{1}{80}$ of an inch in length. The body is irregularly circular, the head conical and armed with four powerful mandibles. A sucker is attached to each of its four anterior legs and a strong bristle (seta) to each of its four long posterior legs, which tilt the animal up and direct the anterior extremity downward toward the skin. There are also a few bristles on the dorsal and ventral aspects of the body, which, being directed backward, prevent the egress of the animal from the skin which it has once penetrated. They have a distinct curved vagina, ovaries, and ovipositor. They pierce the epidermis, and, when impregnated, penetrate deeper into the rete, forming burrows (cuniculi) in which they deposit their ova, probably two or three daily, up to the number of fifty, after which they die; the average duration of their existence being from two to three months. The male is about two-thirds the size of the female, and is provided with distinct testicles and a sucker on each postero-internal leg for purposes of copulation; the penis is supported by a chitinous framework. The male only penetrates the skin after fertilizing the female and in its immediate neighborhood, where it soon dies.

The ova rapidly segment, becoming larvæ with six legs in about six days. At the end of about three weeks, after two or three moultings, they have eight legs and are sexually mature.

Eruption.—The dermatitis produced by *sarcoptes scabiei*, and by the effects of consequent irritation and scratching, is characterized by multiform, inflammatory lesions without definite grouping, but sufficiently characteristic in distribution to be generally easily recognizable at a

glance. The initial lesion is a burrow, straight or irregularly sinuous, sometimes visible to the naked eye—and always easily discernible with a lens—as a whitish or reddish line with a white spot at the end, which represents the insect. The burrows vary from $\frac{1}{8}$ to $\frac{1}{4}$ inch in length, but may be much longer; they are often brownish or black from accumulated ova, fæces, *débris*, and adherent dirt. The female lies at the distal, closed end, and the oldest, *i. e.*, most mature, ova nearest the entrance, from which they easily escape on maturity, as the surrounding epidermis is exfoliated. The seats of election correspond to those regions where the skin is most delicate and thrown into folds, and are: the web between the fingers and toes, the inner side and anterior aspect of the wrists, the back of the hands and forearms, the axillæ, mammæ, front of the abdomen, fork, and penis. Only in young children at the breast, and in excessively dirty persons, are the face and head ever affected. Almost invariably a papular and vesicular rash, intensely itchy at night, results, which, in children and unhealthy subjects, becomes rapidly pustular and scabby. As the result of scratching, erythematous, urticarial, and “ecthymatous” rashes develop, even where burrows are scarce or, perhaps, absent; these are especially common on the anterior surface of the abdomen and thighs, and on the buttocks, where scabbing is often a pronounced feature. These secondary lesions are often determined by friction or pressure, *e. g.*, of belts; thus tailors and shoemakers, who are constantly seated on hard boards, have them over the ischial tuberosities, and miners, who work leaning upon one elbow, over the olecranon process.

Diagnosis is generally easy, the polymorphism, distribution, and absence of grouping of the lesions being sufficient to distinguish the great majority of cases of scabies from eczema. The detection of burrows is of importance, and a sarcoptes can generally be discovered in the distal extremity of some of these and easily extracted with the point of a fine needle. In severe cases, however, the burrows may all be torn open by violent scratching, and in children or persons in general bad health their discovery is often rendered difficult, from rapid vesication and abundant pustulation and scabbing.

Treatment, if carefully carried out, is almost invariably successful in the course of a few days. The burrows must be opened and foreign matters removed from the surface of the skin by a prolonged warm bath every night, followed by thorough soaping, preferably with soft soap, if the skin will stand it. Sulphur ointment (3 j ad 3 j) may then be applied all over the body in severe, or only to the affected regions in mild, cases; it is frequently prudent, or even necessary, to dilute the sulphur ointment. The clothes of the patient, and the sheets between which he sleeps, should be either destroyed or purified in a disinfecting oven; and it is, of course, necessary to treat similarly all persons in intimate contact with the patient suffering from, or even supposed to be suffering from, the disease. The sulphur treatment, if carefully carried out, is almost always effectual in bringing about a cure in three or four days, but is more suitable for public than for private practice, as the odor of the ointment is offensive. It often causes severe and obstinate dermatitis, which may be mistaken for a persistence of the malady; and it may reveal the nature of the disease, which it may be desirable to conceal from the patient. In place of the sulphur ointment Vlemingkx's solution, or the liquor calcii sulphidi, may be painted on at night with a stiff brush and removed by a warm bath in the morning, six or eight hours afterward. In private practice ointments containing naphthol (3 j or 3 jss ad 3 j) or styrax (3 ij or 3 iv ad 3 j) are almost as efficacious as the sulphur preparations, do not cause dermatitis, and the former has the advantage of being inodorous.

J. J. PRINGLE.

SCARLET FEVER.—An acute specific infectious fever, characterized by the appearance upon the trunk and limbs of a minutely punctiform scarlet rash, which is followed by desquamation.

The *incubation period* is usually of about three days' duration, but may be much shorter in some cases and longer in others.

Symptoms.—The onset is sudden in well marked cases, but in very mild ones both the pre-eruptive and the succeeding stages of the disease may escape observation.

Pre-eruptive stage.—The most distinct-

ive symptoms of this period are feverishness, pain, and difficulty in swallowing, vomiting or nausea, and a white-furred tongue with red edges and prominent red papillæ; but any or all of them may be absent in slight attacks, and some of them in more severe ones, although it is probable that in all cases some reddening of the fauces may be seen. Aching pains in the limbs or back may be complained of, and there may be well marked rheumatism even in this stage of the disease. The pulse-rate is much increased. The temperature in simple cases seldom exceeds 103° F. and may tend to fall; but in severe attacks it may be several degrees higher. In the mildest it may not reach 99° F. The state of the tongue is usually as described above, but there may be neither redness nor fur of more than ordinary thickness, nor enlargement of papillæ, conditions which, moreover, are found in cases of disease other than scarlet fever. The tonsils, uvula, and soft palate are red, swollen, and covered with sticky mucus, or dry and glazed. The inflammation may extend forward on the covering of the hard palate, even as far as the teeth, or, on the other hand, it may be limited to the tonsils, of which the follicles may be distended with secretion, or which may be the seat of abscesses. On the soft palate and uvula small congested points may often be seen, while in other cases the redness is uniform. A soft white film may cover the surface of the tonsils, but rarely affects the uvula. The glands at the angles of the lower jaw are commonly enlarged. In very severe attacks diarrhea may come on at the same time as vomiting.

Drowsiness and listlessness are often among the earliest signs of the disease in children, in whom also delirium at night is common; but convulsions are rare, unless the disease be of a grave type.

As a rule, this stage lasts about twenty-four hours, but it is sometimes much shorter, or may extend to three or four days in very exceptional cases.

The eruptive stage.—This is marked by the appearance, first upon the chest and neck, and shortly afterward upon the rest of the trunk and on the limbs, of a finely punctuated scarlet rash. This is not, however, the invariable order, the rash being in some instances seen first upon the limbs, more especially upon the front of the wrists or ankles, on the inner surface

of the thighs, or in flexures. It very seldom appears upon the face, the cheeks being merely flushed, while a white ring surrounds the mouth. In a very small minority of cases the rash appears only on isolated tracts, or not at all.

The rash is made up of minute scarlet points lying very close together, separated by skin which is usually normal in color, but is frequently of a pink or even darker tint. In the latter case, pressure may show that there is a persistent yellow ground color. Complete coalescence of the spots may take place; it is commoner on the trunk and thighs than on other parts, and in adults than in children. The elevation of the reddened spots is in most cases microscopic, except on the backs of the hands and feet, in which situations, as also among others, in front of the shoulders, minute vesicles may form. In severe cases, the rash is, as a rule, deeper and sometimes purplish in color, or hemorrhagic. Even after the fading of a well marked rash, persistent blood-colored lines may not uncommonly be found in the folds in front of the elbow, a point which is of some importance diagnostically. In a small percentage of cases there is swelling of the skin of the face; in many only the hands are perceptibly affected. Itching is sometimes complained of, more often when the rash is fading or desquamation is beginning. In the majority of cases the rash reaches its limits by the second or third day, and then fades within a few days; but, in very slight attacks, it may come and go within a few hours, while in severe ones it may not fade for a fortnight. With the rash, or shortly after it, urticaria, eczema, or acute dermatitis may make their appearance in exceptional cases.

Very quickly, often on the first, and usually by the second or third day of the disease, the temperature reaches its highest point, near which, with slight morning remissions, it remains for a period the length of which depends upon the severity of the attack and the presence or absence of complications. It may not exceed 99° F., or may rise to more than 106° F. If death does not occur the temperature begins to fall, but not so rapidly as it rose, the morning remissions becoming more marked and the evening temperature falling gradually. The pulse-rate may not exceed 80 in very mild attacks, but, as a rule, it is much higher, and in severe cases

may be uncountable. Signs of cardiac failure occur early, if the disease be of malignant intensity, but otherwise the heart rarely appears to suffer, although acute dilatation has sometimes been noticed. Other affections of the circulatory system are rare, but in one case gangrene of the leg followed thrombosis of the femoral artery. Albumin may appear in the urine as during other fevers.

Slight delirium may come on at night, even in mild attacks in children, and during defervescence in adult males. In severe attacks it is often well marked, and may be followed by coma.

The inflammation of the throat may become more intense and, especially in children, may extend to the nose, and thence by the eustachian tube to the ear, or by the lachrymal duct to the eye. In the first case, perforation of the tympanic membrane, suppuration in the mastoid cells, and meningitis may follow, and in the second, lachrymal fistula, conjunctivitis, and even destructive inflammation of the eyeball. The tonsils, soft palate, or epiglottis may slough, but the process rarely extends to the larynx and trachea. Stomatitis and glossitis occur only in exceptional cases, but superficial ulcers often form on the tongue. The glands at the angles of the lower jaw become swollen and abscesses may form in them, or a hard brawny swelling may take place, and either process, but especially the latter, may lead to extensive sloughing or melting away of the tissues of the neck and to hemorrhage, or to septicæmia, or, more rarely, to pyæmia.

Pain of a rheumatic character, in joints or muscles, is complained of in most cases, and some joints may be swollen and tender, but the heart is affected much less often than in rheumatic fever.

Pleurisy is of rare occurrence in scarlet fever, and would appear to be due to secondary septicæmia. If liquid be effused it usually rapidly becomes purulent. Bronchitis and broncho-pneumonia, cellulitis and jaundice may have the same septic origin.

Pregnant women do not, as a rule, miscarry when they are affected by this fever.

Desquamation.—After nearly all attacks of scarlet fever, even when there has been no rash, desquamation occurs and may begin as early as the third day of the disease, or not until some weeks later. It is an orderly process which in

most cases is completed in from six to seven weeks, in some not for several months and in a very few within a month. It is usually seen first upon the face and neck, especially upon the eyelids and ears, and then, in order, upon the trunk, shoulders, and arms, legs, hands, and feet, but in warm moist parts the process may begin out of turn. As a rule, the hands begin to peel during the third week, and the feet during the fourth. The layer of skin may be shed in small scales or in large pieces, separation usually taking place by the widening of the areas of numerous small circles, "pinholes," which first form, but the patches of hard skin upon the hands and feet are in most instances attacked from their edges only, those upon the heels being nearly always the last to fall off.

Sequelæ.—It is while this process is going on, that is to say during the period of convalescence, that certain secondary affections or sequelæ may show themselves, especially in children, of whom the unhealthy and ill-nourished are the more liable to be attacked. There is a marked tendency toward the coupling or association of sequelæ in the same individual. How these affections are caused by an attack of scarlet fever is unknown, but it is conjectured that the elimination of some irritating substance produced by the virus of the disease may account for the nephritis which often follows. The case-incidence of nephritis is increased among scarlatinal patients if they be treated in buildings to which air from drains has access, possibly also in close rooms, and there is a well-marked "family predisposition."

The sequelæ most often met with are kidney and ear disease and swelling or abscess of the glands at the angles of the lower jaw. More rare is rheumatism (late), and mania and melancholia are still more rare.

The disease of the kidneys, which is commoner among males and in childhood, is as a rule very slight, if indeed the mere presence for a short time of a trace of albumen in the urine may be taken as proof of its existence, but, on the other hand, it may quickly prove fatal. It most commonly commences at the end of the third week. Recovery from it usually takes place, but the disease may pass into the chronic form although even in that case the patient's health may not

be apparently impaired (*see* BRIGHT'S DISEASE, ACUTE).

Ear disease may come on many weeks after the inflammation of the throat has subsided and without there having been discharge from the nose. It rarely occurs in patients over ten years old. Suppuration takes place in the middle ear, and the membrana tympani is perforated. The process is frequently painless.

The disease may extend to the mastoid cells, and the usual serious consequences may follow, but as a rule recovery is complete in healthy persons.

A *relapse*, or true second attack of scarlet fever, occurs in about one-half per cent. of cases at any time from the tenth day of the first attack, and is followed by a second desquamation. It may be of any grade of severity.

Diagnosis.—In its onset scarlet fever most nearly resembles the illness sometimes caused by eating shell-fish, etc., in which, however, sore throat is much rarer, and when present is characterized by less swelling of the tonsils and by a more patchy redness of the fauces. The severe scarlatinal sore throat is most like that caused by "drains," or that which is found in some cases of septicæmia. The "strawberry tongue" is not by any means a constant sign, nor is it diagnostic when present. The rash resembles in character that produced by eating shell-fish, etc., the fading rōtheln rash, a prodromal variola rash, typhoid roseola, some forms of acute dermatitis, a rash which sometimes accompanies septicæmia, and the more or less punctiform erythemata produced by various drugs and by other and unknown causes. The occurrence of nephritis or the appearance of characteristic desquamation may confirm the diagnosis of scarlet fever in doubtful cases.

Prognosis.—The disease usually terminates by recovery, but the mortality varies much with age, with social status, and with the epidemic type. Of patients under five years of age about twenty per cent. die, while above that age the mortality does not as a rule reach five per cent., and may be much lower if the prevalent type of disease be a mild one. As a rule the better the social status the better the chance of recovery, and the smaller the probability of complications and sequelæ arising. The prognosis is grave if signs of collapse show themselves at the onset of the

attack, or if there be persistent diarrhea or vomiting. High temperature is not of itself necessarily dangerous, but if it be accompanied by delirium or coma, the probability of recovery is small, and it is not much greater if high temperature and sloughing of the fauces be associated.

Ætiology.—The *exciting cause* is almost certainly a micro-organism, as to the precise nature of which, however, observers do not agree. It is said to cause a disease in some other animals, especially in cows, whose milk, when they are thus affected, is believed to have originated scarlet fever in human beings. It appears to be most active in autumn, but whether this be due to meteorological conditions increasing the potency of the germ or the receptivity of the human organism is unknown. At least one-half of the population of this country never contracts scarlet fever. The virus is capable of retaining its vitality for a long time outside the human or other body, but is more easily destroyed by physical and chemical agents than are many other poisons. An attack of scarlet fever affords a large measure of protection against subsequent infection, but is not so effectual as is the case with most of the other acute specific diseases. The infection probably exists in all parts of the bodies of persons affected with the disease, even in its earliest stages, and is given off in all that comes from them, though it does not seem to be carried to any great distance by the air, or at least not in such a way as to be a source of danger. It attaches itself to fomites, and finds a favorable nidus in articles of food, especially in milk. It is not readily carried from a person affected with scarlet fever to another by means of a third person who is not suffering from the disease, and free dilution with air appears to render it harmless.

The virus may obtain entrance into a house by means of defective drains, the type of disease being made much graver by the combination of poisons. Under such circumstances, some of the inmates may suffer from "drain throats" only, and this may account for some of the cases of "scarlatinal sore throat."

The time which must elapse from the beginning of the illness before a patient ceases to be in an infectious state is not known. Instances have been given in which twelve, thirteen, or even fourteen

weeks have seemed to be too short ; and the continuance of infectiousness has been attributed to delayed completion of desquamation or to persisting discharges from the nose and ears, but it is extremely difficult to exclude imperfect disinfection of hair, clothing, etc., as a possible cause, and in other instances there is evidence that infectiousness has not lasted longer than a few weeks.

Of *predisposing causes* the most powerful is the age of persons exposed to infection. The liability to contract scarlet fever is greatest at about five years of age, and diminishes rapidly from this point onward. Persons with operation or other wounds, burns, or scalds, and puerperal women, appear to be very susceptible, but the subject is a difficult one, owing to the similarity between the rash of scarlet fever and one which not infrequently accompanies septicæmia.

Treatment.—For the prevention of the spread of infection, see DISINFECTION.

No means are known by which an attack of scarlet fever can be cut short, and in the most severe form of the disease no treatment is likely to avert a fatal issue, but there appear to be cases in which the scale may be turned in favor of recovery by the use of antipyretic measures and by the administration of stimulants. In the large majority of cases all that is necessary is to place the patient under such conditions as will favor his return to health. The room in which he lies should be kept comfortably cool and well ventilated, and, if his temperature be high, the bed-clothing should be light. During the pyrexial period the food given should consist chiefly of milk, which may with advantage be diluted with soda water or have ice added to it. Cold water in moderate amount need not be forbidden, and the patient may have beaten-up eggs, or beef-tea and jellies, if he wish for them. In the most severe cases, especially if there be nausea or vomiting, peptonized meat jellies may be of service and the patient must be very carefully fed, rectal alimentation being occasionally necessary. In very mild attacks bread and milk may be allowed. When the fever has abated appetite for food usually returns quickly, and may be safely satisfied without long delay, a more or less gradual return to full diet being permitted according to the severity of the attack. The time during which the

patient is kept in bed need not exceed ten days in most cases. The ordinary ablutions of face, hands, etc., may be performed during the attack, and warm washing-baths be given afterward (see DISINFECTION).

Gargles or sprays of solutions of chlorinated soda, or of chlorate of potash and hydrochloric acid, or of boric acid, may be used with a view to diminish the soreness of the throat. If the pain in swallowing be very great, a few drops of a four per cent. solution of hydrochlorate of cocaine may be sprayed into the throat at intervals, care being taken that the total amount applied be not great. In some cases the pain seems to be lessened by warm water gargles, in others by sucking ice. Children who will not allow remedies to be applied to their throats unless force be used will often permit a powder, consisting of chlorate of potash, bicarbonate of soda, and borax, well sweetened with saccharine or sugar, to be placed on their tongues or between their lips while they sleep. The chlorate of potash may be omitted.

It may be said of the other complications, and sequelæ generally, that they may be treated as if they had arisen independently of scarlatina.

E. O. HOPWOOD.

Symptomatic Indications.—*Aconite* is valuable in the early stage when there is much febrile excitement; *belladonna* in smooth form; tense, bright red skin; sthenic fever. In the more severe form, scarlatina anginosa, with swelling and ulceration of the throat, tendency to gangrene, *mercurius* is very valuable. *Ammonium carbonate* is useful when malignant throat symptoms are present; feeble circulation; cyanosis; delirium. *Veratrum viride* in the early stage may be employed instead of aconite, particularly when cerebral congestion threatens. *Apis mel.*, typhoid symptoms; rapid swelling; nephritis; œdema of the throat. *Arsenicum*, during desquamation; nephritis; involuntary discharges; prostration and weakness; cold clammy skin. *Camphor*, when rash retrocedes; internal heat, though cold to touch; wants to be uncovered. *Lachesis*, scarlatina maligna; typhoid condition; blue, passive congestion of the throat.

SCIATICA.—This term is often used to designate pain in the district of the

sciatic nerve, whatever its causation may be. Some, however, restrict its application to sciatic pain of primary nerve origin, but it seems better, while recognizing their secondary nature, to include also those cases in which the nerve is affected in the course of pelvic and other diseases.

Symptoms.—Primary sciatica is generally gradual in its onset, but in some cases is rather suddenly developed and attended with a certain amount of constitutional disturbance and slight pyrexia. Pain is referred to the sciatic nerve in any part of its course. It is frequently localized to the upper half of the thigh; sometimes it includes the whole of the main branches, so that the patient is able to map out the general distribution of the nerve, and occasionally the terminal branches in the calf and foot are involved. Tender points may be found in the course of the nerve at some or other of the following positions: the posterior inferior spine of the ilium, midway between the tuber ischii and the great trochanter, middle of the thigh, popliteal space, behind the head of the fibula and external malleolus. In certain cases the nerve becomes tender throughout its whole course.

The character of the pain generally differs considerably from that of ordinary neuralgia. It is not paroxysmal and subject to periods of complete remission, but usually constant, and described as heavy, burning, and gnawing, and sometimes as darting and shooting. It may be so slight as only to be noticed after sitting in a cramped and confined position for a long time, or so severe that the patient is bedridden, and sleep is only obtained by means of narcotics. Exacerbations of the pain may occur and these may be spontaneous or induced by muscular movement. To prevent the latter as much as possible the joints of the affected limb are in the slighter cases flexed a little, and the patient walks on the toes, bearing most of his weight on a stick. In severe cases, the flexion is carried to a greater degree, and intense pain may be caused by any attempt at extension of the limb. Sometimes, though rarely, the pain seems reflected to the sciatic of the opposite side, to branches of the lumbar plexus, or even more distant nerves; it may be, however, that these are all involved in the same morbid process.

Other evidences of disordered sensation

are frequently present, and consist of a feeling of pins and needles, numbness, or tingling in the area of the distribution of the nerve, and sometimes of irregular patches of anæsthesia. The occasional occurrence of herpetiform eruptions may perhaps be ascribed to an abnormal trophic state and the frequent coldness of the limb to vaso-motor changes.

There is sometimes a considerable amount of muscular wasting, which is apparent in the buttock, back of the thigh or leg. This is not the result of disuse, but dependent upon an actual paretic condition of the muscles, for it is often noticed soon after the development of symptoms, and the faradic excitability of the muscles may be much diminished, although the reaction of degeneration is very rarely obtained. Fibrillary tremors sometimes occur in the affected muscles, and painful cramps may add to the distress of the patient.

The *course and duration* of the disease vary considerably in different cases. Sometimes the attack is mild, the pain is never severe and passes off in a few weeks; or it may persist for years and be liable to slight exacerbations and remissions. In the severe cases of almost sudden onset, the patient experiences the most agonizing pain and speedily becomes bedridden; all the joints of the limb are rigidly flexed and the muscles waste. Such a condition may continue almost unchanged for months in spite of all treatment, or be subject to remission and relapses. Recurrences of the disease, in which the same sciatic nerve, or that of the opposite side, is affected, are not at all infrequent.

In cases of secondary sciatica, pain is generally present in both lower extremities, and is experienced not so much in the main trunk of the nerve as its distribution.

Diagnosis.—If the symptoms of sciatica be borne in mind there is not much danger of mistaking it for diseases of neighboring parts. In morbus coxæ there is neither painfulness of the nerve, nor tender spots in its course, but pressure on the great trochanter elicits pain, which is not obtained in sciatica. Similarly with sacroiliac disease, in which pain is caused by pressure on the joint. Myalgic pain is characterized by occurring only when the affected muscles are put in action. The lightning pains of tabes dorsalis are par-

oxysmal and fugitive, and other evidences of that disease will probably be found—*e. g.*, the Argyll-Robertson pupil and loss of knee jerks. Secondary sciatica is distinguished from the primary variety by its pain being often bilateral and referred rather to the peripheral distribution of the nerve than its trunk. Both these points should lead to a suspicion of pelvic disease, and suggest a rectal examination.

Prognosis.—Primary sciatica is not attended with any danger to life, but a very cautious opinion should be expressed as to the probable duration of the disease, for not only do the acute cases run a long course, but they are often subject to relapses and recurrences. The prognosis of secondary sciatica must depend upon its probable causation.

Pathology.—The weight of evidence, both clinical and pathological, seems to show that nearly all cases of primary sciatica depend upon a perineuritis, which may spread along the interstitial tissue and cause the nerve-fibers themselves to be affected. Some, however, still hold to the opinion that sciatica is a pure neuralgia, whose symptoms are modified by the large size of the nerve, its superficial course, and its proneness to mechanical irritation.

Ætiology.—Sciatica is a disease of adult life, most common at forty to fifty years of age, and attacking men more frequently than women, probably in the proportion of four to one. It is often associated with gout and rheumatism, and has also been ascribed to syphilis and malaria, but in some cases no predisposing cause can be obtained. Exposure to cold is the commonest exciting cause, and in some cases overexertion of the lower extremities seems to have elicited the disease. Secondary sciatica is usually the result of disease of the hip-joint or its neighborhood, and tumors of the sacrum or os innominatum pressing on the sacral plexus. It may also occur in the course of cancer of the spine and tumor of the cauda equina.

Treatment.—It is always necessary to give the affected limb complete rest, which is sufficiently obtained in slighter cases by the recumbent position on a couch; in the acuter forms of the disease it is desirable to keep the patient in bed, and in very severe and protracted cases a water-bed affords much comfort. Any constitutional disease, which may be sup-

posed to underlie the affection, must be appropriately treated. Of these the most frequent is gout, for which alkalies, colchicum, and iodide of potassium may be given as well as saline purgatives. Salicylate of soda does not often seem to afford much relief, but may be given when the rheumatic diathesis is pronounced. Syphilis and malaria must be treated with iodide of potassium and quinine respectively. The hypodermic injection of morphia becomes necessary to relieve the exquisite pain of the acute cases, but on account of the frequent long duration of the illness, it is essential to take precaution for preventing the development of the morphia habit. For this reason the patient himself should not be trusted with the performance of the operation, and the dose should be kept as small as possible. This is the more important since a very small dose is sufficient in some cases to relieve the pain. The needle may be thrust into the nerve so as to combine with the sedative action what good may result from acupuncture. Cocaine may be similarly injected and sometimes affords considerable relief in doses of $\frac{1}{8}$ to $\frac{1}{2}$ gr. In mild cases stimulating liniments, such as belladonna, chloroform, and aconite, sometimes prove useful rubbed along the course of the nerve, but counter-irritation of the same region, by means of mustard plasters or flying blisters, is far more effective. Hot linseed poultices applied to the seat of pain are often soothing at the commencement of an acute attack. In the later stages galvanization may be employed with advantage. It is necessary that the whole length of the nerve should be brought as far as possible under its influence, and for this purpose a large flat electrode is placed over the sciatic notch, and a smaller one successively over different points of the nerve and its distribution. Another method consists in placing one electrode over the sacrum, and the other in a tub of salt water, in which is the patient's foot. In each case the current is gradually turned on, two cells at a time, till from twenty to forty are in operation, the number depending on the fatness and tolerance of the patient. The application should continue for five to ten minutes, when the number of cells must be gradually diminished to zero, in order to avoid giving an unpleasant and undesirable shock

to the patient. In cases of considerable muscular wasting the affected limb may be gently rubbed once or twice a day, or the muscles may be roused to action by a gentle interrupted voltaic current. In chronic and inveterate cases, acupuncture may be tried, although it is not often attended with marked success. Appropriate needles, two to four in number, are thrust in at the painful spots to a depth of one to two inches, and, if possible, into the nerve itself, where they are allowed to remain half an hour to two hours. The operation of nerve-stretching is sometimes attended with relief of the symptoms.

WM. GAY.

Symptomatic Indications.—*Aconite* is valuable and effective in many obstinate forms, particularly in recent thecal and rheumatic varieties. *Rhus tox.* in chronic cases, rheumatic and thecal form; pain worse from rest, and at night; *cinicifuga*, in myalgic variety, particularly in women with uterine derangement. *Belladonna*, when neuralgic; sharp pain; restlessness; pains appear and disappear suddenly. *Veratrum album*, pains like electric flashes, more at night or in the early morning. *Bryonia* is useful in rheumatic form; pain worse on movement. *Chamomilla*, when occurring in young persons of nervous temperament; intense pain, worse at night; paralytic sensation. See HOT AIR TREATMENT, p. 1558.

SCLEREMA NEONATORUM.—A disease characterized by the development of extensive areas of induration or of hard patches in the true skin. The disease is either present at birth or develops in the few days succeeding it.

The color of the skin over the affected parts is generally bluish-red; a fold of skin cannot be picked up by the fingers and thumb owing to the stiffening and thickening. It appears as if mummified, is hard, tense, and shiny, but does not pit on pressure. The region of the shoulders and buttocks is very often affected; the extensor surface of the limbs and the back of the trunk are more affected than the thin-skinned flexor surface; the face is not often much involved; in one case symmetrical indurations existed in the cheeks; in another a patch was situated over the left parotid gland.

The lesions spread at varying rates and in such a manner as sometimes to involve large tracts of skin; indeed, the induration may affect the whole trunk, rendering it rigid.

The temperature of the body tends to fall in sclerema, especially if the debility progresses. The mode of dying may be by convulsions, diarrhea, syncope, or asphyxia.

Many cases are congenital in date and rapidly prove fatal from asthenia, the cry gradually growing weaker and sucking being impossible from the rigidity of the lips. In these atelectasis pulmonum is often found. All cases are not rapidly fatal; sometimes the spread of the induration is very slow, there being no weakness of the heart or lungs, and the voice remaining strong.

Sclerema may be associated with œdema of the subcutaneous tissues, but in pure œdema neonatorum the course of the disease is like any case of cardiac dropsy, and no doubt it is the expression of cardiac weakness.

Morbid anatomy.—The epidermic layers are normal, the rete and corium thinned, and the connective tissue dense and compressed.

Treatment consists in maintaining the vitality by warmth and stimulation. The body should be swathed in a cotton-wool dress; washing of the skin should be done so as to cause as little exposure as possible. The mechanical nurse or *couvseuse* should prove valuable. Brandy in five-drop doses should be given in veal tea, or in whey. Vomiting and indigestion have to be contended with by the use of peppermint, aniseed, or dill, given cold with a little brandy. The debility may be so great that sucking is impossible; if so, the food should be placed at the back of the throat by means of a small spoon, or it may be syringed into this region, or it may be inserted into the rectum.

The inunction of camphorated or olive oil into the indurated patches does good, especially in the chronic cases which can be restored to health. Warmth is certainly beneficial.

In two cases the recovery appeared to be promoted by the inunction of mercury.

ANGEL MONEY.

SCLERODERMA.—A rare disease, occurring chiefly in adults, in which the skin becomes hard and bound down

tightly to the subjacent tissues. It occurs in two distinct forms—diffuse and circumscribed.

Circumscribed Scleroderma (*Morphæa*; *Keloid of Addison*) is the less rare form. It occurs more frequently in females than in males, and especially in early adult life. Its commonest seats are about the breasts and neck. The patches often show marked nervous distribution, those on the trunk following the course of the intercostal or lumbar nerves and terminating abruptly at the middle line; those on the face usually occurring in the distribution of the supra-orbital or some other branch of the fifth nerve; those on the limbs being longitudinal in the direction of the principal cutaneous nerves. Their locality may also be determined by injuries, friction, or pressure (*e. g.*, of clothes, stays, garters). The subjects of the affection are often neurotic, and its development frequently follows mental shock or anxiety.

The first appearance of the disease is generally unaccompanied by subjective symptoms, and its discovery, unless situate upon an exposed part, is often accidental, but occasionally slight itching or discomfort attracts attention to the part. A characteristic patch is at first slightly elevated above the general surface, and is pink in color, but it soon subsides to the skin level or below it; its form is often roughly circular or oval; the outline is generally irregularly tongued or sinuous, but well defined, and outside it there is a marked zone of pink, lilac, or purple color due to minute capillary telangiectases. The size of the patch or patches usually varies from that of a coin to the palm of the hand, but they may be mere punctæ, the size of a split pea or smaller (*maculæ atrophicæ*) or, on the other hand, as large as a dinner plate. Their surface is smooth, devoid of hair, of a waxy, dead yellowish or ivory-white color, the pinkness previously noted being of brief duration. They are firm, brawny, and inelastic to the touch, and the skin is picked up with some little difficulty. Sensibility is seldom markedly affected, but sometimes there is anæsthesia, sometimes hyperæsthesia and pain. Sweat secretion is usually diminished or arrested, the results being some dryness, desquamation, and cracking. Extension of the disease occurs by the development at the periphery of small, circular, atrophic spots, which ulti-

mately coalesce with the original patch. In other cases, especially upon the limbs and in young subjects, the distribution of the disease is in longitudinal, depressed, cicatricial-like bands or stripes, the minutest forms of which are represented by *lineæ atrophicæ*. The more marked examples often cross joints and fix them, being bounded on either side by infiltrated and hyperæmic skin.

The disease is characterized by the infinite variety of its objective characters, clinical history, and associated phenomena. Thus the patches may be single or multiple; depressed, flat, or considerably elevated and bossy; symmetrical or asymmetrical. Their size and distribution vary widely in different cases, as well as the subjective symptoms (itching and pain) attending them. In old standing cases there may be considerable brown pigmentation roundabout. The patches may develop and disappear rapidly, in the course of a few days or weeks, or may persist for months and years. Recovery is often ultimately perfect, as fatty degeneration and absorption of the new cell products occur, but on the other hand a permanently atrophic patch of parchment-like skin may be left. The disease may be associated with atrophy of subjacent muscles, unilateral atrophy of the face, alopecia areata, canities, and other tropho-neurotic conditions.

The *differential diagnosis* of the patchy form must be established from leucoderma, anæsthetic leprosy, and true keloid of Alibert; that of the linear form from *lineæ albicantes*.

Pathology.—The pathology appears to be that, owing probably to some defect in innervation, an exudation occurs round the vessels, narrowing the lumen, obstructing therefore the blood-flow and leading to thrombosis and sometimes to a real rupture and effusion. Each atrophic spot seen near a growing patch is the base of a cone from which the blood supply is cut off, the violent zone being due to collateral hyperæmia round an anæmic area. The patch, or atrophic spot, thickens by the fibrillation of the effused cells. Where the arterial supply is completely cut off, an atrophic spot is produced; where it is merely diminished, partial atrophy with connective tissue hyperplasia or morphæa is the result.

Diffuse symmetrical scleroderma (*Scleroma*; *Scleriosis*) is a rarer condi-

tion than the preceding. It is also much commoner in women than in men, and occurs especially in early adult life. It begins by a dense infiltration and thickening of the skin, which gives rise to a sensation of stiffness, almost always first noticed at some point above the level of the waist, and most commonly about the shoulders, back of the neck, chest, or arms. Sometimes there is antecedent œdema, with pitting on pressure, the duration of which may vary within wide limits. At the onset of the disease there may or may not be slight elevation of the local temperature, according to the amount of erythema present; but, as a rule, it is not marked. The spread of the condition varies much in rapidity in different cases, but generally extends over a period of months or years; it occurs by periodic exacerbations, the whole of the arms, neck, scalp, face, and upper half of the trunk being ultimately involved; it is also usually present, to a less degree, on the feet and legs, but the lower extremities are never involved alone. The skin becomes intensely hard, stretched, devoid of its natural furrows and wrinkles, and cannot be picked up from the tissues beneath. Its surface is generally smooth and glossy, but sometimes is drier than natural; desquamating and cracked, owing to the diminished secretion of sweat and sebum. Its color may deviate but little from the normal, or it may be pink, purplish, fawn-colored, deep brown, or mottled, while the parts where the pathological process is most advanced and the vessels completely strangulated are quite white. Here and there over the affected area are groups or tufts of telangiectases. The surface temperature is now usually a little below normal. The margin of the diseased area may be well defined and easily seen, or only determined by the sense of touch. Not infrequently itching is a troublesome symptom, but sensibility is seldom affected. Pain and tightness are the subjective sensations generally complained of. The size and appearance of the affected portion of the skin, as well as the subjective symptoms, are liable to considerable variations from day to day, dependent perhaps chiefly upon external temperature, the effects of cold—to which the patients are peculiarly susceptible—being especially deleterious. The joints, over which the skin has a peculiar tendency to be involved, become fixed in a

position of semiflexion, the hands being clawed, the patient becoming literally hide-bound. Ulceration is very apt to occur over the articulations from overstretching or from pressure. The limbs shrivel and become of ivory-like hardness, but the palms and soles almost always remain unaffected. The face becomes absolutely fixed and expressionless, owing to obliteration of its natural lines, and thus some old and middle-aged persons appear rejuvenated; ultimately the eyelids are fixed, the mouth motionless, and the patient may die of starvation from incapacity to take or masticate food. On the trunk the process extends to the intermuscular connective tissue, or the muscles themselves undergo atrophy; thus respiration becomes embarrassed, the patient often dying of bronchitis and asphyxia. In a few cases the mucous membrane of the mouth and pharynx has been involved.

Dr. Crocker maintains that the cases preceded or ushered in by œdema inevitably go on to irremediable atrophy, while those which begin by tense, solid infiltration have a decided tendency to clear up sooner or later, the skin ultimately resuming its natural fineness, softness, and elasticity. In all cases the process is very slow and interrupted, and the patients are prone to be carried off by intercurrent disease, especially nephritis, pneumonia, and bronchitis.

No difficulty in *diagnosis* can possibly arise, except when the case is seen in the initial œdematous stage, and at that period no definite diagnosis can be established.

Pathology.—Of the nature of scleroderma we know nothing, but there is undoubtedly a close relationship between it and the condition we term rheumatism, the latter disease frequently preceding or being associated with it. In other cases evidences of endocarditis are present, or so-called rheumatic nodules. Exposure to cold and privation are probably responsible for the occurrences of a certain number of cases, but the majority remain totally unexplained.

The morbid *microscopic appearances* are found in the corium and subjacent connective tissue, and comprise dense accumulation of cells of doubtful nature round the blood vessels, which they compress, and may even obliterate, and especially round the sweat and sebaceous glands—which they ultimately de-

stroy—and the production of excessively abundant and dense connective tissue.

Treatment.—The patient should be clothed in flannel, and take every possible precaution against exposure to cold or draughts. Turkish baths give, at all events, a temporary sense of comfort, probably by promoting sweating, as well as by the shampooing. If they cannot be procured, vigorous rubbing and the inunction of oils of any sort impart some suppleness to the skin. Galvanism is certainly of use in some localized cases. No drug administered internally is of the slightest service.

J. J. PRINGLE.

Symptomatic Indications.—*Bryonia* is said to have cured.

SCORBUTUS.—See SCURVY.

SCROFULA. — *Definition.* — A diathesis rather than a disease. Its characteristics are neatly given by Billroth as follows: "Exists chiefly during childhood; though more advanced ages are not free from it." "Persons with this diathesis, especially children, are greatly disposed to chronic inflammatory swellings of the lymphatic glands, even after inconsiderable irritation; to certain inflammations of the skin (eczema, impetigo), especially of the face and head; to catarrhal inflammations of the mucous membranes, especially of the conjunctiva, more rarely of the intestinal canal and respiratory organs; to chronic inflammation of the periosteum, and of the synovial membranes of the joints." Formerly the condition called "tuberculosis" was unanimously included in the term scrofula. Majority of modern pathologists differentiate the two, while acknowledging the frequent origin of the former from the products of chronic inflammations induced by the latter.

Causes.—Inheritance. Unfavorable conditions of life, *e. g.*, low, damp dwelling, want of light, insufficient food, mental depression. Attacks of acute, infectious fever, especially measles. Chronic inflammations, the result of scrofula, are indolent and slow to disperse. They tend greatly to suppuration and caseous degeneration. Certain general appearances of the person are described as scrofulous types, especially two, viz., (1) thick lips, muddy skin,

coarse features, pot-belly, flabby muscles, often with tendency to fatness; (2) fair, thin, clear skin, long eyelashes, fine hair, pearly teeth, bright, refined, "delicate" look. These so-called typical appearances are of doubtful diagnostic value. Dyspepsia very common.

Diagnosis.—The great question is, "What justifies the surgeon in terming a certain patient 'scrofulous'?" The answer usually depends greatly on the surgeon's individuality. By some authorities such a thing as scrofula is hardly admitted to exist, all the appearance associated with its name being referred to local or special causes. Usually any morbid manifestations involving joints or glands, if the known exciting cause is trivial, or if no cause at all be known, are regarded as scrofulous; and especially if more than one such affection attack the same individual, and if he present the peculiarities of personal appearances mentioned above.

Prognosis.—Under treatment, with moderately favorable conditions, the individual manifestations usually disappear, often leaving ugly scars. But the diathesis almost always remains. It may lie latent throughout a vigorous manhood, and reappear in a decrepit old age. Danger of tuberculosis supervening; said to be greatest in fair, delicate, or "sanguine" type of the scrofulous.

Treatment.—Hygienic and medical, general and local. Hygienic requires the various conditions usually considered "strengthening," fresh air, good food, dry lodgings, daylight, cheerful occupation, flannel clothing, moderate exercise. Cleanliness of head and skin. Strict attention to each trivial ailment. Medical treatment is (1) anti-dyspeptic, and (2) tonic and nutritive. Tongue, stomach, and bowels must be attended to on general principles. Gregory's powder and hydr. c. cret. often useful, especially in children. Sodæ bicarb. (grs. x-xv) ter die in inf. calumbæ just before meals. Cod-liver oil is the remedy. Give it after meals, 3j bis die, increased gradually up to 3j ter die. Occasionally suspend its administration, if it disagree with the stomach. Small doses of nitric acid and strychnine useful adjuncts. Iron, ammonio-tartrate, citrate, fresh carbonate, vinum ferri (iodide of iron in fat, flabby children). Iodides sometimes mischievous if fever be present. Mineral

acids. Quinine, tinct. cinchonæ co. Pancreatic emulsion. Change to a new climate, which, whether warm or temperate, should certainly be dry : sea voyage. Local treatment is given under special heads. In old age, "iron, cod-liver oil, sea air, etc., of little potency. Rest, warmth, and good food more important."

C. B. KEETLEY.

Symptomatic Indications.—*Calcareo carbonica* is the principal remedy in all scrofulous conditions ; in scrofulous ophthalmia ; otorrhœa ; nasitis ; ulcers, of the knee and hip-joint ; especially useful in children with glandular enlargement ; enlarged and hard abdomen ; chronic diarrhea. *Iodine* is valuable in sanguine type, especially when wasting occurs while eating well ; glandular enlargement ; enlarged mesenteric glands ; *Mercurius biniod.* when the disease is associated with enlarged glands, hard abdomen, and eruptions on the head, face, and ears. *Kali iod.*, in exostoses, and necrosis, symptoms worse at night. *Spongia*, swelling and induration of glands ; lax muscles and skin ; much appetite and thirst. *Sulphur* is valuable when skin and mucous membrane present morbid tendencies. *Calcium sulphide* is valuable in chronic glandular abscesses, with symptoms of general scrofulosis : inflamed and suppurating glands ; boils, ulcers, etc. *Silicea* is very valuable in scrofulous affections of bones, and in ulcers with callous edges.

SCROFULODERMA (Strumous or Scrofulous Ulceration of the Skin).—A clinical term used to describe a true tubercular disease of the skin attended with ulceration, and intermediate in point of acuteness between lupus and acute tuberculosis.

Strumous ulceration usually occurs in children or young persons, but is liable to recur in more advanced life. Its subjects almost always exhibit the aspect and other evidences of the strumous diathesis. It may affect almost any part of the body, but its commonest site is the neck, where its first manifestations are found in the submaxillary or nuchal or post-sterno-mastoid lymphatic glands. These are enlarged, hard, and indolent, seldom tender ; slowly the caseous matter, of which the masses are mainly composed, softens, breaks down, and suppu-

rates. The skin above becomes implicated, adherent, red, or purple, and inflamed ; numerous sinuses, through which gummy pus is discharged, riddle and undermine it in all directions. In other instances the initial nodules are formed in the subcutaneous or cutaneous lymphatic tissue, but they follow the same course as those originating in glands. Ultimately large unhealthy ulcers are formed with steep or overhanging edges which, if they spread at all, do so very slowly. In form they are often oval : their surface, which bleeds readily, is uneven and covered with luxuriant, pale granulations and pus, which dries up to form thin, brown or yellow crusts. Various such lesions often coexist or occur successively on different parts of the body. There is little tendency to spontaneous cure, but they generally yield rapidly to appropriate treatment, when the scars left are often thick, hard, nodular, and very disfiguring.

The *pathology* is similar to that of lupus, from which there is no advantage in differentiating it. Congenital syphilis may closely simulate scrofuloderma and must be eliminated, but careful examination of all the features of any given case makes its nature clear.

Treatment.—Constitutional remedies in a certain proportion of cases are by themselves curative. The food must be digestible and nourishing, meat with plenty of fat being especially recommended. Eggs, milk, and cream ought to be given freely. Good hygienic surroundings should be provided, and sea air is especially beneficial.

Cod-liver oil, arsenic, iodides, and ferruginous tonics are all of real service, and may be administered, separately or collectively, in combination with the employment of local measures. The remains of caseous glands should be removed by scraping. Ulcers may be washed with mild mercurial lotions and afterward dusted with iodoform or iodol.

J. J. PRINGLE.

Symptomatic Indications.—*Calcareo carbonica* ; *sulphur* ; *calcium sulphide*, or *silicea*.

SCURVY (Scorbutus).—A disease due to imperfect diet, chiefly characterized by anæmia, a swollen, spongy condition of the gums, and by the occurrence of hemorrhages in the skin.

Symptoms.—The disease is somewhat

insidious in onset, the characteristic symptoms being preceded by a period of languor, lassitude, debility, and pains in the limbs, the complexion becoming sallow, and cachectic. There may be listlessness and drowsiness, but no fever. In a few days, petechiæ appear, generally (as in all purpuric affections) first upon the lower extremities. It is pointed out as characteristic of scurvy that the hemorrhage occurs mainly at the orifices of the hair follicles. As the disease advances the purpuric condition extends, and large discolored patches, like bruises, cover the limbs, while anæmia becomes more marked, with concomitant dyspnœa. The hemorrhage may take place in the loose tissue of the eyelids and the face assume a puffy, bloated aspect. Further, hemorrhage occurs in the deeper tissues, and painful swellings from extravasation into the substance of muscles, possibly unattended by any cutaneous discoloration, make their appearance; or there may be hemorrhagic effusion into joints, or beneath the periosteum. In infantile scurvy hemorrhage is especially liable to occur in this latter situation and about the epiphysal junctions.

The pathognomonic symptom of scurvy is the spongy, swollen state of the gums around the implantation of the teeth, which may become loose and fall out, the gums bleeding on the slightest touch, and, in bad cases, sloughing and ulcerating. This ulcerative stomatitis produces a foul odor of the breath. Ulcers may also form on the limbs where there has been much subcutaneous hemorrhage.

The constitutional symptoms are those of anæmia. Besides the dyspnœa, which increases in intensity with the progress of the disease, there is a great tendency to syncope. Except in very severe cases, there is not much liability to hemorrhage into the internal viscera, but there may be gastro-intestinal hemorrhage, or pulmonary hemorrhage. Dysenteric symptoms and pneumonia or gangrene of the lung may complicate the case. Other complications consist mainly in inflammation of serous membranes, which may be accompanied by hemorrhage. Retinal hemorrhage is not common, at least in milder cases, and hence its occurrence has been attributed to the degree of anæmia produced by the disease rather than to the hemorrhagic tendency

that characterizes it. A remarkable symptom connected with vision is nyctalopia or "night-blindness."

The *course* of scurvy is, as a rule, slow and prolonged, owing to the extreme debility and marked emaciation.

Pathology.—There can be little question that is essentially a blood disease, and its ætiology suggests that there is a deficiency of some element in the blood, which is supplied in fresh vegetable food. Dr. Ralfe, from a careful study of the urine, concludes that the essential cause is a diminished alkalinity of the blood. He finds the acidity of the urine is diminished, and that there is a great reduction in the alkaline phosphates. Dr. Ralfe's view is, that as the alkalinity of the blood depends upon the carbonates and bicarbonates, the withdrawal from the food of organic salts—such as the lactates, malates, and citrates—from which these carbonates are derived, affords a satisfactory explanation of the dietetic associations of the disease, since, on this view, the blood may be de-alkalinized by the introduction of a preponderating excess of acids or acid salts in the food.

Ætiology.—Scurvy is therefore due to an insufficient diet. All other circumstances may be favorable, but if there be a deficiency of vegetable food, scorbutic symptoms may arise. Naturally, the most severe cases of such an affection are to be met with among those who are subjected to other depressing influences; but it has been proved that, given the absence of a proper vegetable diet, exposure to cold and damp are not necessary to its occurrence, although together with other debilitating conditions they may favor it. The most striking examples of its ravages occur in military and naval and Arctic service, where, from defects in commissariat or impossibility of obtaining fresh vegetables, scurvy has at times prevailed to an extreme degree during war or protracted sea voyages. It has occurred also in association with a potato famine, or failure of other vegetable crops, and to a more limited extent in prisons and reformatories, when the diet has been defective in the above particular. Sporadic cases are to be met with in most large towns, and are invariably to be traced to the same essential cause, affecting both young and old alike. Of recent years attention has been drawn

to a condition closely analogous to scurvy, and associated with rickets in young infants, this "infantile scurvy" or "scurvy rickets" being also traceable to improper feeding, especially the lack of fresh milk.

Treatment.—There are few diseases which better illustrate the value of appropriate and rational treatment. In the milder cases—such as are now commonly seen—where there may be little but sponginess of gums, slight purpura, with debility and anæmia—recovery is soon brought about by the free use of fresh vegetables and fruit (especially lemons, oranges, etc.), to which may be added the administration of potash salts, the citrate of tartrate, and hematinics, as iron or arsenic. Fresh meat in lieu of salted meats, and fresh milk in place of preserved milk, are excellent adjuvants. Indeed, as the cause is largely dietetic—so must the treatment be. Prophylaxis is of the greatest importance, armies in the field and ships should be supplied with tinned vegetables and fruits, and, when these are inaccessible, with good lime juice.

SIDNEY COUPLAND.

Symptomatic Indications.—*Aconite* is useful for acute stomach ache or sore mouth with ptyalism in persons of a scorbutic diathesis; *carbo vegetabilis* is often valuable, especially for the gum symptoms; *arsenicum* is frequently useful.

SCROTUM, DISEASES OF THE.—Malformations of the scrotum are for the most part associated with hypospadias; the cleft scrotum, occasionally met with, has given rise to the very vexed question of hermaphroditism. The plastic operations undertaken for such conditions other than hypospadias are merely of an empirical nature.

Injuries of the scrotum.—Considering the position and texture of the scrotum, wounds are more rare than might be expected. Incised wounds are to be washed clean and brought neatly together with Chinese silk sutures. Contused wounds are specially liable to become gangrenous; they are best treated by support to the scrotum, and ice or evaporating lotions rigorously applied. Should gangrene threaten, punctures or incisions will have to be made.

Œdema of the scrotum.—Children are especially liable to this disease. Newly born children now and again exhibit a form of œdema, and children of six

months and thereabouts are apt to suffer from a similar swelling.

It quickly subsides under the effect of treatment, such as an evaporating lotion or dusting with oxide of zinc. In very weakly children care must be taken that the œdema do not end in erysipelas or sloughing.

In adults it is often the associate of general dropsy, or may be due to some affection of neighboring parts, such as the urethra, etc. It is best relieved by numerous punctures.

Inflammation and erysipelas may result from slight injuries, abrasions, etc.; from a boil or small abscess; from sores and eruptions in other parts, such as the thighs, abdomen, etc.; from dribbling of urine, from simple incontinence, or from a urinary fistula. Erysipelas may also occur idiopathically. Anyone of these conditions may end in cellulitis or sloughing of the scrotum, especially as it is often a local expression of general disease or debility. Care must be taken not to mistake the disease for extravasation of urine.

The *treatment* must be carried out on general principles. Special attention must be paid to the condition of the patient. Iron and quinine, or cinchona and ammonia, must be given freely, and a liberal diet ordered; any specific affection having its special treatment. The local treatment will consist in warm fomentation, disinfecting, and deodorising lotions where necessary; when there are indications of sloughing, free incisions must be made.

Gangrene of the scrotum may occur as the result of the above affections, in the course of fevers, or from extravasation of urine. For treatment, free incisions must be made, antiseptic and warm lotions or charcoal poultices applied. Great attention must be paid to the general health. To favor separation of the dead parts, stimulating applications may be needed. Both testicles and cords, although exposed, will probably get covered in during the healing process; if not, some plastic operation will be required.

Eczema of the scrotum is not uncommon in elderly and gouty people, and must be treated on general principles.

Prurigo of the scrotum is confounded with three other conditions, viz.,

eczema, pruritis, and phthiriasis (crabs). True prurigo, mostly occurring in elderly people, is a most obstinate and troublesome affection. With children or young people, it soon disappears under judicious treatment. The affection is characterized by the presence of red flat papules, the skin being thickened and more moist than normal, there being a decrease in the horny epithelial cells. The causes are obscure, for sometimes it appears to occur in perfectly healthy people. It is probably due to some change in the nerve endings, or in the structures around them.

The *treatment* must be to support the general health, and counteract the baneful influence of the local irritation. Locally, alkaline lotions, boracic and carbolic acid lotions, and a host of others have been tried, but frequently the disease proves intractable. White precipitate ointment will cure phthiriasis, and pruritis is relieved by the bichloride of mercury, and dilute hydrocyanic acid, grs. ij and 3 ij respectively, to six ounces of water.

Elephantiasis.—This, a very common disease in Eastern countries, is rarely met with in this country. The cases seen are undoubtedly importations.

Signs and symptoms.—The scrotum and penis are enormously enlarged, sometimes weighing more than one hundred pounds. The skin is hypertrophied, brawny, rough, and covered with verrucosities, or mammillated. On microscopic examination the cellular elements of the skin and subcutaneous tissue are found enlarged and increased in number, some undergoing degenerative changes. There is also a large increase in the fibrous tissue, this being arranged in layers parallel to the surface. The papillæ are much enlarged, and among the tissues there is a large amount of albuminous and fibrinous exudation. The lymphatic vessels and spaces are much enlarged and filled with cells and fibrinous material. Another affection, probably a variety of this disease, is the so-called *lymph scrotum*. In it the scrotum also enlarges, a milky or sero-sanguinolent fluid oozes from the skin: associated with which there is at times slight feverishness, chylous urine, enlargement of lymphatic glands, and great increase of the lymphoid tissue in the scrotum.

Each of the affections mentioned is be-

lieved to be due to the presence of "*filaria sanguinis hominis*," in the blood.

Treatment.—If seen in the early stage it may be thought wise to try the effect of mercurial ointment, combined with pressure of a rubber bandage. Probably, the only remedy is complete excision of the growth, a formidable operation not to be undertaken rashly.

The testicles and penis should be saved, if possible. Care must be taken that there be no hernia, and that the cavity of the tunica vaginalis be not opened.

The patient should be placed upon the operation table a few hours before the time for operation; the mass to be removed should be elevated by suitable tackle, bound with elastic bandages, and in some such way all the blood possible should be got out of it. Then the base may be clamped, constricted by an elastic cord, or several bands may be passed through and around different portions of the base. Then, the patient being under an anæsthetic, three skin flaps, one central and two lateral, must be dissected out of the healthy skin, to cover the penis and testicles. Next, the penis and testicles should be dissected out, the glans being found by following up the opening by which the urine escapes. After these have been turned up to the abdomen, the whole mass should be removed. Great dexterity is needed to secure the blood vessels; otherwise the patient may die from loss of blood.

Cancer of the scrotum.—Epithelioma is the variety of malignant disease usually met with in the skin of the scrotum. So exclusively almost is this disease met with among chimney-sweeps that it has obtained the name of "chimney-sweeps' cancer."

The growth commences as a soft wart, tubercle, mole, or enlarged sebaceous gland, generally in the front part of the scrotum. After a time this becomes hard and indurated, spreading concomitantly; next a scab forms, which falls off, and a small bleeding ulcer is found beneath. The ulcer goes on spreading at its margins, always being preceded by induration. Thus a sore, discharging a bloody, ichorous, foul liquid, having a hardened base, irregular, excavated, and thickened, with a tuberos and hardened margin, is formed. This goes on spreading until the whole scrotum is destroyed, and the testicles are exposed. The inguinal

glands are infected, and after a time break down and ulcerate; but rarely, if ever, are the lumbar glands or internal organs involved. It usually destroys life by the wasting induced by the discharge.

The *diagnosis* is not usually difficult; the age of the patient (rarely occurring before thirty, most frequently about middle life), his occupation, the slow ulceration, always preceded by induration, together with the history, will mostly point to the true nature of the case.

The *treatment* consists in the complete removal of the growth; this may be done by caustics, but the knife is the most satisfactory method. Care must be taken to go wide of the diseased part. Should the affection recur, it should be again removed. The inguinal glands should be removed if enlarged, most certainly if they be indurated. If the disease has advanced to a large extent, and if the inguinal glands have ulcerated, all one can do is to feed, tranquillize, and soothe the patient. The fetor may be moderated by deodorants.

Other growths of the scrotum are: (1) fatty, (2) fibrous, (3) multiple sebaceous tumors, (4) cysts. Other growths, occurring in cicatrices of the scrotum, have been described, viz., carcinoma and sarcoma, cartilaginous and adenoid tumors. These need no special remark.

Diseases of the testicle.—Inflammation of the testicle is a generic term used to include inflammation of two associated organs, the epididymis and the testicle itself. Of these epididymis is by far the most common, acute orchitis being a rather rare affection.

Epididymitis.—Acute inflammation of the epididymis is almost invariably a secondary affection, being set up by gonorrhea, prostatic irritation, or by the passage of a catheter. It may, however, occur primarily, as when a pendulous scrotum, during a long walk, allows of the epididymis being compressed and irritated by the clothing.

Ætiology.—The explanation of how disease, or irritation, of the urethra sets up epididymitis bears discussion. (1) Continuity of inflammation, *i. e.*, extension of the inflammation from the urethra along the common ejaculatory ducts, and so along the vas deferens to the epididymis, is an accepted explanation by some. Were this the case, one would expect to

find the vas deferens in the groin swollen and tender, and not only so, but also the vesiculæ seminales behind the prostate in the same condition. That this actually does take place I have satisfied myself by frequent examinations, per rectum, of the vesiculæ seminales, immediately after an epididymitis shows itself. In most cases (six out of nine) one vesicula seminalis was found swollen and tender, the vas deferens at the same time being found tender in the groin. I have come to the conclusion that continuity of inflammation is the commonest cause of epididymitis, but that, unless the swollen seminal vesicle is felt for within twelve hours after the onset of epididymitis, all trace of this symptom disappears.

(2) Reflex irritation is possibly a correct explanation in many cases. The point of the penis and the testicle are connected in the spinal cord with the same center. An irritation or inflammation, existing in any part of the area supplied by that center, may extend to the whole of the area which the nerve center influences.

(3) Metastasis is the explanation advanced by those who regard the condition as a mystery.

All attempts at explaining why epididymitis supervenes in any particular case are futile, as men who take the utmost care may get epididymitis, while those who are careless as to their clap, and take no treatment for it, may escape. It may come on late or early in the disease. Injections into the urethra seem to have a tendency to set it up. Particular drugs are blamed by some, but there is no rule to go by. Certain it is, however, that a man who uses strong urethral injection in the early stage of clap, and who takes much walking exercise, is very apt to develop epididymitis.

Signs and symptoms.—The patient is made aware of the onset by an uncomfortable sensation in the region of the scrotum, which induces him to alter his position frequently and by and by to feel and look at his testicle. He will find that the testicle of that side appears swollen, with pain along its posterior part, and slight tenderness in the groin. In a few hours the pain becomes acute, the swelling rapidly increases, and the symptoms of feverishness supervene of a more or less acute nature. When fully developed the skin of the scrotum of the inflamed parts appears tense and glistening, the fur-

rows and wrinkles of the scrotum disappear, there is much dragging sensation in the groin and iliac fossa, and an aching pain in the lumbar region.

Diagnosis.—Epididymitis is to be distinguished from orchitis, which it closely resembles. This close resemblance is brought about by the effusion into the tunica vaginalis, which occurs in both diseases. The epididymis touches the tunica vaginalis for some distance along the outer side behind; hence an inflammation of the former will set up an effusion into the cavity of the latter. This effusion is modeled in the tunica vaginalis to the surface of the testis, and leads to the appearance of the testis itself being inflamed. That this is not the case may be made out by careful examination of the epididymis, which will be found above and behind the testicle, lying like a thick semilunar mass, threatening to overlap the testicle above, below, and at the sides. The swelling of the testicle will be found to be apparent only from the fact of fluctuation being present, from the slighter constitutional and local symptoms generally; and, if transparency of the fluid can be made out, as in hydrocele, then it will be conclusively proved that an acute hydrocele, and not an orchitis, is present.

Prognosis.—In a healthy man the prognosis is complete recovery. In weakly men, or in the strumous, there is the danger of testicular disease developing. Now and again abscess may result; thickening of the epididymis may remain; obstruction of the lumen of the tube may cause subsequent wasting of the testicle. Occasionally epididymitis is succeeded by orchitis.

Orchitis.—Acute inflammation of the body of the testicle is a less common disease than inflammation of the epididymis.

Ætiology.—The commonest causes of simple orchitis are: a blow on the testicle, extension of the inflammation from the epididymis, metastasis, so called, from mumps, and the gouty diathesis. That orchitis may arise primarily from gonorrhea, without epididymitis, we have on high authority, but it is seldom met with in practice.

Signs and symptoms.—In the onset and subsequent exhibitions of the disease, simple orchitis closely resembles epididymitis. It will, however, be noticed, that

the constitutional disturbance is greater, the local pain is much more intense; the patient does not care to assume the erect position, but walks bent with his legs apart. The testicle is felt to be enlarged, globular, and extremely sensitive and tender; the scrotum is seen to be red and swollen. Effusion into the tunica vaginalis also occurs in this as in epididymitis, as can be ascertained by making out the fluctuation.

Diagnosis.—Acute orchitis has to be distinguished only from epididymitis. The diagnosis has been already given with epididymitis (*q. v.*); that mumps is a concomitant disease, can be made out by examination of the salivary glands; one submaxillary, slightly enlarged, may be all that is to be found.

Prognosis.—Orchitis usually gets well, but it may, rarely, end in suppuration or chronic enlargement, or it may be followed by some of the diathetic diseases, mentioned anon. Should suppuration occur, the gland tissue may escape through the opening in the tunica albuginea, and present through the skin as a hernia testis.

Treatment.—The treatment of epididymitis and orchitis will be considered together, although the surgeon is much more frequently called upon to treat the former. If absolute rest can be obtained, lay the patient up in bed at once. If the disease is epididymitis, the patient might be able to go about his work, with the scrotum well tucked up in a comfortable suspender, but in orchitis he will be compelled to lie up. When in bed, the scrotum is to be supported upon a pillow placed edgewise between the thighs; a pillow below the hips, also, will tilt the pelvis and afford comfort. Administer a smart purgative. Apply hot fomentations to the supported scrotum, to be changed every half-hour. Place a cradle over the patient's pelvis (a bonnet-box will serve the purpose, when nothing else is available). Should further treatment be required, proceed as follows: To allay pain, apply belladonna externally over the scrotum and along the groin. A suppository of $\frac{1}{2}$ gr. of ext. opii, and of ext. belladonnæ respectively, introduced in the rectum at intervals of four or six hours, will aid in soothing pain. The application of simple or poppy-head fomentations. Local depletion, not by leeches, to the scrotum (or extravasation,

to a frightful extent, may result), but by pricking a vein, may be productive of good. When about to deplete, proceed thus : Cause the veins of the scrotum to dilate by heat, either by hot fomentations, or by the heat of the fire, the patient sitting in front thereof. Compress the distended vein by the thumb above the spot to be punctured, and incise with a lancet or scalpel, freely, to prevent blood escaping beneath the skin of the scrotum. Should the pain become great, opium must be given in large doses ; or the cavity of the tunica vaginalis must be punctured ; or a needle, or narrow scalpel, may be driven through the tunica albuginea into the testicle, and so punctured or incised ; multiple punctures with a needle rapidly made is the most efficacious and least painful method of puncturing the tunica vaginalis. Instead of hot applications, cold applied to the scrotum in the form of cold-water drip, evaporating lotions, or an ice bag may cut short inflammation.

Subacute orchitis, as occurs in gouty people, and as concomitant with mumps, requires but to be mentioned. The pain in gouty inflammation of the testicle far exceeds what the local condition of things would lead one to expect. When concomitant with mumps, the inflammation may become acute, and give rise to subsequent abscess or atrophy. The usual local remedies are to be applied ; in gouty orchitis vinum colchici acts almost as a specific.

Simple chronic orchitis, sometimes called simple sarcocoele, to distinguish it from orchitis dependent upon the syphilitic or tubercular taint, is merely an induration of the testicular connective tissue, usually the result of acute inflammation. At times an epididymitis will end in chronic enlargement of the testicle. A blow or squeeze is a frequently assigned cause of this, a rather infrequent primary disease.

The *pathology* of such a condition is shortly told. The effusion of inflammatory materials causes a hyperplasia of the connective tissue, which, becoming developed, expands the bulk of the testicle, at the same time compressing the vessels and the tubuli seminiferi within its grasp. An untoward end of this may be loss of testicular sensation, indicating that the tubuli seminiferi are obliterated, and should this take place in both testicles, as sometimes happens, sterility must result.

Signs and symptoms of the disease are :

an enlargement remaining after an acute attack, accompanied by less and less pain as time wears on. The testicle feels smooth, enlarged, hard, and is devoid of testicular sensation. There is but a slight fluid effusion into the tunica vaginalis, and the testicle appears flattened at the side. The epididymis may or may not be slightly enlarged.

Diagnosis.—The history of a previous acute inflammation or of a blow or squeeze, the chronicity, the absence of syphilitic history, the non-implication of the epididymis, and the smoothness of the surface of the testicle, will decide between simple and syphilitic, tubercular and malignant sarcocoele. The disease more usually affects youths, and that, combined with the fact that both organs are affected usually either separately or together, will distinguish it from the fibro-cystic disease of older men. The shape, history, and non-transparency will establish the diagnosis between it and hydrocele, and its gradual development, contrasted with the sudden onset of a hematocele, will decide the diagnosis between these disorders.

JAMES CANTLIE.

Symptomatic Indications.—*Pulsatilla* is the principal remedy, having a special affinity for the testicle. *Belladonna* is useful when there is much neuralgic pain ; sensitiveness of the nervous system. *Veratrum viride* or *aconite* when there is much fever and arterial excitement, *arsenicum* in chronic orchitis with œdema of the scrotum ; *aurum* in chronic cases with induration.

SEASICKNESS.—Vomiting, excited by the pitching and rolling of a boat or ship at sea.

Symptoms.—At first a feeling of gastric uneasiness, intensified by the ingestion of food ; followed by nausea and a swimming sensation in the head, which may be accompanied with flushing or pallor of the face and sweating. There soon arises not only a distaste for food, but a repulsion from it, and a feeling of nausea is induced by its smell. These symptoms may be relieved by vomiting, but very often its frequency only increases the distress, especially if the stomach be empty. The vomit is generally acid, and may be mixed with bile and mucus. At this period everything swallowed is at once ejected. The tongue is now thickly coated, the breath foul, and there is often

an excess of salivary secretion. The bowels are, as a rule, obstinately confined, but occasionally there is diarrhea. The urine is scanty, dark, strong-smelling, with a thick deposit of urates, and sometimes a trace of sugar. The continuance of these symptoms renders the individual wretchedly helpless, he wraps himself in his rugs, for he feels excessively cold, takes no interest in his surroundings, is continually dropping off to sleep, and refuses food. If this go on for long, a period of exhaustion sets in, the pulse becomes very weak, and actual syncope may occur; sometimes a condition of stupor comes on, from which the patient is with difficulty roused. When these symptoms of depression are long continued, the case is one to excite considerable apprehension, for death sometimes results, usually from syncope. Women sometimes abort, and the secretion of milk may be arrested in mothers who are suckling. Such extreme cases are, however, rare, and generally after a few days the symptoms gradually abate, and are followed by a state of mental and physical exhilaration and an enormous appetite. Some people only suffer from a feeling of heaviness, anorexia, and frontal headache, which may be very persistent. Others experience no discomfort at all, and this is particularly true of the extremes of life. As a general rule, women are more often and severely affected than men. Sometimes an individual gets so accustomed to the movements of the ship that it takes him some time to recover his land legs, and in rare cases vomiting and retching occur upon landing. Retching and vomiting may continue for some time after landing from a short and boisterous voyage.

Prognosis.—Complete recovery may generally be expected in from three to five days, but very severe cases often give rise to considerable anxiety.

Pathology.—In considering the pathology of seasickness, it is essential to remember that similar, if not identical, symptoms may occur under circumstances in which an individual's relationship to surrounding objects is not quite clear. In this way many people cannot enjoy a swing, and some experience a mild form of "seasickness" whenever they travel by train. Others are so far unable to adapt themselves to new conditions that not only is their gait uncertain upon

landing, but they may even feel sick and actually vomit. All these cases are probably explained by the fact that equilibrium and the conception of relationship to space are maintained by a most delicate co-ordination of impulses from very numerous and widely separated parts of the body, and that in some people the slightest disturbance of these impressions is sufficient to cause a feeling of uncertainty and insecurity, which results in vertiginous sensations, nausea and vomiting. So marked may be this want of adaptability to varying external conditions, that imagination alone may give rise to symptoms of seasickness, as is shown by its occasional occurrence before the ship has left dock. According to this view, the sickness of mal-de-mer differs only in degree from that induced by swinging, etc.

Treatment.—This must be conducted on general principles, for although most new remedies are vaunted as specifics, none of them really deserve the title. A seat in one of the warmest parts of the deck should be chosen, not only because fresh air is desirable, but objects are seen on a larger scale there, and appear therefore less "out of joint." Some people who can remain on deck all day vomit only when they get up and go to bed, because they are in the confined area of their cabin, where all the movements of the ship appear exaggerated, since they are seen within a small compass. When the patient is unable to leave his cabin, he should lie in his berth on his back, and keep his head low. The obstinate constipation should be treated with aperients and the dyspepsia of the early stages, if necessary, with alkalies or prussic acid and diffusible stimulants, but in the later stages of long protracted cases acids are indicated. Opium, or the hypodermic injection of morphine, is sometimes useful by procuring a prolonged rest. It is very difficult to overcome the distaste for food, but it is necessary to insist on some being taken. This is best administered in a fluid or semi-fluid form, such as beef tea or arrowroot, which should be repeated frequently and in small quantities. Iced champagne is an admirable stimulant, and is frequently tolerated when nothing else can be taken. When the stomach becomes more tractable, cold toast with ham and chicken, or other meats, may be given. Many drugs, of a more or less

specific nature, have been recommended, and are occasionally useful, but very often fail to have the desired effect. Among these may be mentioned the bromides chloral, nitrate of amyl, nitro-glycerine, cocaine, and antipyrine. Dr. Chapman's spinal ice-bag sometimes affords considerable relief to the general symptoms, and alleviates the headache, which may be very distressing. WM. GAY.

Arseniate of strychnine, hyoscyamine, aa $\frac{1}{132}$ gr., bromohydrate of morphine, $\frac{1}{67}$ gr., in the form of the dosimetric granules, every hour until relieved is a specific against seasickness.

SEBACEOUS GLANDS, DISEASES OF.—Milium (*Grutum* ; *Strophulus Albidus* of Willan).—A

hemispherical, whitish or pearly projection from the skin, usually about the size of a millet seed, and formed by the accumulation of altered sebum, epithelium, fat, and small hairs in a sebaceous gland, the excretory duct of which is obliterated. They often cretify and constitute so-called cutaneous calculi. They are usually multiple; the condition is chronic and painless, and is commonest about the eyelids and forehead, penis and scrotum. The general ætiology is the same as that of acne, but the disease is one of middle, rather than of early, life. Milium may occasionally be mistaken for xanthoma or molluscum contagiosum.

Treatment consists in puncturing the sac and expressing its contents; the lining membrane may be scraped or lightly cauterized. Frequent washing with soap and warm water is a useful preventive measure.

Keratosis pilaris (*Lichen pilaris*, *pityriasis pilaris*).—A chronic, acquired disease of the skin, characterized by the formation of minute, pale, conical elevations about the openings of the hair follicles, caused by the accumulation of sebaceous matter and epithelial cells, and usually enclosing a twisted or stunted hair, the end of which may appear as a dark point. These prominences are grayish or dark from adherent dirt, can be removed from the orifice of the hair follicle, and arise from skin which is usually normal, but may become inflamed. In well marked cases the skin becomes dry and harsh, feeling like a nutmeg grater when the hand is passed over it.

The disease is commonest in working-

men of uncleanly habits, but also occurs in scrofulous children, and as a sequela to pityriasis rubra. It attacks chiefly the extensor surfaces of the thighs, arms, and forearms, and frequently also the buttocks and shoulders. It gives rise to no subjective symptoms. The condition closely resembles true, inflammatory lichen pilaris, and congenital ichthyosis follicularis, and must also be distinguished from lichen scrofulosorum, the minute papular syphilide, and cutis anserina. It has recently been shown to be due to the presence of pathogenic coccidia or psorospermia.

Treatment consists in vigorous washing with soap and water, and the subsequent inunction of glycerine, oil, or a mild petroleum ointment.

Colloid milium (*Colloid degeneration of the skin*).—A rare skin affection characterized by the presence of minute, shining, flat or slightly raised lesions of a pale or bright lemon color, especially on the bridge of the nose, forehead, and cheeks, and occasionally on the upper extremities. To touch they are hard and elastic; after incision homogeneous, gelatinous matter can be expressed. The disease affects persons of middle or advanced age. The lesions may disappear spontaneously, or inflame and scab, leaving an ill-defined, often umbilicated scar. They are due either to colloid degeneration of pre-existing milium bodies, or of the connective tissue of the corium. Xanthoma is the only disease for which this can be mistaken.

For other affections of the sebaceous glands, see ACNE, ASTEATOSIS, COMEDONES, SEBORRHEA.

J. J. PRINGLE.

SEBORRHEA (*Steatorrhea*).—A functional non-inflammatory disorder of the sebaceous glands characterized by the excessive secretion of altered sebum and its accumulation on the skin, along with epithelial debris, in the form of an oily coating, greasy crusts, or fine, branny scales.

The condition may be (1) universal, or (2) local. The vernix caseosa existing at birth may be considered as a physiological seborrhea, but if it be excessive in quantity, or persist after the first month of life, it becomes pathological.

Universal seborrhea is rare; three principal forms are recognized:

(1) *Seborrhea squamosa neonatorum* (ichthyosis congenita) in which the accumulated sebum forms thick, yellow plates firmly adherent to the skin and fixing it; deep rhagades form at the articulations, the eyelids are tightly stretched, the lips retracted, causing the gums to be exposed; the fingers, toes, and ears are badly developed. The subjects invariably succumb in a few days.

(2) *Seborrhea universalis* (*vel pityriasis tabescentium*) occurs only at the end of wasting diseases (*e.g.* diabetes mellitus), and consists in the existence of a universal, branny desquamation, especially over the trunk and extremities.

(3) *Cutis testacea* is a condition closely resembling ichthyosis hystrix, in which the trunk and extensor surfaces of the extremities are covered with large thick plates of greasy, inspissated sebum, usually greenish or blackish from accumulation of dirt upon them. The subjacent skin is not inflamed, and the sebaceous nature of the disease is clearly shown by the presence of processes from the under surface of the plates penetrating the dilated sebaceous ducts.

Treatment may be conducted on the same lines as for the local forms of seborrhœa.

The various forms of local seborrhea are among the commonest skin diseases presenting themselves for treatment. They most frequently develop about the period of puberty, like the other forms of sebaceous disease with which they are often associated, and they affect the female more than the male sex. Occasionally they occur in healthy persons, in which case they are usually very amenable to treatment, but the greater number of cases arise in persons suffering from anæmia, weak circulation, dyspepsia, menstrual disorders or phthisis. Personal uncleanliness strongly predisposes to the disease. Authorities differ as to whether it is worse in summer or in winter, the majority leaning to the latter view.

In *Seborrhea oleosa* the sebaceous discharge is very abundant and gives a glossy or greasy appearance to the skin, or may even form large oily drops upon it, causing a distinctly rancid odor. The condition is physiological among the negro races, but somewhat rare among whites, and affects chiefly brunettes. The nose, forehead, and the bald scalp

are the chief seats of the disease; on removing the secretion the openings of the sebaceous gland ducts are seen to be very patulous and the oily discharge rapidly reaccumulates. The condition frequently complicates rosacea, and is specially common in alcoholic subjects.

Seborrhea sicca is by far the commonest form of the disease; the sebum is secreted less rapidly and in smaller quantity than in seborrhea oleosa, and is mixed with epithelium from the sebaceous glands and excretory ducts so as to form fine greasy or branny scales; the underlying skin is pale and leaden. No subjective symptoms are present, but decomposition of the sebum may give rise to eczema and itching (*see ECZEMA SEBORRHEICUM*). The disease presents certain peculiarities according to its sites.

(1) *Seb. sicca capillitii* (dandruff, pityriasis simplex) is usually diffuse over the whole hairy scalp, but most severe at the vertex. It may be so slight as only to occasion a little furfuraceous scurf, or the secretion may be so abundant as to mat the hairs together. The disease, if of long standing, may cause permanent baldness (alopecia pityrodes *vel* furfuracea) from destruction of the hair bulbs, and even in mild cases the hair usually falls to some extent. When it extends over the forehead a little eczema is usually set up. The disease must be differentiated from eczema, psoriasis, tinea tonsurans and the secondary squamous syphilide, all of which it usually complicates.

(2) *Seb. faciei* is a common sequela of variola and other exanthemata, and a frequent concomitant of the composite disease rosacea. It affects chiefly the forehead, superciliary regions, sides of the nose and cheeks, and is specially liable to produce secondary eczema. Marked disfigurement is often caused by the greenish or blackish color of the scales. Cases in which the plugs of sebum penetrate the patulous excretory ducts simulate closely or may prove to be the early stage of lupus erythematosus, hence the name seborrhea congestiva originally applied to that disease by Hebra.

(3) *Seb. genitalium* consists in the accumulation of smegma beneath the prepuce in males, about the clitoris and between the labia and nymphæ in women. Decomposition of the sebum frequently causes balanitis in the male, and in the

female a condition liable to be taken for gonorrhea.

(4) *Seb. corporis* is the disease formerly described as lichen circumscriptus, circinatus, marginatus, annulatus, gyratus, etc. Its characters vary considerably from those of the forms just described. The eruption usually occupies a triangular patch between the scapulæ, the base being directed upward, and the sternal and clavicular regions; it consists of groups of minute pink papules, which form rings with well-defined margins, spreading centrifugally and coalescing to form gyrate figures. In old standing and extensive cases, the rings may be only observable at the outside of the patches. In the center of each ring is a thin, greasy scale frequently detached by the clothing. Persons who wear flannel clothing, and especially those who wear the same night and day, are frequently the subjects of the disease. Seborrhea capitis is almost invariably present, and acne is frequently intermingled with the disease. Moderate itching is usually complained of. The condition has little tendency to cause eczema, except, perhaps, in rheumatic subjects. The disease is apt to be confounded with tinea versicolor, tinea circinata, pityriasis maculata, and the early circinate syphilide.

Treatment of Seborrhea.—*Constitutional*: fresh air, exercise, and proper feeding must be enjoined. Cod-liver oil, iron, arsenic, and the sulphide of calcium are the drugs most generally used.

Local: crusts and scales must be softened with rags soaked in diluted liquor potassæ, or, preferably, with oil, and removed; in cases of seborrhea capillitii it is as well to apply the oil freely at night and wear a flannel nightcap; then vigorous friction made with an alcoholic solution of soft soap (spiritus saponis alkalinus of Hebra) which removes loose hairs and further cleanses and stimulates the skin. Mild astringent ointments containing alum, borax, or tannin should then be applied, or more stimulant applications, such as diluted red oxide or white precipitate ointments. The addition to these ointments of salicylic acid or resorcin (2–5 per cent.) is beneficial and prevents decomposition of sebum with its deleterious results. The habitual use of soap containing carbolic acid, sulphur, or tar is usually advisable. Should eczema arise as the result of too vigorous treatment, it

must be dealt with on general principles.

J. J. PRINGLE.

Symptomatic Indications.—*Iodine; natrium mur.*

SEPTIC DISEASES (*Sapræmia*, *Septicæmia*, and *Pyæmia*).—These affections, though usually observed as secondary consequences of wounds or other injuries, occasionally arise under other circumstances.

In *Sapræmia*, or septic intoxication, the symptoms are produced by the absorption of soluble products of bacteria action. These bacteria are probably those present in ordinary decomposition, and are not themselves capable of surviving or producing any effect in the living blood or tissues.

By *Septicæmia* is to be understood a condition in which the blood becomes itself infected by microbes, ordinarily associated with suppuration. There is no one microbe constantly present; the staphylococcus pyogenes aureus or albus, or the streptococcus pyogenes, may one or all be the active agent in suppuration and in septicæmia, but it is probable that the last named is the most malignant, and most often associated with severe septicæmia.

Pyæmia is to be regarded as a form of septicæmia characterized by the occurrence of multiple or so-called metastatic abscesses. Clinically, no hard and fast line can be drawn; pathologically, the microbes found in the blood and in the affected tissues are the same, and the morbid anatomy renders it probable that the essential event in pyæmia is the occurrence of phlebitis at the seat of the primary lesion. As this phlebitis is infective, it is reasonable to suppose that particles of the clots in the veins are detached and become impacted in the lungs, or if the radicals of the portal system be the veins involved, in the liver, and there set up a suppurative process.

No organ of the body enjoys immunity, but the most frequent seats of destructive purulent inflammation are the joints, the pleura and peritoneum, the meninges, the endocardium, the eye, the muscles, the liver, and the spleen. The infective factor is undoubtedly a microbe, the streptococcus pyogenes, or one or both of the two above mentioned staphylococci. The probable sequence of events is that

a minute vessel or capillary becomes plugged by an infective embolus—a collection of cocci, or a clot containing cocci. Each embolus is a focus of inflammation, leading to coagulative necrosis in its immediate neighborhood, with minute extravasations around. Secondary inflammation ensues about the necrotic focus, and the inflammatory process becomes, through the agency of the pyogenic cocci, suppurative.

That a very slight wound may be followed by a severe septic disease is a well-established clinical fact, but a satisfactory explanation of it has not yet been afforded.

As has been stated, the microbes found in the most acute forms of septic disease are specifically identical with those present in a trivial furuncle, or in the so-called “laudable pus.” Why in certain cases those microbes are the determining cause of so malignant a process as septicæmia or pyæmia is not very clear. In some cases a partial explanation may be found in a neglect of the old maxim: “If there be pus, let it out.” In others the debilitated condition of the patient may be a contributory cause. In others, again, the anatomical relation of the parts primarily involved is of importance; this is the case in puerperal fever, and in pyæmia secondary to inflammation of the vermiform appendix. But a considerable proportion of cases remain, in which it seems necessary to suppose that the microbes themselves are more virulent—*i. e.*, possess a greater power of growing and spreading in the tissues, than is ordinarily the case. Some importance may also attach to the dose, that is to say, to the number of microbes reaching the blood from the primary focus.

Symptoms.—The general symptoms of these three varieties of septic disease are described in the article on PUERPERAL FEVER (*q. v.*), and it will suffice here to point out some of the morbid conditions under which septic diseases are liable to occur as complications, for the proportion of cases in which either septicæmia or pyæmia arises spontaneously is very small, and it is doubtful whether even in these cases the spontaneity is not more apparent than real. The specific poison may obtain entrance through a slight abrasion of the skin, or through a bed-sore, which may even heal under suitable local treatment while yet the general sys-

temic poisoning progresses; or the point of entrance may be an ulceration of the mucous membrane of the pharynx, intestine, or urethra. The cases in which septicæmia (or more probably, perhaps, pyæmia) seems to be most distinctly spontaneous are examples of *Acute Osteomyelitis*, where without any abrasion of surface, an acute infective process originates within the cancellous structure of the long bones; here, however, a previous traumatism has probably in all cases lowered the vitality of the bony tissue. A specific infection of the endocardium may occur in the course of septicæmia or pyæmia, and may be the intermediate process which converts the former into the latter, but in a considerable proportion of cases the lesion of the endocardium is the most prominent, and, at least appears to be, the primary lesion. Such cases come within the definition of ulcerative or malignant endocarditis. (See HEART, ACUTE DISEASES OF THE VALVES.)

The temperature is of the remittent type; the initial rise in septicæmia is generally sudden and may be accompanied by a rigor; the exacerbations are apt to occur daily in the evening, giving the temperature curve a general resemblance to that of enteric fever. The development of pyæmia is marked by wider fluctuations. The temperature rises rapidly, often to 105°–106° F. during the rigors; the subsequent remission, which is accompanied by copious perspiration, may bring the temperature down below the normal point.

The skin, which soon assumes a sallow or more distinctly icteric tint, may be the seat of minute petechiæ or of larger ecchymoses; an erythematous eruption is frequent, and has been mistaken for that of scarlatina; septic disease is, however, not an infrequent complication of scarlatina anginosa; roseolar, urticarial, and pustulous eruptions may also be met with.

The pulmonary symptoms, even when abscesses exist, are often obscure; patches of broncho-pneumonia may be discoverable, but the amount of dyspnœa may be out of proportion to the physical signs. Bronchitis is a frequent complication.

The spleen is enlarged at an early stage and may subsequently become the seat of infarcts which break down into

abscesses. Hepatitis occurs with great frequency in those cases in which the primary lesion is within the domain of the portal system; multiple hepatic abscesses and general pyæmia may thus have their origin in suppurating hemorrhoids, in inflammation of the vermiform appendix, or in ulcerative enteritis. Colliquative diarrhea is frequently present; and is not always due to enteritis, discoverable after death.

The serous cavities may be the seat of purulent inflammation, generally produced by extension from the viscera; thus pericarditis and empyema are common complications.

The renal symptoms vary widely; an acute septic nephritis with miliary abscesses, or one or more suppurating infarctions may be present, in which case the urine is highly albuminous, and contains casts, or epithelial cells and blood. In other cases, in association with ecchymoses in the substance of the kidneys, or hemorrhage into the mucous membrane of the pelvis, or miliary abscesses, a small amount of albumin and perhaps traces of blood are present, while in others little or no albumin may be detectable.

The occurrence of suppuration in and about the joints, in the muscles, and aponeuroses, as well as the occurrence of panophthalmitis, are mentioned in connection with the pyæmic form of puerperal fever.

The cerebral symptoms are of the same typhoid character as those produced by other severe and exhausting fevers. More rarely meningitis, cerebral hemorrhage, or abscess may be observed.

Diagnosis.—The diagnosis of septic disease is usually in the early stages difficult. The resemblance of certain cases to scarlet fever has been mentioned; cases of purpura variolosa, that is to say, cases of smallpox, in which, before the papular eruption comes out, numerous widespread cutaneous ecchymoses appear, have been confounded with septic disease. The true nature of such cases can only be recognized by a careful consideration of their ætiological relations. The same remark applies to those somewhat chronic cases of septicæmia, in which the general prostration, enlarged spleen, diarrhea, and perhaps roseola, present a general resemblance to enteric fever; the history of the case, the character of the stools, and the temperature curve may afford valuable

information; careful examination ought also to be made for cutaneous ecchymoses, swelling of the joints, and retinal hemorrhages.

The resemblance of some cases to acute miliary tuberculosis may lead to considerable difficulty, and in view of the pathological affinities of acute tuberculosis and pyæmia this is not surprising, nor is it always possible to remove all doubt until the development of some distinctive symptom, such as well marked arthritis or choroidal tubercle.

In those cases of septic disease which present at an early stage arthritis of many joints, endocarditis, and high temperature, the diagnosis from acute rheumatism is not at once possible. The effect of salicin in reducing temperature and relieving articular pain is very much more marked in acute rheumatism than in pyæmia, and, later, the occurrence of icterus and cutaneous ecchymoses, of retinal hemorrhages, of broncho-pneumonia, and of marked splenic enlargement will point to pyæmia, though cutaneous ecchymoses and broncho-pneumonia are occasionally observed in severe cases of acute rheumatism.

If severe acute nephritis be developed early in the case, it may be impossible to distinguish it from one of acute Bright's disease, and indeed such a case may be in one sense considered to be a variety of acute Bright's disease, with the super-added danger that the inflammation is secondary to an infective inflammation of some other organ or tissue.

Prognosis.—The prognosis of sapræmia is, speaking generally, less favorable than that of septicæmia, since, if the cause can be discovered and removed, the poisoning will cease; the prognosis of sapræmia, therefore, is dependent on the nature of the causative malady. The prognosis of acute severe septicæmia is extremely unfavorable and death may ensue in a few days; in less severe cases, if the primary lesion can be discovered and treated, the prognosis is more hopeful.

When pyæmic abscesses have formed the prospect is much more gloomy, since each such abscess is a fresh focus from which the infective particles may be distributed.

Treatment.—The treatment of sapræmia has been indicated; it consists in removing the source from which the poisonous matter is derived; the appli-

cation of this principle to the special case of one form of puerperal fever is fully discussed in the article on that subject (see subhead Septic Poisoning). The treatment of septicæmia is not hopeful; internal medication is only palliative, but large doses of quinine reduce the temperature, probably conserve the patient's strength, and may tend to check the morbid process, but no radical benefit can be hoped from such means. If suppuration be known or surmised to exist in any organ or tissue, exploration at the earliest possible date is advisable. This is the more necessary since it is impossible to say with certainty, in the early stage of any case, whether it is an instance of sapræmia, or of true septicæmia. Acute pyæmia is almost invariably fatal. Subacute cases, however, occur; in them, especially those in which the earlier abscesses are in easily accessible situations, much may be hoped for from persistent treatment; every abscess must be evacuated and its cavity rendered antiseptic, the patient's strength being maintained by the administration of easily digestible or predigested food, and by the exhibition of stimulants (champagne, old port wine) in moderate quantities.

DAWSON WILLIAMS.

SHOCK.—Shock may be described as a depression of all the functions, the result of a powerful impression applied to the nervous centers or some portion of the nerve periphery. The impression (injury, or operation, or mental disturbance) acting on the nervous system affects every organ connected with it. The heart is chiefly impressed, and impaired cardiac action, affording a diminished supply of blood, induces an aggravation of all the symptoms, and gives some of them peculiar characters. Indeed, the most striking evidence of shock is seen in the circulatory organs. Brunton shows that shock is mainly due to paralysis of the heart and vasomotor paralysis of the abdominal vessels. The sudden dilatation of the abdominal vessels may simulate sudden hemorrhage.

There are some poisons which give rise to shock by acting directly on the muscular fiber of the heart; such are the upas poison and cyanide of potassium, when injected into the blood.

The partial or complete cessation of muscular action is very marked in shock.

Muscular actions are of two kinds: those which take place through the instrumentality of the spinal cord and medulla oblongata, and those which are the direct manifestations of the psychical power. The first set of actions comprise the excito-motor or reflex, as well as the sensori-motor or consensual; while those of the higher seats of origin of nerve power are those educed by the feelings, the ideas, and the will. In shock, the most exalted of these are the first to be impaired or suspended; the impairment is attended with little danger. It is not so as we descend in the scale of nervo-muscular action. When sensori-motor action is arrested, life itself is in danger; and when excito-motor action in some of its manifestations (the suspension of all excito-motor action, it is needless to say, is inconsistent with life) is impaired, a fatal termination is extremely probable.

The *causes* of shock may be classed under four heads: 1. Those which act on the corporeal organization. 2. Those which act on and through the psychical functions. 3. Those which are both corporeal and psychical in equal or unequal degrees. 4. Cold, which, though fully recognized by physiologists, has somewhat escaped the attention of surgeons. Poisons may be classed under the first head.

The greater number of cases of shock are found under the third head, where both bodily and mental causes contribute to the effect, such as burns, extensive wounds, operations, bites of poisonous animals. Irritant poisons act in a similar manner to burns or irritants on the surface. The causes which act purely through the medium of the psychical function are the more powerful emotions: joy, grief, anger, fear. When these causes lead to a fatal result it will usually be found that some disease of heart or brain is present. Causes which act purely on the corporeal organization are rare; the sudden emptying of an habitually distended bladder or the rupture of an internal aneurism may be cited as examples.

The *symptoms* of shock correspond for the most part—not invariably, or under all circumstances—with the severity of the cause. In the severest cases, as after the crush of a limb, or the opening of a large joint, or gangrene of a portion of bowel, the injured person is found motionless, on his back, or as placed by bystanders;

he is cold, perhaps covered with a cold sweat, and pale in lip and skin; the eye turned upward, the upper lid depressed; the conjunctiva is lusterless or even "glazed." The features are contracted, the lips are parted and thin. If the shock be due to continued loss of blood, great restlessness and tossing of the limbs will take the place of muscular inaction.

It is commonly said that the action of the heart is accelerated by shock. Probably in every case there is at first, for a longer or shorter time, diminished frequency of the heart's action. Consciousness, the intellect, the sensibilities are blunted, and the will is paralyzed. Deglutition may be difficult, and the contractility of the sphincters lost. The urinary secretion and glandular activity generally are retarded or arrested. The respiration is feeble, quickened, and irregular. Nausea and vomiting may be present. The temperature is lowered.

In order to give greater precision to our knowledge of shock, I have used the thermometer in many instances of its severer forms. The temperature may descend to 97° or even 96° ; its descent below 97° is not frequent. A remarkable incident, which I have found to occur in amputation of the thigh, is this; the very moment the saw comes into action in dividing the bone, the temperature suddenly falls from a tenth to a fifth of a degree; no change is seen when the soft parts are cut, wherever the extent of the incision may be.

Shock has many varieties, and circumstances may considerably modify its phenomena. It is more marked in the so-called "nervous" temperament. It is less marked in calm and hopeful temperaments. Extreme excitement, as in battle, may delay, but, probably, it does not avert the symptoms of shock. Its phenomena are intensified by prolonged or severe pain.

Certain injuries to the head produce a peculiar form of shock, which is known as concussion of the brain. Consciousness, intelligence, and the emotions are more or less in abeyance, while the sensorimotor and the excito-motor functions are, perhaps, but slightly impaired. A stun or jar to the nerve centers may thus give rise to apparently more intense shock than a limb injury which is about to prove fatal.

The influence of *sex* and *age* on shock

is of great interest. I am of opinion that woman, other things being equal, bear injuries better than men. I am assuming, however, that the nervous system is less taxed that it is in men.

Patients of advanced age, presuming that the age is not extreme, that the internal organs are sound, and the habits temperate, often bear shock remarkably well. When old age is associated with disease of important organs, shock is frequently severe. Often the shock *seems* less intense, but it persists, and, when we least expect it, may prove suddenly fatal. Chronic and relapsing forms of shock are met with in very feeble and in ailing persons. Children, it is commonly supposed, suffer severely from shock. Children suffer more than adults from cold, or loss of blood, or absence of nourishment, but probably they bear injuries and operations better than adults. The explanation which I offer, and which is based on experiments on animals is this: The lower the manifestation of vitality, so far as this is tantamount to the manifestation of nervo-muscular force, the less the susceptibility to shock from injury. Where nerve force is predominant, shock also becomes predominant. On this principle, the person with old joint disease, worn to mental and bodily torpor, and the young child whose force is developmental rather than nervous, bear operations and injuries better than a man in the prime of life, whose every organ and function are subservient to the exercise of nerve force. *Disease* has a more important bearing on shock than either age or sex. Cardiac, pulmonary, hepatic, and, above all, renal ailments lend a peculiar risk to operative proceedings.

The principal feature in railway accidents is the combination of the psychical and corporeal elements in their most violent forms, and the resultant shock is more than ordinarily severe.

Reaction, with all the incidents which accompany increased vigor of circulation, follows on shock. It may be slight or severe, but in bodily injuries and in operations much of the febrile action, which was once attributed to reaction, is now, with greater justice, put down to septic change.

The *death* after shock is usually due to syncope or asthenia. The syncope is of two kinds. In one there is sudden and extreme spasmodic contraction of the

heart, the heart remaining empty and contracted. Very much more frequently the heart simply ceases to beat, and its cavities contain more or less loosely coagulated blood. When the death itself is exceedingly slow and protracted, decolorized clot may be found.

The *treatment* of shock is for the most part of a negative character. Where the head is not injured stimulants may be given; into the rectum in extreme cases. A little opium is often of benefit. If brandy stimulates and opium produces drowsiness, the prospect is so far more favorable. Probably the one great remedy for shock, and we owe this knowledge to experiment on animals, is the early application of heat. Hot air is the best form of using heat; the hot bath comes next; a goodly number of hot-water bottles are also efficient. After all the severer operations the application of numerous hot-water bottles, even in summer, should not be neglected. In the hottest weather, loss of blood and the shock of an operation give rise to a feeling of distressing coldness.

In operations, at any rate, something may be done to lessen or prevent shock if it be true, as I have attempted to show, that shock is always most marked where nerve function is highest in character and most intense in action. The maximum of shock is in the adult man whose will and ideas predominate over all other functions; the minimum of shock is seen in the young, the feeble, and the old, so long as youth, debility, or age is indicated by blunted or altered nerve force only. May we not imitate this bluntness of the higher nerve forces by enforced and prolonged indolence in bed, by mild opiates, or chloral, or even some approach to alcoholism, or in some cases by slight etherization for many hours before sudden, unexpected, and severe operations?

PROF. FURNEAUX JORDAN.

Symptomatic Indications.—*Camphor* is the most valuable and important remedy for this condition. When the persevering use of this remedy has failed to relieve, *veratrum album* will usually be found efficacious.

SHINGLES.—See ZOSTER.

SHORT SIGHT.—See REFRACTION.

SHOULDER, DISLOCATION OF.

—See DISLOCATIONS.

SHOULDER, EXCISION OF.—See EXCISION OF JOINTS.

SINUS.—An abnormal passage whose length decidedly exceeds its diameter, and which is not a healthy, healing wound. Paget, in describing sinus and fistula together, says they include three classes, viz.: (1) long, narrow, suppurating canals, (2) canals giving exit to unnatural secretions (*e. g.*, gastric fistula, biliary fistula), (3) abnormal apertures between mucous cavities (*e. g.*, vesico-vaginal fistula). He goes on to say that “if a distinction is to be made between the terms,” “sinus” should be applied exclusively to those of the first form, in which the canal has but one opening. To thus limit the term, “sinus,” would be to differ from many surgeons with whom sinus means either blind or complete fistula.

Causes.—Usually (1) abscess; sometimes (2) wound, (3) ulceration, (4) sloughing. In addition to these, one or other of the following secondary causes almost essential, viz.: (1) Presence of dead bone, or of foreign body, (2) some mechanical obstruction to the free discharge of pus, (3) the occasional passage of secretions into the sinus, (4) presence of diseased glands, strumous or otherwise. Passage of sinus among muscles is a cause which may be classed with (2).

Treatment.—Find out and treat cause. Sayre's vertebrated probe useful when track is sinuous. Remove dead bone, etc. Slit up, if situation of sinus permits. Injections of iodine, tannic acid, Condyl, etc. Antiseptic bougies. Pressure. Drainage by passing a tube nearly to the bottom of the sinus. This can be combined with injection. Withdraw slightly each day. Cautery, especially galvanic or benzoline cautery. If the sinus pass among muscles, and cannot be slit up, the attachments of these muscles should be fixed by bandages, etc.

C. B. KEETLEY.

SINUSES OF THE DURA MATER, THROMBOSIS OF.—Thrombosis of the cerebral sinuses is undoubtedly favored by the peculiar conditions under which the venous circulation is carried on within the cranial cavity. These sinuses are little else than channels formed in a fold of the dura mater, and have consequently rigid walls and an unvarying capacity. They must then always contain the same amount of blood, notwithstanding the more or less engorged state of the rest of the venous system. Unlike the rest of

the veins, the circulation within them is removed from the influence of atmospheric pressure, and of muscular contraction, while, in the case of some of the sinuses, the current is against the influence of gravity. Moreover, in the case of the superior longitudinal sinus, and some others, the entering veins may have a direction contrary to that of the main current in the sinus. Lastly, some sinuses are curiously traversed by fine trabeculæ which must further retard the flow of blood. Hence, of all venous channels in the body the cerebral sinuses are perhaps the most favorably disposed for the spontaneous coagulation of their contents, and there can be no question that such an event comparatively often occurs. But they are also the seat of thrombosis, which is secondary to inflammation of their walls, or due to extension of clotting from some of their tributary veins.

Ætiology of Sinus Thrombosis.—Obstruction of the cerebral sinuses, by coagulation of their contained blood during life, may be brought about in several ways. At least two main divisions are met with.

(1) There are cases where thrombosis occurs in the weakly, in states of exhaustion, however produced, such, for example, as are met with in the very young or the aged, from exhausting diarrhea, in the course of lung disease, or following prolonged fever; and, at other periods of life, in the anæmic, or the subjects of phthisis or cancer. Rarer to be met with are similar spontaneous thromboses in the states of pregnancy of the puerperal period, and perhaps rarest of all, in organic heart disease. It is obvious that these are also conditions which are the most favorable to thrombosis in veins generally. It may be pointed out that we have, in these conditions, all the known factors which favor this process. First, there is feebleness in the propelling power of the heart, which is most felt in the cerebral sinuses, and most of all in the superior longitudinal sinus, which is, *par excellence*, the seat of this form of thrombosis. Secondly, there is probably a greater tendency to coagulation of the blood in such conditions (*e. g.*, anæmia, puerperal state), and, thirdly, the nutrition of the vessel wall may share in the lowered vitality, and thus favor coagulation of the blood in contact with it. The essential feature

of these cases is the condition of exhaustion or depressed vitality, and hence the term *marantic* applied to this form of thrombosis.

(2) The other form is that which is due to *inflammation* of the vessel wall, and with this may be allied those cases where the thrombosis, originally of phlebitic origin, spreads by continuity into the tributaries of the inflamed vein. Examples of this form abound in the case of the cerebral sinuses. Perhaps the most frequent is thrombosis of the lateral sinus by direct inflammation of the sinus secondary to disease of the temporal bone, and associated with pachymeningitis at the same spot, but often the thrombosis in this sinus is set up by continuity from its tributaries, the venules from the bone itself, or from the petrosal sinuses. Indeed, we may have the sinus blocked by extension of the clotting from the longitudinal sinuses on the one hand, or the cavernous on the other. These latter sinuses may be thrombosed secondarily to phlebitis in connection with the facial, nasal, or pterygoid veins as well as the orbital and ophthalmic veins. Hence it is that cavernous thrombosis may arise as a sequel of erysipelas of the face, or facial carbuncle, alveolar abscess, maxillary periostitis (it has followed extraction of a tooth), injuries or disease involving the jaws, nose, or face, and orbits. Occasionally cavernous thrombosis may arise, apparently spontaneously, or may be due to pressure from tumors or aneurisms, which are more often to be found in its vicinity than in that of the other sinuses.

Morbid Anatomy.—From the foregoing it will be seen that the sinuses most likely to be the seat of thrombosis are the superior longitudinal, lateral, and cavernous, and that the first is more liable to marantic, the others to phlebitic thrombosis. The post-mortem appearances differ somewhat in the two varieties. In *marantic* thrombosis the sinus is filled by a clot, pale, firm, laminated, and but slightly adherent to the wall, unless it have been formed for some time, when it may be undergoing organization. To this clot may be attached more or less coagulum, obviously of more recent date. If, on the other hand, the greater part, or the whole of the sinus has been recently occluded, then the thrombus has a less pale appearance and is less firm.

The tributary veins are also distended, and appear as solid cords, from being filled with clot. As before said, the process may extend from one sinus to another, although mostly limited to the superior longitudinal, or to only a portion of this. Owing, however, to the sinus receiving blood from the brain, the portions of this organ, whence the blood stream is thus arrested, undergo red softening. The cortex and centrum ovale will be studded with minute hemorrhages, and in places there may be considerable subarachnoid hemorrhage. If the straight sinus be blocked, then the softening will involve the basal ganglia, and the ventricles be filled with blood-stained fluid. The appearance of *phlebotic* thrombosis varies according to the nature of the primary source of inflammation. In the most frequent example—that of inflammation of the lateral sinus secondary to disease of the ear—the conditions are such as to give rise to a septic inflammation. Accordingly, in such cases, the sinus is found to be occupied by a pultaceous, semi-purulent, or ichorous mass, sometimes of greenish-black appearance. This can in great part be washed away by a stream of water, leaving the thick-walled sinus lined by a ragged layer of disorganized clot, except at the extremities, where the channel is occupied by a parti-colored thrombus. The softened thrombus may extend far down the jugular vein, or, on the other hand, be limited to only a small part of the sinus; it is invariably accompanied by a purulent or adhesive pachymeningitis in its vicinity, or with more wide-spread dura-arachnitis. No situation could well be more favorable for pyæmic infection, and therefore it is common in these cases to meet with pulmonary abscesses, which obviously own this origin, the septic material being conveyed direct to the lung. Of the other sinuses the most frequent to be the seat of this secondary form of thrombosis is the cavernous, owing to its free venous communications through the ophthalmic vein, as already mentioned. This sinus may indeed be involved by the extension through the petrosal from the lateral, and often the thrombosis extends from one cavernous sinus to the other.

Symptoms.—Except in the case of the cavernous sinus, there are no constant or definite symptoms of this condition, and

it must be confessed that, in the majority of cases its occurrence, although suspected, can hardly be proved during life. This, however, it is justifiable to say, that whenever in a patient who is suffering from marked anæmia, wasting disease, exhaustion, or other state favoring thrombosis, brain symptoms supervene, commencing with headache, often of great and increasing intensity, followed, it may be, by delirium, convulsions, hemiplegia, or other paralyses, and passing into coma, sinus-thrombosis may reasonably be expected. The headache may occur for days before any other signs arise, and optic neuritis is not usually present. These remarks apply chiefly to the ordinary form of marantic thrombosis—that, namely, in which the *longitudinal* sinus is primarily concerned. The paralytic and other objective phenomena are in this case due to the extension of the process to the cerebral veins, and the resulting hemorrhage. It depends upon the seat of the latter whether or not there are any convulsive or paralytic symptoms, and that again is determined by the situation and extent of the thrombus. But as regards the *lateral* sinus, it may be said with truth that there are no symptoms directly referable to its occlusion. It is the collateral circumstances that suggest its occurrence. Great and undue distension of the jugular vein on the affected side, and, in rare cases actual evidence of the plugging of this vein, with enlargement of its collaterals, would point to involvement of the lateral sinus—*e. g.*, in a case of chronic ear disease. Rigors and other indications of pyæmia may also occur. It is different with thrombosis of the *cavernous* sinus, for owing to its intimate relation to orbital circulation and the fact that its wall is traversed by certain cranial nerves, its occlusion is generally marked by very definite signs. Among these the most constant is proptosis, which may be very slight or produce marked exophthalmos, its occurrence being due, for the most part, to venous congestion and œdema of the orbital tissues. It may be quite transient, for collateral circulation may become established. When the proptosis is very slight, it may be solely attributable to the paralytic condition of the ocular muscles. Œdema of the eyelids, chemosis, and facial œdema are associated with thrombosis of the sinus, when, as often,

happens, there is also ophthalmic and facial phlebitis. An enlargement of the frontal veins is sometimes apparent from the diversion of the blood stream through the orbito-facial anastomosis. Contrary to general belief, retinal congestion and swelling of the disk are not distinctive signs of occlusion of this sinus, and, when present, indicate the involvement of the ophthalmic and retinal veins in the thrombotic process. Next to proptosis are the signs of involvement of the nerves which run in the walls of the sinus. Severe frontal headache or supra-orbital neuralgia, indicating disturbance of the first division of the fifth nerve, may be one of the earliest symptoms. The third, fourth, and sixth nerves may all be affected, producing complete ophthalmoplegia externa, or only one, most commonly the third, may be paralyzed. At first there may be myosis, but commonly mydriasis, ptosis, and external strabismus occur. No doubt there must be phlebitis, as well as mere thrombosis, to produce total ophthalmoplegia, and if first one eye and then the other be thus affected, the inference of cavernous thrombosis is made almost certain, since such a sequence indicates the extension of the process from one side to the other. Of thrombosis of the remaining sinuses there are no distinctive signs.

Diagnosis.—It is thus apparent that except in the case of the cavernous sinus, the diagnosis of sinus thrombosis is little more than conjectural. It must mainly depend, not upon direct signs, but on the existence of antecedent conditions favorable to thrombosis, conditions, that is, of debility and exhaustion, of impoverished blood and cardiac enfeeblement, in the marantic form; conditions of inflammation in the vicinity of the sinuses or their tributary veins, in the phlebitic. The differential diagnosis will have to be made from meningitis, tumor, hemorrhage, or cerebral abscess, and as each of these lesions may coincide, either as antecedents, concomitants or results of sinus thrombosis, it is often impossible to determine the presence of the latter to the exclusion of the former. The duration of the symptoms is no safe criterion, since the thrombosis may be very gradual and slow in producing complete occlusion. In a case of ear disease, undue fullness, and perhaps actual throm-

bosis of the jugular vein will suggest that thrombosis of the lateral sinus is concerned in the production of any cerebral symptoms that may be present. In cases of marantic thrombosis of the longitudinal sinus, the only symptom may, as has been said, be severe persistent headache, until the occurrence of convulsions or paralysis, speedily followed by coma, points to the secondary production of meningeal hemorrhage and red softening.

Prognosis.—Although the majority of cases are fatal within one or two weeks of the appearance of cerebral symptoms, yet, in a few cases, there has been evidence of a slight amount of thrombosis being recovered from. This is more likely to be the case in the marantic than in the phlebitic form. In any case it is a rare event. Again, some cases of cavernous thrombosis, though ultimately fatal, have been of long duration.

Treatment.—There is little to be said on this head. The enforcement of absolute rest is imperative, and the symptom of pain needs to be dealt with. Ammonia and bark should be given in the marantic cases; bromides and even morphine may be required for the severe neuralgia and headache. If the symptoms be of long duration then iodide of potassium or sodium may be given, in the hope that the thrombus may be absorbed. The phlebitic cases are usually characterized by pyæmic symptoms, and therefore the treatment must be as for pyæmia. Professor Horsley advocates the excision of the thrombosed lateral sinus in cases of ear disease as anticipatory of pyæmia, and has performed this operation in one case.

SIDNEY COUPLAND.

SIXTH NERVE, DISEASES OF.

—This nerve, which supplies the external rectus muscle of the eyeball, arises from its nucleus in the floor of the fourth ventricle, runs forward in the substance of the pons, and emerges near the middle line at the level of the junction of the pons with the medulla. Its nucleus is surrounded on three sides by the fibers of the facial nerve in their course from their nucleus to the surface of the medulla.

Paralysis is the most common affection of this nerve. The nucleus itself may be involved in a tumor, especially of the

substance of the pons. Outside the medulla and pons the nerve may be affected by syphilis, meningitis, tumors about the cavernous sinus, or in the orbit. One of the commonest causes is cold. The resulting paralysis is different according as the nerve or its nucleus is the seat of lesion.

In the case of the *nerve* there is internal strabismus of the eye of the same side, and the eyeball cannot be turned outward. There is diplopia on looking toward the paralyzed side, the false image being on the same side as the affected muscle, and the two images become more separated as the eyes are turned further out toward the affected side; in looking at an object above the horizontal line, the false image is slanted so that its lower end is nearer to the true image than the upper, and with objects below the horizontal line the upper end is nearer to the true image than the lower. Secondary deviation is shown by the other eye moving outward in fixing an object when the affected eye is covered up.

When the *nucleus* is affected there is, in addition to paralysis of the external rectus, inability of the internal rectus of the opposite eye to turn that eye inward. As a consequence of this the axes of the eyes are kept parallel, and both are conjugately deviated to the opposite side, away from the side of lesion. The reason of this is that the nucleus of the sixth nerve sends fibers up in the pons to that part of the nucleus of the opposite third nerve which supplies the internal rectus; we thus have paralysis of the internal rectus without the nucleus of the third nerve being involved, owing to its receiving its nervous impulse for parallel movement from the sixth nucleus of the opposite side. As the sixth nucleus is in such close proximity to the facial nerve in the substance of the pons, it is frequently found that the whole of the face on the same side is paralyzed, and gives the electrical reaction of degeneration, so that with a lesion of the *left* sixth nucleus there is conjugate deviation of both eyes to the *right*—*i. e.*, paralysis of the left external and the right internal rectus, and sometimes complete paralysis of the *left* side of the face.

Diagnosis.—Paralysis from lesion of the nerve is usually diagnosed without much difficulty, especially if the second-

ary deviation of the sound eye and diplopia be noted. Lesions of the nucleus are well shown by the above symptoms. Affections of the nerve just outside the medulla may also be associated with complete facial paralysis of the same side, but there would be no conjugate deviation of both eyes.

Tumors about the cavernous sinus or in the orbits would probably cause paralysis of the third nerve and optic atrophy of the same side.

Prognosis.—When the lesion is produced by tumors in the pons, or at the base of the brain, the prognosis is hopeless, but when in the orbit the growth can sometimes be reached. When due to cold or syphilis recovery usually occurs, especially in the former case.

Treatment.—When caused by cold, hot fomentations to the head, followed in the chronic condition by blisters to the temporal region of the affected side, and tonics internally, are indicated. In cases where tumor is diagnosed, mercury and iodide of potassium in full doses should be given on the chance of its being syphilitic. In cases of paralysis due to cold, a very weak constant current of two or three cells, or more if the patient can bear it, may be applied to the closed eyelids.

C. E. BEEVOR.

Symptomatic Indications.—See PARALYSIS.

SKIN, ANÆMIA OF.—See ANÆMIA OF SKIN.

SKIN, ATROPHY OF.—See ATROPHIA CUTIS.

SKIN GRAFTING.—See SKIN, TRANSPLANTATION OF.

SKIN, HYPERÆMIA OF.—See HYPERÆMIA OF SKIN.

SKIN, TRANSPLANTATION OF.

—(1) Minute pieces of epidermis, which should include the youngest layers, namely, those next the true skin, are shaved or cut off and placed upon the surface of a healing ulcer, in order that they may there form nuclei whence cicatrization may spread. (2) Skin is sometimes only partially severed from its connections, and then, with the circulation still active within it, transferred to the raw surface of another part. In this way, *e. g.*, gaps in the skin of the chest may be filled in from that of the arm. Of course the arm has to be bound to the

bosom until the skin has formed adhesions in its new site. (3) Pieces of skin, even of considerable size, thoroughly cleaned of subcutaneous tissue, have been successfully transplanted without any pedicle being left attached to them. In the first (far the commonest) method, it is enough to place a small piece of gutta-percha tissue over each transplanted fragment, and to cover with water-dressing.

C. B. KEETLEY.

SKOLIOSIS. — *Definition.* — Lateral curvature of the spine (*q. v.*).

SKULL, FRACTURES OF. — See HEAD, INJURIES OF.

SLOUGHING. — See GANGRENE.

SLEEP, DISORDERS OF. — It is necessary for the maintenance of health that sleep of a certain quality and quantity be regularly enjoyed. The exact amount required varies in different individuals and at various periods of life. Some people are naturally light sleepers and easily disturbed. It is evident that, *cæteris paribus*, such persons need more sleep than those whose slumber is profound, and in whom, therefore, the degree of rest is the more complete. The amount of sleep demanded varies very considerably, and probably largely depends upon the recuperative power of the individual and the extent of exhaustion, mental or physical, which the day's work entails. Sleep is generally more profound during the developmental period of life, and at that time the amount necessary is considerably in excess of what is subsequently required. Thus, a healthy newborn infant will sleep for twenty hours in the day, while during the prime of life some persons can maintain a condition of health upon five hours' sleep only, and others can occasionally go without sleep for thirty or forty hours with no apparent discomfort.

It is almost as requisite for the procuring of normal sleep that the body be in a condition of health, as that sleep is necessary for the preservation of health. Disorders of sleep are, therefore, extremely common, and depend upon a multiplicity of causes. They may be roughly arranged, for purposes of classification, into three groups.

(1) **Excessive Sleep.** — An unusual amount of sleep may be a normal occur-

rence after prolonged labor, either physical or mental. It is not uncommon at sea, but is most marked in cases of seasickness. Sleep, bordering on stupor, sometimes persists for days and even weeks after typhoid fever, and is frequently present in the course of many cerebral disorders.

Cases are occasionally met with in which there is a tendency to fall into a profound sleep, lasting, as a rule, a few minutes only, but sometimes persisting for an hour. Such attacks frequently occur in those affected by dreams, but may not accompany them. It is generally possible to awaken the patient, and, in most of its characters, the sleep appears to be purely physiological. As such it must be carefully distinguished from a dreamy state, which sometimes occurs as a warning in cases of *petit mal*.

The condition called *trance* consists of a profound sleep lasting for hours or weeks. The subjects of it are usually liable to functional nerve disorders, and often come of a neurotic strain. In severe cases the organic functions of the body may be so lowered in their intensity that death is closely simulated, while, in slighter attacks, the patient may be perfectly sensible of his surroundings, though apparently quite unconscious. All grades exist between these two extremes. In some cases the condition seems closely allied to that which is induced by hypnotic suggestion.

The *sleeping sickness* is a disease which exclusively attacks the negro inhabitants of the West Coast of Africa. Its chief symptom is a gradually increasing somnolence, which ultimately ends in a profound sleep, from which the patient cannot be aroused. Emaciation occurs, and the termination is nearly always fatal in from three to six or twelve months from the commencement. The affection has been supposed to be in some way related to an enlargement of the cervical glands, which sometimes takes place at the onset, but this is extremely doubtful.

(2) **Sleep Deficient in Quantity.** — An insufficient quantity of sleep may be obtained on account of restlessness, a condition arising from a great variety of causes. It is essential for the treatment that its causal relationships be recognized and appropriately remedied.

Much more important than restless-

ness, because more persisting and difficult to relieve, is inability to go to sleep—*insomnia*. This occurs in its most aggravated type in cases of delirium tremens, syphilitic insanity, acute, and acute delirious, mania, in which no sleep may be obtained for several days. Much more commonly the complaint is that it is impossible to get off to sleep for one or more hours after going to bed. In other cases again, a few hours normal sleep is succeeded by a prolonged state of wakefulness in the early morning. Insomnia is very often of purely functional origin, occurring in the nervous and impressionable, and depending upon mental overwork, worry, anxiety, etc. It is also frequently the result of various organic disorders, and may occur in the course of phthisis, pneumonia, Bright's disease, gastric or intestinal irritation, heart disease, senility, and febrile conditions. Pain, too, is a common cause of sleeplessness.

Treatment.—As many conditions of ill-health contribute to the causation of insomnia, it is necessary that a very careful inquiry be made into the general state of health and habits. Some of the most difficult cases to cure are those which arise from worry, etc., because it is often impossible to get rid altogether of the exciting cause. These patients should be recommended to indulge in such exercise during the day as will create a feeling of moderate fatigue, and to read some light and interesting literature before retiring to bed. Among other devices, which sometimes succeed, may be mentioned bathing the feet in warm gruel, beef-tea, or dilute alcohol before going to bed. These means are not often successful of themselves, and then arises the question of hypnotics, in the administration of which great care and discretion are always necessary. Of these opium and chloral hydrate must still be regarded as the most reliable, but, until other measures have failed, should not be prescribed in cases of simple sleeplessness, for fear of developing the opium or chloral habit. Bromide of potassium, butyl chloral, and cannabis indica, singly or combined, are frequently useful in the insomnia associated with neuralgia and headache. Paraldehyde is a safe and efficient hypnotic, but its nauseous taste is a great drawback to its general use. Sulphonal is a favorite remedy, but its

insolubility, on account of which some hours may elapse before the desired effect is produced, is an objection in some cases. Both amylene hydrate (soluble in 1-8 of water) and chloralamide (soluble in about 1-3 of rectified spirits) promise to be of considerable value. Urethane is very unreliable, and the other recently introduced hypnotics, acetal, methylal, hypnone, and chloral-urethane need only be mentioned. Sleeplessness resulting from pain or associated with heart disease is best treated with opium, which in lung disease is contraindicated. In delirious states chloral hydrate, bromide of potassium, or hyoscine should be administered. In the treatment of the insomnia of various forms of insanity, paraldehyde, sulphonal, and amylene hydrate are the most popular remedies.

(3) *Sleep Partial in Character.*—During normal sleep the whole of the higher functions of the brain are in abeyance, and there is a persistence only of "vital" actions. It often happens, however, that some of the higher centers retain their activity although the functions of the highest are suspended—a condition which may be termed "partial sleep." In this manner two great classes are formed, in the first of which there is a defect of consciousness and a correlative wildness of ideation—sleep with dreaming. In the second loss of consciousness and correlative elaborate motional actions—sleep with somnambulism.

In the course of *dreams* the most incongruous ideas are generally associated together into an ataxic whole, but in some people the flow of thought is to a certain extent sequential and orderly. Dreams are occasionally so vivid that they leave a lasting impression on the individual; at other times the images recalled during sleep are so faint that they pass unremembered. Children are peculiarly liable to dreams of a terrifying nature, possibly constructed upon the idle tales of servants and others. They awake screaming loudly, and such is the impression made upon them, that it takes a long time to make them disbelieve in the actuality of all they have seen and heard. These children have generally a neuropathic hereditary or personal history. Happily, bromide of potassium in moderate doses is able to

hold these so called "night terrors" in check.

Somnambulistic states are closely allied on the one hand to those unconscious and elaborate actions, which characterize post-epileptic automatism, and on the other, to one of the forms of unconsciousness produced by hypnotic suggestion. The somnambulist may retain his faculties of sight and equilibration to a really remarkable extent, but yet be altogether unconscious of his surroundings. And more, he may be able to exercise his intellectual faculties to an equal, and in some cases it is asserted even to a greater, degree than obtains during the state of wakefulness. Somnambulism must undoubtedly be regarded as one of the minor neuroses, and the subjects of it be looked upon as possessing a vulnerable nervous system, which may possibly break down in one way or another under any unwonted strain.

Treatment should be the improving of the general condition of the patient by placing him under favorable conditions of existence and by the administration of bromide of potassium at night.

Symptomatic Indications.—Deep sleep, with difficult waking; stertorous breathing, may often be relieved by *opium*; after *opium*, *belladonna* or *gelsemium* may be useful. *Belladonna* is also useful in insomnia, with heat and throbbing in the head; pain in the eyes; sleepy, but unable to sleep. *Hyoscinum* for insomnia from nervous excitement; light sleep broken by dreams. *Coffea*, sleeplessness from cerebral activity; sleeplessness in children. *Gelsemium* in simple wakefulness. *Cimicifuga*, when from bodily restlessness, in children during dentition.

SMALL-POX (Variola).—An acute infectious disease, characterized by a certain range of temperature and the development of a papular eruption, which becomes vesicular and ultimately papular.

Symptoms.—After an incubation period of from eight to fourteen days, during which, as a rule, there are no symptoms of ill-health, the disease commences suddenly with chills or actual rigors and high fever, with thirst, anorexia, a furred tongue, a full pulse, and nausea. Vomiting is an early and common symptom, and usually there is constipation. Sweating is generally present from the first,

and is often of diagnostic value. The temperature rises to a considerably height, 104° F. or 105° F. at the very outset; during the second and third day there are remissions, but it attains its maximum on the evening of the third day. Before the development of the characteristic eruption, however, certain *scarlatiniform eruptions* appear, usually in the form of a more or less bright diffuse erythema in the lower part of the abdomen and legs, and also about the chest and trunk, especially the axillæ and groins, and also at the bends of the elbows and in the popliteal spaces. A dusky erythema generally precedes a severe attack. About this time the papular eruption appears, and the severity of the disease will be directly proportional to the intensity and character of the eruption; the late appearance of the papules presages a mild attack; their premature appearance, on the other hand, is an evidence that the attack will be severe. The papules appear first on the face, scalp, and neck, then on the chest and back, and subsequently on the extremities, about two days later than the face. They are at first solid, indurated, and shotty, but gradually they become conical and may be surrounded by a red areola. The vesicular stage follows and umbilication takes place—*i. e.*, they have a central depression. The contents at this period become cloudy. At first the papules are separate and scattered (discrete); afterward, when the eruption is more extensive and the vesicles are more closely aggregated, and when they run together, it is said to be confluent. Papules, or pocks, may also appear on the mucous membrane of the mouth, throat, and nose, and on the conjunctiva about the same time as on the skin.

The fever, constitutional disturbance, and pains in the back remit when the rash comes out, and gradually disappear so that at the end of the first stage—*i. e.*, about the eighth day—the patient may feel quite well. As a rule, the sweating is the only symptom which persists. About the ninth day the next stage—*i. e.*, the period of maturation, sets in, the pocks become larger and hemispherical in shape, and lose their umbilication, the surrounding skin becomes uniformly red or brawny and is swollen and painful; some of the pustules burst, their contents flow over the neighboring skin and

form large yellowish scabs, which, on the face, are very disfiguring. Salivation, a hoarse cough, nasal discharge, and ophthalmia are all apt to be present, and sometimes there is purulent infiltration of the cornea. The fever now returns proportional in degree to the amount of suppuration. A disagreeable odor is often noticeable.

In the confluent form all the above symptoms are much exaggerated, the face is covered with crusts, and the hands and feet are much swollen, while delirium or unconsciousness may be present. This stage may last till the twentieth or twenty-second day. Confluent small-pox is particularly dangerous, death resulting from adynamia, gangrene, or one of the complications about to be mentioned. In the less severe cases, about the eleventh or twelfth day, those pocks which have not ruptured begin to dry up, become brown in the center, dry, sink in, and eventually form a round scab; the surrounding redness and swelling then subside, and the scabs come away in a few days, leaving violet-red elevations, which may, with time, completely disappear. In many of the pocks, however, the process will have gone deeper and will have involved the cutis vera; when such pocks fall off they leave a deep round scar with a punctated base, which at first is red, but ultimately becomes white and never disappears. In the confluent form the scars are larger and deeper, and the disfigurement much greater.

The most malignant form is the hemorrhagic; here ecchymoses, petechiæ, and vibices come out during the initial erythema, with hemorrhages into the various mucous membranes and hematuria.

Sometimes death takes place before the typical eruption has had time to be developed, or before its characters can be recognized.

Modified Small-pox (Varioloid).—Those who have been vaccinated, if they take the disease, usually have it in a modified form, "varioloid" as it is called. The initial fever is less, the pocks are less numerous and run their stages more rapidly; there is less surrounding redness, and the eruption hardly ever becomes confluent. There is no secondary fever, and as a rule the pocks fall off without leaving permanent scars; it is rarely fatal.

Complications.—Among the compli-

cations, nephritis is one of the most common, especially in the confluent form; œdema of the larynx and purulent pneumonia also occur; both are very dangerous to life. During convalescence there is often a marked tendency to the development of boils. The initial pain in the back may be very severe, and is occasionally accompanied by paraplegia.

Diagnosis.—In the early stages the chief points are the pain in the back and the sweating, signs which should always be regarded with suspicion in a pyrexial attack of unexplained origin. When the scarlatiniform rash is present the disease may be distinguished from that fever by the absence of the throat symptoms and of the characteristic appearance of the tongue, and by the absence of a fall of the temperature after the appearance of the rash. The eruption of measles has some features in common with small-pox, but the spots are more minute; they are aggregated into clusters, they come out more rapidly over the whole body, and they are preceded and accompanied by catarrhal symptoms. The hemorrhagic form sometimes presents difficulties in diagnosis which are almost insuperable; pain in the back is the symptom upon which the greatest stress should be laid in such cases.

Pathology.—At first hyperæmia of the papillary layer of the corium, with thickening of the rete; the papillæ increase in size, forming the solid papules; between the meshes of the reticulum serous fluid is exuded, forming the vesicle. The umbilication is due to the lesion occurring at the origin of a hair follicle or duct of one of the sudoriparous glands. The epithelial septa gradually give way, and cause the pock to become hemispherical and to lose its umbilication, and its contents to become cloudy.

Ætiology.—The disease is both infectious and contagious, but the materies morbi has not yet been isolated. It may be conveyed by the breath before the eruption has appeared, or by inoculation of the contents of the pock. No age is exempt, and during an epidemic all who are unprotected by a previous attack or or by vaccination, as a rule take it; second attacks, though decidedly rare, are not unknown.

Treatment.—Vaccination or re-vaccination, if performed at any time before the symptoms have actually appeared,

would probably be in time to modify the course of the disease. Careful dieting and nursing are all important; but during convalescence the diet should be especially nutritious. When once the disease has developed it will run its course without being materially influenced by treatment. Stimulants should be given or withheld on general principles. Various measures have been proposed to prevent the pitting, none of them completely satisfactory. Covering the face with a mercuric plaster, or puncturing each pock separately and inserting a little nitrate of silver, are methods recommended by persons of great experience. To allay the irritation, which, from the swollen condition of the skin, is always very great, cold compresses or a solution of corrosive sublimate may be used, or the face may be anointed with carbolized vaseline.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Cimicifuga* is sometimes useful in the first stage of the disease, with severe pain in the back and eyes; headache. *Belladonna* is also useful in the early stage; congestive fever, headache, delirium, photophobia. *Mercurius* when maturation impends, increase of fever, salivation, ulcerated throat. *Camphor* is valuable when eruption retrocedes or the disease assumes great malignancy, great depression of vital powers. *Antimonium tartaricum* in varioloid with gastric or pulmonary complications, nausea and vomiting. *Arsenicum iod.* is valuable in the malignant form. *Lachesis* in the hemorrhagic form. *Sulphur* in hemorrhagic form, or when the disease takes an irregular form; green, purple, or black pustules.

SNEEZING, PAROXYSMAL.—A symptom most commonly met with in the subjects of asthma and hay fever. The attack may be excited by any direct irritant, a bright light, cold, dust, the pollen of certain grasses, or the presence of certain articles of food in the stomach. Gout and hysteria have also been assigned as causes. The attack is usually accompanied by intense itching of the interior of the nose, and sometimes of the conjunctivæ and throat also.

The most effective treatment is the insertion high up the nose of a tabloid of cocaine, or the interior of the nose

may be painted with a five per cent. solution of cocaine. The inhalation of iodized vapor (tr. iodi. m. xx-xxx to a pint of boiling water) has also been found useful. Some cases are relieved by sniffing strong "smelling salts." (See also HAY FEVER.)

Symptomatic Indications.—*Arsenicum* is useful for frequent sneezing with copious discharge of watery mucus; burning in the nose with soreness. *Mercurius*, frequent sneezing, watery saliva, heaviness of forehead. *Gelsemium*, violent running paroxysms of sneezing; excoriating discharge.

SORDES are the crusts which form about the lips and teeth in the course of a serious illness, which is most often of a febrile character. They are composed of débris of food and epithelium, schizomycetes and micrococci being present in great numbers. Sordes may be yellow, brown, or black in color, and vary in thickness according to the degree of prostration, and the length of time they have been allowed to collect. They only form on those parts of the lips, teeth, and gums that are habitually exposed to the air. They are rather firmly adherent, and should be removed by careful sponging.

SOMNAMBULISM (Sleep-walking).

—An unconscious state of automatic movement, sensation, and intellectual activity of various extent, and sometimes anomalous character, which is almost always continuous with normal sleep, occurring in it rarely and as an interlude.

In the simpler instances of such an affection, there may be no definite symptoms of bad health; the sleep-walker may for an hour or so during normal sleep get up and dress himself without losing his unconsciousness, and employ himself on something he has set his mind upon, or on his daily occupation. For example, a housemaid may begin to dust the furniture, a chemist to make up the prescriptions, and having done so, may return to bed again and to natural slumber, waking subsequently without any recollection of anything that has happened, and without any power of recalling it, even when any evidence of the work done causes surprise and calls attention. Such conditions, though not very rare, have not as yet

been sufficiently, widely, and accurately observed to make us thoroughly familiar with all their physical details and psychological characteristics. They are not common in childhood and youth, not markedly more common in girls than boys. They generally go along with a neurotic temperament or tendency to such general disturbance of nervous equilibrium as epilepsy, hysteria, chorea, or megrim; but there are some cases which seem to accompany excellent health, and others only a passing emotional excitement, such as chagrin, anger, or surprise. To a slight extent the diathesis is hereditary; there are also some instances of the habit spreading from one person to another by the hysterical tendency to imitation (neuromimesis). It is very rare in idiots, and not more frequent in the insane than in the sane. In a case well observed by Mesnet, it came on about six months after a severe bullet wound in the left parietal bone, and the resultant state resembled very closely what Charcot has called the somnambulic stage of hypnotism. There is hyperæsthesia of touch and hearing in a few cases, and nyctalopia, and in a great majority good muscular sense; but frequently hearing and sensation are nearly or quite gone, and now and then there is loss of balance.

The term somnambulism has been used of late years, especially in France, to cover a wider range of mental abnormalities, among which are a state of profound lethargy which may simulate death (see TRANCE), and a condition of quite secondary personality, which has in a few rare cases for long replaced the normal character. The memory in consecutive somnambulic attacks is generally continuous from one to the other, and entirely separate from that of the ordinary life, and it is remarkable that it has been revived by artificial hypnotism.

Of the *pathology* of this condition, nothing is definitely known; the symptoms suggest a close analogy to the sometimes active state of post-epileptic automatism.

Treatment.—It is judicious to forbid and even punish the attack, although there is honestly no recollection of its occurrence, for as a rule the organic memory takes effect. A. T. MYERS.

SNAKE BITES. — See POISON, WOUNDS BY SNAKES, etc.

SPAMMENORRHŒA.— *Definition.*—Scanty menstruation.

Causes.—Phthisis, ovaritis, ovarian tumor, ante-flexion, mental depression.

Treatment.—According to the cases (*vide in loco*). In functional cases stimulants to the uterus, leeches, pulsatilla, ice-bag to sacrum, warm enemata, good diet, exercise, change of air, iron, quinine, strychnia.

SPASM.—An abnormal contraction of striped or unstriped muscle fiber. The term cramp is generally used to designate spasm accompanied by pain.

1. *Spasm of involving muscle* is of common occurrence, as unstriped muscular tissue is present in the coats of most hollow organs. Excessive stimulation in any of these induces an increase of afferent impulses and a corresponding degree of muscular contraction, which persists as long as the irritation is continued. In this way reflex spasm arises—*i. e.*, a muscular contraction, abnormal in degree and duration, and depending for its production upon the presence of some local irritation. As illustrations may be mentioned renal and biliary colic, esophagismus, rectal and vesical tenesmus. The vasomotor system is brought into connection with certain physical states, and it happens, therefore, that although spasm of the arteries may result from reflex action, it may also occur as an expression of emotion—*e. g.*, fear and rage. Bronchial spasm is in some cases undoubtedly due to peripheral irritation, and in others it is as clearly of central origin.

2. *Spasm of voluntary or striped muscle* manifests itself in various ways. The contractions may be continuous and *tonic* in character, or they may be subject to regular relaxations, and are then termed *clonic*. In some cases more or less extensive movements are produced, which may be rhythmical or disorderly, in others tremor only results. Tonic spasm may occur as a functional affection, from organic cerebral or spinal disease, and probably also from direct irritation of the nerve trunks in cases of spinal meningitis. For a consideration of the contractures which occur from these causes, the article on RIGIDITY may be consulted.

In regard to the origin of the spasm in cerebral disease many opinions are held.

Hitzig believes that the late rigidity of hemiplegia represents the sum of the associated movements, which are no doubt often increased in that condition, and seen in some cases to increase the spasm. The persistence of the rigidity during complete rest, as in sleep, tells strongly against this view. Hughlings Jackson regards the cerebellum as possessing motor functions, supplementing those of the cerebrum, and being in a way antagonistic to them. He considers late rigidity to be due to an unantagonized cerebellar influence. Charcot and others consider that the initial increase of reflexes, which occurs a week or two after a hemiplegic seizure, is possibly due to moderating cerebral influence, but that the rigid spasm of contracture is caused by a sclerosis of the lateral columns of the cord, irritating and producing an over-action of the anterior motor cells.⁷

Clonic spasms are typically seen in an epileptic fit, after the stage of rigidity is over. They probably depend upon exhaustion of the discharging cortical motor centers, which are no longer able to keep up a tonic contraction. Irregular or mobile spasm sometimes occurs in cases of hemiplegia, in which some power is regained, but it may also exist as a primary affection. The movements may be constant and may even persist during sleep, but they are usually most marked during voluntary effort. They are much more frequent in the arm than the leg, and are often associated with hemianæsthesia. Little is known with regard to the nature of these spasms. They are more common in children, and after embolism rather than hemorrhage. In adults the lesion is always in the optic thalamus or its neighborhood, and very often in the posterior part of the internal capsule. Similar choreiform spasms have been noticed in cases of tumor near the optic thalamus and of growths involving the parietal lobe. The characteristic spasm upon voluntary movement in cases of disseminated sclerosis is probably due to irregular wasting of the white substance of Schwann, on account of which an impulse meets with unequal resistance in different parts of its course, and a disorderly movement results. The same symptom is rarely met with after hemiplegia, and in some cases of tumor of the pons or crus.

Spasm in Spinal Disease (Pathology

of).—Spasm is a frequent result of those lesions of the cord in which the lateral columns are affected—*e. g.*, spastic spinal paralysis, disseminated sclerosis, myelitis, etc. It has not yet been definitely settled whether the rigidity in these cases is due to loss of cerebral control, to irritation of the anterior motor cells, or to the combined influence of the two.

WM. GAY.

SPERMATORRHEA.—An abnormal discharge of semen. A chronic disorder. Nocturnal emissions, if not oftener than once a fortnight, scarcely considered abnormal.

Cause.—Almost always masturbation.

Symptoms.—Niemeyer describes four classes of cases: (1) Persons who have unnatural emissions simply because they continue to masturbate. To their doctor they describe such symptoms as "nervousness," lassitude, palpitation, various exaggerated pains about the genitalia, etc. They readily confess that they have practiced self-abuse, but pretend they have given it up. (2) Robust looking persons who have really given up their bad habits and recovered their general health, but who are sexual hypochondriacs for some other reason. (3) Weakly, anæmic persons, who have never masturbated, and in whom ordinary and not frequent wet dreams produce dullness and lassitude. (4) True cases of spermatorrhea, in which exhaustion, etc., are really produced by too frequent seminal losses. Their symptoms are: sadness, dislike to work, lassitude, inattention, cowardice, trembling, noises in the head, dizziness, neuralgic pains in back of head, etc. Resemblance to hysteria. In these cases especially, semen often flows away with the urine or during defecation. But note, the latter symptom is not uncommon in healthy men. Distinguish between mere mucus and semen by the microscope, which in the latter case should discover spermatozoa.

Pathology of the last form (true spermatorrhea).—Probably a state of chronic congestion and relaxation about the prostatic part of the urethra and the openings of the seminal ducts, added to an undue irritability of the nervous system; in fact, a condition similar to the hysteria caused in women by ulceration of the os uteri.

Prognosis.—Cure difficult in many

cases, (1) because patient will not refrain from bad habits, either of self-abuse, of alcohol drinking, of excessive meat eating, of lying in bed in the morning, or of sedentary employment without proper outdoor exercise; (2) because of chronic nature of ailment.

Treatment.—Insist upon total abstinence from the vices just enumerated. The difficulty of stopping masturbation is well known. It seems to me that the most rational indication is to be derived from its being essentially a secret vice, practiced chiefly or entirely in bed. A patient, who eventually lost his reason through it, even when the habit was inveterate, always ceased from it so long as his attendant slept in the same bed with him. The sex of the bedfellow does not affect the result, therefore marriage may be advisable. Occasional intercourse with lewd women, which has been recommended even by physicians, is of somewhat doubtful value, and of course, morally objectionable. Cold hip-baths in the morning. Patient should get up and empty his bladder as soon as ever he awakes in the morning, even if he gets into bed again. Hard mattress. No suppers; no tea in evening. Attend to digestion. Revelenta Arabica, or fish and milk diet may be useful. Keep bowels open. Blisters to perineum. When varicocele or relaxed genitalia co-exist, patient should wear a suspensory bandage. If improvement be not satisfactory, cauterize prostatic part of urethra with Lallemand's "porte caustique." Repeat three or four times if necessary. Drugs given are (1) belladonna, gr. $\frac{1}{4}$ of extract + zinci sulph. gr. iiss. ter die; (2) bromide of potassium, phosphorus, quinia, strychnia, iron, and cantharides are given when spermatorrhea is associated with impotence.

C. B. KEETLEY.

Symptomatic Indications.—The most effective remedy is *digitalis*, especially when there are frequent emissions, with feeble erections; cold hands and feet; *cantharis* is useful for deficient tone of seminal vesicles; feeble erections; weak sexual feeling, also when due to chronic inflammation of prostatic portion of urethra, after gonorrhea. *Phosphorus* is valuable for induced mental and physical debility; also for irritable cases, with amorous dreams. *Cinchona* for frequent attacks of morbid excitement resulting in

involuntary emissions; is very valuable in atonic form from masturbation or sexual excess.

SPHYGMOGRAPH.—The sphygmograph is an instrument by which what is known as the pulse of an artery may be graphically recorded. It consists essentially of a lever, the short arm of which presses on the artery, while the long arm magnifies the movements transmitted to the short arm, and records them upon a moving surface. A simple sphygmograph may be made by crossing one leg in the flexed position over the opposite knee. The popliteal artery of the crossed leg is then pressed between the two knees and its movements are transmitted to the leg of the same side, being amplified by the length of the leg. If then, by some means, the foot of the superimposed leg be made to write on a revolving cylinder, the pulse will be recorded graphically.

For practical purposes three varieties of instrument are employed: Marey's original sphygmograph, its modifications by Mahomed, and the simpler instrument of Pond and Dudgeon. The latter two are provided with an arrangement by which graduated pressure can be applied to the artery, and by means of a dial the pressure can be read off in ounces. This, however, is a source of fallacy, for so much depends upon the way in which the instrument is applied, its mode of contact with the artery, and the substance against which the vessel is pressed, that little reliance can be placed on comparative measurements of the pressure exerted at different times. Nevertheless, when the instrument is properly applied, by an experienced observer, and the artery duly pressed against a bone in a direction at right angles to its length, the indications of the dial afford some idea of the relative pressure under which different tracings are taken. It must not be supposed, however, that what are termed, on the dial, "ounces," represent, in fact, ounces of pressure. They represent simply degrees of pressure, and the degrees are not by any means equal.

A tracing being required of the radial pulse, and the Mahomed sphygmograph being used, the hand is laid on a wooden rest in an easy position of supination, with the wrist somewhat extended. The site of the artery is then ascertained, and

an ink-mark made over the artery where it lies upon the styloid process of the radius. The instrument is then placed on the forearm with the button immediately over the ink-mark, and is secured to the rest by means of straps. Pressure is applied by the screw and eccentric, with which the instrument is provided, until the recording needle shows the most ample movement, when the degrees of pressure (so-called "ounces") are noted. The needle being then brought into contact with a blackened plate which travels by clockwork, a tracing results which records the movements of the artery.

Normal Pulse.—Fig. 1 represents the tracing obtained from a normal pulse.

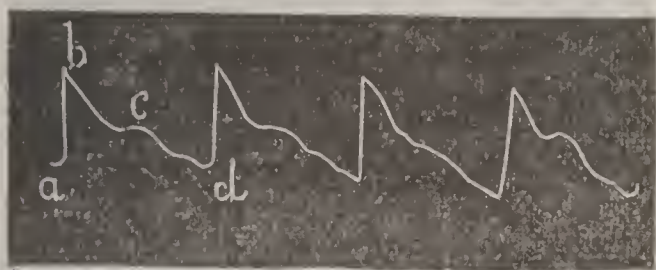


FIG. 1.

It consists of: (1) An ascent more or less vertical (*a* to *b*), (2) a summit (*b*), and (3) a descent (*b* to *d*) which is broken by a second elevation (*c*) the dicrotic wave. The horizontal line from which the up-stroke starts is called the base line. The height of the ascent represents the degree of change of shape of the artery, which, as stated previously, is really what we feel as the normal pulse. Thus the height of the ascent is a measure of the "size" of the pulse. The sudden or gradual manner in which the pulse impresses itself upon the finger is represented in the tracing by the vertical or sloping direction of the ascent. The summit is often broken by a small wave, which is usually known as the "percussion wave." Its origin has been somewhat questioned; probably it is not related to any change in the artery, but is due simply to the needle being jerked by the artery to a greater height than is warranted by the change in the shape of the artery. The needle, therefore, soon descends slightly to the level corresponding with the true movement of the button in contact with the artery. The total summit is known as the tidal wave, its horizontal extent from the beginning of the summit to the beginning of the de-

scend, represents the "length" of the pulse, and is a measure of the length of contraction of the left ventricle, or at least of the time during which the contraction of the ventricle increases the tension in the arteries. The portion of the tracing which extends from the end of the tidal wave to the base line is the descent. Its sudden or gradual progression to the base indicates the manner in which the increase of tension, due to the ventricular systole, is lost in the arteries. The notch in the descent, formed by the dicrotic wave, is known as the dicrotic notch. Its height above the base line indicates inversely the time which elapses after the systole of the ventricle is completed before the elastic recoil of the arteries increases the tension in the radial artery. It is one measure, therefore, of the degree of arterial tension, and in time it corresponds with the closure of the aortic valves. The height of the dicrotic wave is a similar wave of tension in the arteries, being the more marked when the tension is low. Generally speaking, the higher the dicrotic notch above the base line, the less marked the dicrotic wave, and *vice versa*. The base line is often not perfectly horizontal, but shows a curve of its own, comprising in its extent four, five, or six tracings of individual pulse beats. This is the respiratory curve, and is due to the alterations of arterial pressure produced by respiration. It is not uncommon to meet with numerous small waves in addition to the dicrotic wave; these result from vibrations of the needle not communicated to it by the artery. They are to be avoided to a great extent by a proper application of the instrument, but some are inherent in the sphygmograph.

Irregular Pulse.—In certain pathological states the tracings are characteristic, and are a useful help to the mere digital examination.

High Arterial Tension.—The tracing of high arterial tension shows a somewhat slanting ascent of no great height, a square or rounded summit, a lengthened tidal wave, a gradual descent, a high dicrotic notch, and slightly marked dicrotic wave (Fig. 2). The explanation of these peculiarities, which appears most probable, is the following: The arterioles are contracted, and, therefore, do not admit of a pulse of great "size," consequently, the lever of the sphygmograph

is not greatly raised, and the ascent is low. The ventricular contraction is somewhat slow in increasing the already high tension, and thus there are produced the

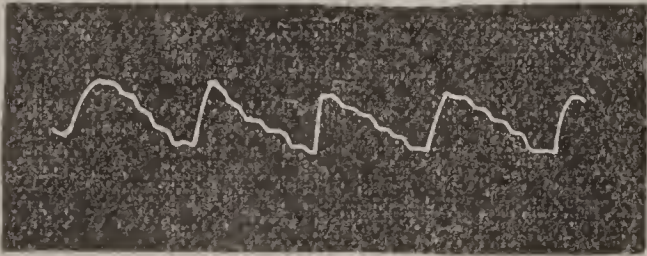


FIG. 2.

gradual pulse and the sloping ascent of the tracing. The left ventricular must maintain a prolonged contraction to drive the blood onward against the increased resistance, and thus the tidal wave is long and the summit rounded. The recoil of the arteries, when their tension is great, must occur very shortly after the ventricle has ceased acting, and, consequently, the dicotic notch appears early in the descent of the needle and high above the base line. The tense arteries do not allow themselves to be greatly distended by the blood forced into them by the ventricles, and as a result of this their elastic recoil, which produces the dicotic wave, is but slight.

Low Arterial Tension.—In low arterial tension we have an ascent which is exten-

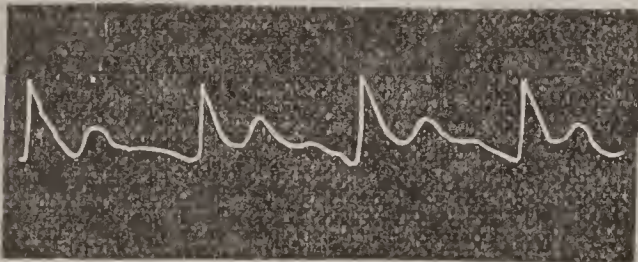


FIG. 3.

sive, and is perpendicular or even sloped backward (Fig. 3). The ascent is either high or low, according as the left ventricle is acting forcibly or feebly, either of which conditions may exist. The summit is sharp, the tidal wave short, the descent sudden, the dicotic notch low, and the dicotic wave well marked. Here the relaxed arteries allow themselves to be suddenly and greatly expanded by the blood forced into them from the ventricle, and thus cause the extensive and perpendicular up-stroke. No prolonged contraction of the ventricle is necessary; hence the sharp summit and short tidal wave. The relaxed arteries lose the temporary tension imparted to

them by the ventricular systole as easily as they gain it, and consequently the descent is abrupt, while their laxity favors an extensive but delayed recoil, and causes the well-marked dicotism and low dicotic notch.

Virtual Tension.—In “virtual” tension (*see* PULSE) we find a tracing showing a combination of the characters of high and low tension (Fig. 4). The up-stroke is extensive and high, the summit sharp, the tidal wave short, the descent somewhat sudden, the dicotic wave well marked; but the dicotic notch is high above the base line. As already stated, this form of pulse indicates peripheric

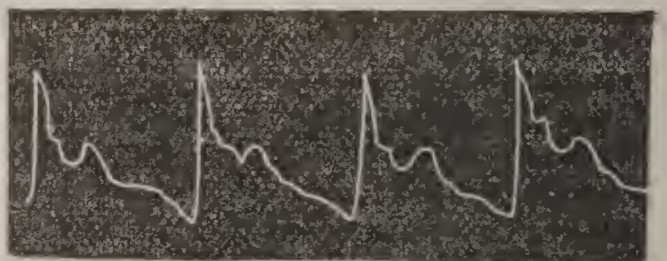


FIG. 4.

resistance with a failing left ventricle and dilated arteries.

Aortic Regurgitation.—In aortic regurgitation the tracing usually shows a high and perpendicular ascent, a sharp summit, short tidal wave, and an abrupt descent, in which there is scarcely any indication of a dicotic wave (Fig. 5). The latter two features are characteristic. As has already been stated, the pulse in aortic regurgitation is quite a different phenomenon to the normal pulse. Here the radial artery is really distended by blood with each ventricular systole, becoming empty during each diastole. The tension is suddenly increased, to be just as suddenly decreased. This explains why the descent of the tracing is so abrupt. The recoil of the arteries after

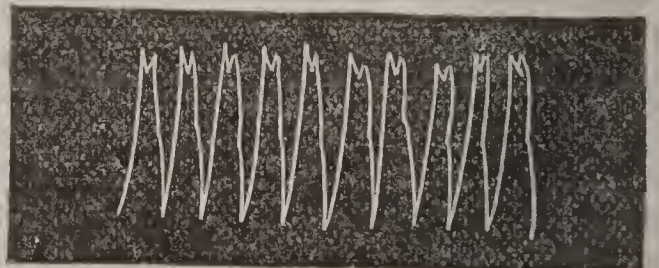


FIG. 5.

the ventricular systole can only influence the tension in the general arterial system when the aortic valves close perfectly, and offer a sufficient *point d'appui*. When

the valves are incompetent, the recoil of the arteries will be greatly spent in forcing blood back into the left ventricle, and consequently no dicrotic wave will be seen.

Aortic Stenosis.—In aortic stenosis the systole of the left ventricle can only gradually influence the general arterial tension, and its force will be exerted for a considerable time (Fig. 6). As the result of this we find a tracing showing a gradual and low ascent, a rounded apex, and a long tidal wave. The descent is gradual because the arteries "contract down upon the diminished blood-stream" (as Dr. Broadbent has put it), and, as a consequence, the increase of tension due to the ventricular systole is only gradually lost. There is no great distention of the aorta by the systole, hence but a small recoil, and therefore little or no dicrotic wave appears in the tracing. The tracing very much resembles that which is found in aneurism, to be described later,

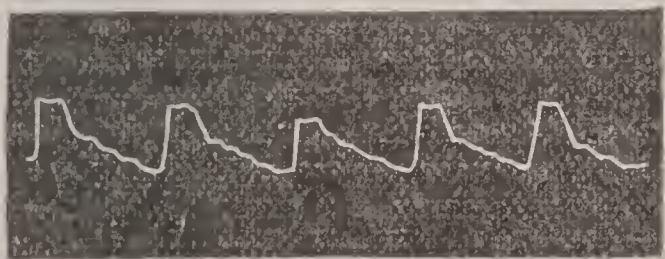


FIG. 6

but it is to be obtained usually with the application of a much lower pressure than suffices for the aneurismal tracing. Such is the usual tracing of aortic stenosis, but occasionally another and quite different one is obtained. Here we find a trace with three separate summits, but at different heights above the base line, the first being generally the highest. The first is probably a percussion wave, the second a tidal wave; the conditions of dicrotism are not present, consequently the third summit cannot be that of a dicrotic wave, but Dr. Broadbent explains it as an instance of *pulsus bisferiens*, due to a reinforcement of the ventricular systole near its close by a further muscular spasm.

Where aortic stenosis and regurgitation are combined, as is commonly the case, the characters of the tracings are to a certain extent also combined. It will mainly be noticed that the sudden ascent and descent characteristic of aortic regurgitation are lost.

Atheroma of the Arteries.—In atheroma of the arteries, affecting among others the arch of the aorta, a tracing is obtained which shows a well-marked, but not high percussion wave, a prolonged tidal wave, a low dicrotic notch, and an ill-marked dicrotic wave (Fig 7). The

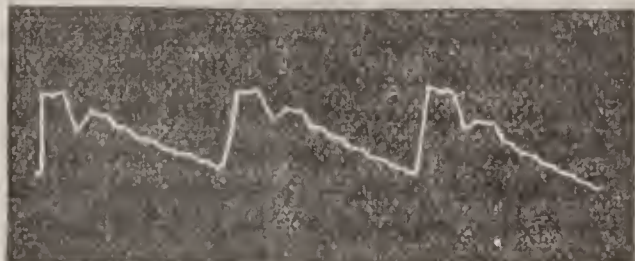


FIG. 7.

rigidity of the arteries, possibly, accounts for the appearance of the first. The necessarily hypertrophied condition and prolonged action of the left ventricle causes the prolonged tidal wave, while slight expansion and consequently small recoil of the arteries produce the condition of the dicrotic wave.

Aneurism.—The typical aneurismal pulse gives a tracing characterized by a low, sloping ascent, rounded summit, prolonged tidal wave, and a gradual descent, in which the secondary waves are lost (Fig. 8). This tracing resembles that of aortic stenosis, but is obtained in its best form with the application of a much higher pressure than is required for the tracing in the latter disease. In the typical condition the characters of the tracing are due to the interposition of the elastic reservoir formed by the aneurism, between the ventricle and the artery examined. The impact of the ventricle, as well as the shock of recoil of the arteries,

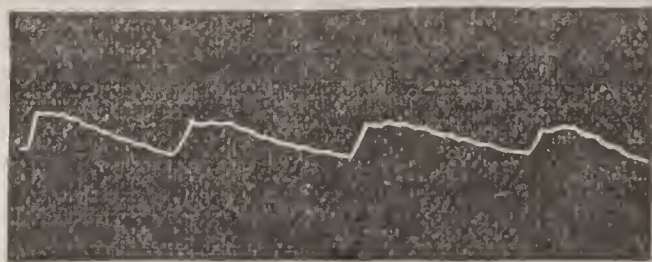


FIG. 8.

is absorbed by the aneurismal reservoir, to be distributed more gradually to the arteries. The form of the tracing is thus easily explained. But the aneurism acting in this way maintains a constant supply of blood to the arteries, thus accounting for the great amount of pressure usually necessary to bring out the tracing.

Yet the conditions of the circulation in aneurism are not always those described. The aneurism may press on the artery examined, or on a trunk from which it springs; and again it may narrow the mouth of an artery which arises from the sac. In these conditions, a similar tracing is obtained, but, the writer thinks, by the application of a lower pressure than when the typical aneurismal conditions are present. In fact, the conditions, and therefore the tracing, resemble those of aortic stenosis.

It is in respect to the diagnosis of aneurism that the sphygmograph is of most clinical value. Its indications are shown, when the unaided finger, no matter how highly educated, is sometimes at fault, whereas in other affections the findings of the finger are only recorded and supported by the tracing.

Mitral Stenosis.—Here the sphygmographic tracing resembles that of high arterial tension (Fig. 9). The ascent is gradual and low, lower, indeed, than is ordinarily the case in simple high tension; the summit is rounded, the tidal wave moderately long, the descent gradual, the dicrotic wave slight, and the dicrotic notch fairly high above the base line. The conditions of the circulation are (1) that the left ventricle is imperfectly filled, and consequently its action produces only a slight rise of the sphygmographic lever; (2) the arteries contract down upon the diminished supply of blood, and so only gradually receive the impact of the ventricle, causing the up-stroke of the tracing to be sloping, and the summit rounded. The contracted state of the arteries also hinders their recoil, and tends to eliminate the dicrotic wave. It

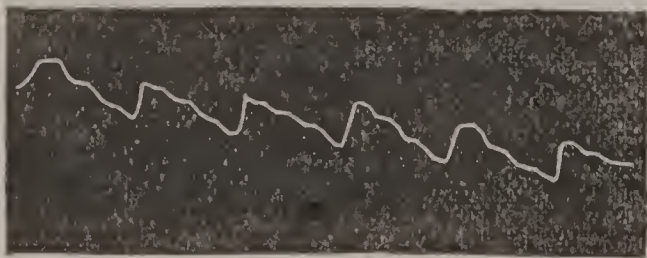


FIG. 9.

is to be specially remarked that the separate pulse tracings are uniform in character and equal in size.

Mitral Regurgitation.—The opposite is the case in this affection, for the tracings are pre-eminently irregular in size and character (Fig. 10). Their prevail-

ing type is that of low tension, a straight ascent, sharp summit, short tidal wave, sudden descent, moderate dicrotic wave, with low dicrotic notch. But the extreme

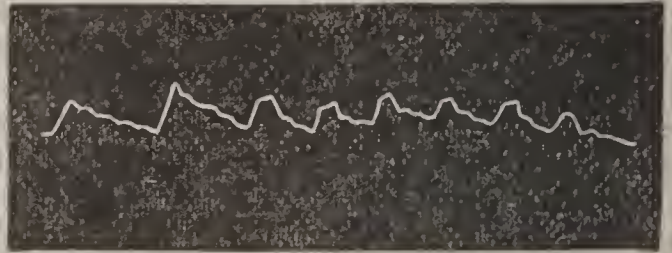


FIG. 10.

irregularity in the action of the left ventricle, which is characteristic of the disease, causes all these appearances to vary greatly with the individual pulse beats.

ROBERT MAGUIRE.

SPINAL ACCESSORY NERVE

(the eleventh pair of cranial nerves) consists of two parts, the smaller or internal part (accessory), which joins the pneumogastric nerve, and a larger or external part (spinal), which is supplied to the sterno-mastoid and trapezius muscles. The accessory part arises from the continuation downward in the medulla of the vagus nucleus, that part of it which lies behind the closed central canal of the cord, and also just outside the point of the calamus scriptorius. The fibers from this part course through the medulla, taking the same direction as the vagus nerve about them, and they must be looked upon as a root of that nerve, which they finally join (*see* PNEUMOGASTRIC NERVE). The spinal part arises from the whole extent of the cervical portion of the spinal cord as far down as the fifth or sixth cervical roots, by a series of roots along the lateral column, from the intermedio-lateral tract and adjacent part of the anterior cornu below and the formatio reticularis and base of the posterior cornu above. The nerve ascends the spinal canal, passes through the foramen magnum, gives some branches to the accessory part, and passes out of the skull by the foramen jugulare; it pierces the sterno-mastoid muscle, supplying it, and ends in the trapezius muscle, where it forms a plexus with branches from the cervical nerves. The nerve is liable to be affected at its nucleus as in acute bulbar paralysis, or in the more chronic form, but in these cases the accessory part is much more involved than the spi-

nal, for whereas paralysis of the soft palate, pharynx, and larynx are common symptoms of chronic bulbar disease, (*see* PNEUMOGASTRIC NERVE), paralysis and wasting of the sterno-mastoid and trapezius are rare; in fact, the upper fibers of the latter are the last to be affected.

Both parts of the nerve are involved in meningitis, simple or syphilitic, tumors outside the medulla, and fractures or dislocation of the cervical vertebræ; in such cases there is paralysis of one-half of the soft palate, one vocal cord, and one sterno-mastoid and trapezius, all on the same side (Hughlings Jackson). The spinal part alone is apt to be implicated in its long course from the cord to the muscles, by growths of meningitis in the spinal canal, or by enlarged glands, tumors, or abscess in the posterior triangle of the neck, or simply by cold. Here the sterno-mastoid and trapezius of the same side will be paralyzed, but the latter not completely, as its middle and lower parts receive fibers from the cervical plexus.

The symptoms of paralysis of the accessory part are given with the description of the pneumogastric nerve. When the spinal part is paralyzed the patient cannot rotate the head to the opposite side, and is not able to use the upper part of the trapezius in shrugging the shoulders, while complete fixation of the scapula cannot be effected, and muscles like the deltoid work at a disadvantage. The paralyzed muscles waste, and give the reaction of degeneration to electrical currents.

The *prognosis and treatment* depend very much on the cause; when the paralysis is due to cold the prognosis is favorable, but very unfavorable when caused by growths, unless they can be removed. In the early stage of the former condition a blister applied over the course of the nerve, and the use of the constant current to the muscles, would be the suitable treatment.

Besides paralysis, the muscles supplied by the spinal accessory nerve are liable to be affected by spasm, giving rise to what is known as torticollis or wry-neck (*q. v.*).

C. E. BEEVOR.

SPINAL BIFIDA.—See SPINE, DISEASES OF.

SPINAL CORD, ANÆMIA OF.—*Symptoms.*—Little is positively known

about the symptoms induced by diminished vascular supply to the spinal cord. In anæmia, simple and pernicious, weakness of the limbs is frequently present, and may be due in part to altered nutrition of the cord. It has been alleged that structural changes may develop from persistent anæmia, and the writer has seen one case, in which degeneration occurred in the white matter of the cord, in a patient suffering from pernicious anæmia. Paraplegia has been described as occurring after profuse hemorrhage from the uterus, stomach, and other parts; from obstruction of the spinal arteries, and from obstruction of the abdominal aorta by compression, thrombosis, or embolism. Vasomotor ischæmia of the cord, from peripheral irritation, has been invoked to explain various transient and subjective sensations in the extremities; but the assumption is hypothetical.

Treatment.—General anæmia will require the usual remedies, of which iron and arsenic are the chief. When the symptoms depend on hemorrhage, attention should be directed to the special organ at fault. At the same time the recumbent position, with the head and legs raised, should be enforced. The use of the constant current to the vertebral column has been suggested, as well as the application of heat by means of sand bags or Chapman's spinal bags.

W. B. HADDEN.

Symptomatic Indications.—See ANÆMIA.

SPINAL CORD, ANATOMY AND PHYSIOLOGY OF.—The spinal cord extends from the foramen magnum to the level of the body of the second lumbar vertebra. The pia mater, which closely invests the surface, sends a process into the anterior median fissure, is continuous with the fibrous strands penetrating the substance of the cord, and furnishes a covering to the nerve-roots. Superficial to the pia mater, and loosely united to it by fine strands of connective tissue, is the thin arachnoid membrane. The interval between the two is the subarachnoid space, which is in direct continuity with the subarachnoid space of the brain, and through the foramen of Majendie with the ventricles. The ligamentum denticulatum passes on each side between the spinal arachnoid and pia mater, midway between the anterior and posterior roots,

thus dividing the spinal subarachnoid space into an anterior and posterior part. The external membrane of the cord, or dura mater, is separated from the bony canal by venous plexures and loose areolar tissue.

The spinal cord presents two enlargements, the cervical, extending from the level of the third cervical vertebra to the second dorsal; the lumbar, beginning at the tenth dorsal vertebra and reaching to the second lumbar. Between the second and tenth dorsal vertebræ the cord is small and of uniform size. In the middle line of the cord in front is the anterior median fissure which reaches as far as the anterior commissure. The posterior median fissure, really composed of connective tissue, extends to the posterior commissure and separates one posterior column from another. On each side of the posterior median fissure is the rather ill defined posterior intermediate septum, which marks off the postero-median column (column of Goll) from the postero-external column (column of Burdach or posterior root-zone). The white matter between the posterior cornu and the anterior median fissure is the antero-lateral column, which is subdivided into the anterior and lateral columns, the point of limitation being the most external of the anterior nerve-roots. The white matter is composed of nerve-fibers of different sizes, surrounded by and embedded in the nerve-cement or neuroglia, in which are scattered small nucleated bodies called the cells of Deiters.

Tracts or Systems of the Cord.—It has been shown by means of pathological investigation, by experimental observations on animals, and by researches in embryology, that the white matter of each half of the cord, which to the naked eye is of uniform appearance, is made up of definite tracts or systems having distinctive functions. These tracts of fibers degenerate according to a law, first propounded by Waller; efferent fibers, such as those of the pyramidal tracts, when destroyed at any part in their course, undergo *descending* degeneration; afferent fibers, such as those of the columns of Goll, undergo *ascending* degeneration.

The *crossed pyramidal tract* occupies the posterior part of the lateral column, outside the posterior cornu, with which it is in contact posteriorly, though an-

teriorly it is separated from the gray matter by the *lateral limiting layer*. This latter is made up of short fibers connecting the gray matter at different levels. In the lower dorsal and lumbar regions the pyramidal tract reaches to the surface; but in the greater part of the cervical and dorsal regions it is separated from the periphery by the *direct cerebellar tract*.

The *direct pyramidal tracts*, which are subject to considerable variations in size and form, are situated on each side of the anterior median fissure. Often they cannot be traced beyond the middle or lower dorsal region.

The *anterior ground fibers* occupy the rest of the anterior columns. They are probably commissural, connecting the anterior cornua at different levels and also those of the opposite side.

The direct and lateral pyramidal tracts transmit voluntary motor impulses from the brain. Tracing the motor tract from above, it may be stated briefly that the fibers pass from the central convolutions, with the multipolar cells of which they are supposed to be in relation, to the internal capsule, occupying the anterior two-thirds of its posterior segment. In the peduncle, the fibers form a compact bundle, lying in the middle third of the "foot" or lower layer of the crus. In the pons the fibers are split up into bundles, so that they are not so readily distinguished as elsewhere. The tract again forms a compact area in the medulla oblongata, constituting the anterior pyramids. At the lower part of the bulb the decussation takes place, giving rise to the direct and crossed pyramidal tracts just described. There is little doubt that many of the fibers again decussate lower down in the cord, and it is very probable that an intercrossing also occurs to a varying extent at other levels above the medulla. It has already been stated that there is a strong presumption that each pyramidal tract fiber is in relation to a multipolar cell in the cerebral cortex. It is equally probable that the termination of each fiber is connected with a spinal multipolar cell. The lateral pyramidal tract, though mainly composed of large fibers transmitting motor impulses, contains in addition many nerve-tubes of small size, some of which belong to the same system as the direct cerebellar tract, and degenerate in an upward direction.

The *direct cerebellar tract* is situated at the periphery of the posterior half of the lateral column, just external to the crossed pyramidal tract. It begins in the upper lumbar or lower dorsal region, increases in size in passing upward, and, finally, enters the cerebellum by the restiform body. This tract is supposed to be connected with the cells in Clarke's posterior vesicular column, but its exact function is still unknown.

The so-called *antero-lateral ascending tract* is situated in the anterior mixed region of the lateral column, lying in front of the direct cerebellar tract, with which it is in some places continuous. The other fibers of the anterior mixed region are partly connected with the anterior roots and partly commissural. The antero-lateral tract is roughly wedge-shaped, the base reaching to the periphery of the cord and sometimes extending nearly as far forward as the anterior median fissure. This tract probably has its origin in the lumbar region, but its termination above is uncertain. The fibers appear to be in relation with the posterior nerve-roots, possibly through the posterior vesicular columns. The writer believes the fibers enter the cerebellum by the restiform body, but some observers think that the tract is connected with the nucleus lateralis in the medulla.

The *postero-median columns* or columns of Goll, which are small in the lumbar region and increase in bulk passing upward, enter the medulla as the fasciculi graciles and reach as high as the clavate nuclei. The fibers which compose these tracts are derived mainly from the posterior nerve-roots. The degeneration is ascending.

The *postero-external columns*, or columns of Burdach, are composed mainly of short vertical fibers, probably commissural, partly of horizontal and oblique fibers from the posterior roots, and partly of horizontal fibers passing between the posterior cornu and the postero-median column. The degeneration in this tract is of short vertical extent in an ascending degeneration.

Lissauer's tract is composed of fine nerve-fibers lying in front of and behind the entrance of the posterior roots. These fibers, which proceed from posterior roots at a lower level, are supposed to be in relation with the posterior vesicular column.

The *gray matter* is composed of the anterior and posterior cornua, an intervening lateral part, and the central gray matter, the latter being pierced by the central canal. The gray matter is subject to considerable variations in size and form, but into these details it is not now necessary to enter. Both anterior and posterior cornua are composed of a spongy network of fine fibers partly proceeding from the adjoining white matter, partly from the nerve-cells; in addition there is the neuroglia, and scattered through the network are cells of various sizes. The cells in the anterior cornu are mostly of large size (ganglionic or multipolar), are connected with the fibers of the anterior roots, and through them and the motor nerves control the nutrition of the voluntary muscles. These cells, when seen in a cross section of the cord, are arranged in groups, which are termed, from their position, *internal, anterior, antero-lateral, postero-lateral, and central*. In the lower cervical and upper dorsal regions there is a group of cells occupying the external part of the root of the posterior cornu; this is Clarke's *intermedio-lateral tract*. In the posterior horns the cells are small, spindle-shaped, and diffusely scattered.

At the inner part of the base of the posterior cornu, chiefly in the upper lumbar and lower dorsal regions, is Clarke's *posterior vesicular column*, in which are placed fusiform cells, some furnished with axis-cylinder processes. The cells in Clarke's columns are supposed to be connected with the fibers of the direct cerebellar tract, and possibly with Lissauer's tract.

Anterior and posterior nerve-roots.

—Some of the anterior roots enter the anterior cornua directly and end in the ganglionic cells; some probably pass into the anterior gray matter at a different level after a short course in the anterior mixed region, and some cross to the anterior horn on the opposite side through the anterior commissure. The fibers of the posterior roots, at the entrance into the cord, divide into two bundles, the external and internal radicular fasciculi. The former passes into the substantia gelatinosa, some of the fibers entering the anterior commissure and, finally, reaching the cells of the opposite anterior cornu, some probably proceeding to the posterior vesicular column with the cells

of which they are connected. Of the fibers of the internal radicular fasciculus some pass either directly, or, after a short upward course, into the postero-median column; others, probably, decussate with the fibers on the opposite side in the posterior commissure; others pass into the posterior horn and, possibly, enter into connection with the cells in the posterior vesicular column.

The Sensory Path in the Cord.—The afferent fibers cross to the opposite side of the cord soon after their entry, but the course and position of the fibers, in their upward path to the brain, are uncertain. It is probable that tactile sensibility travels mainly by the posterior columns, whereas painful impressions are believed to be conducted in the lateral columns. Impressions from muscles probably traverse the posterior columns, and there is reason to believe that these fibers, unlike other afferent fibers, do not decussate in the cord (*see TOUCH, DISORDERS OF*).

Vascular Supply.—The spinal cord receives its arterial supply from (1) the anterior median artery, which courses along the anterior surface of the cord. This vessel is formed by the union of the two anterior spinal branches of the vertebrals. (2) The two posterior spinal arteries, which are also derived from the vertebrals, and which pass down the cord on each side close to the posterior roots. In addition, small branches from the inferior thyroid, the intercostal and lumbar arteries, proceed to the cord and its membranes. From the anterior and posterior spinal arteries small vessels penetrate the cord, those from the former entering by the anterior median fissure, those from the latter for the most part accompanying the posterior root-fibers. These intraspinal twigs ramify within the cord and anastomose with one another. From the anterior and posterior spinal arteries a plexus of arterioles in the pia mater is derived, and from this source numerous arterioles pass inward to supply both gray and white matter. To the disposition of the main vessels must probably be ascribed, as the late Dr. Moxon pointed out, the peculiar liability of the lower part of the spinal cord to softening. The small caliber of the anterior and posterior spinal arteries, their unusual length, and the fact that the re-enforcing vessels from the lumbar arteries have to pursue a much longer course than the analogous

arteries in the cervical and dorsal regions predispose the lower portion of the cord to vascular changes. In consequence of the long and tortuous course of the spinal arteries the blood pressure is very low, and to this must be ascribed their relative immunity from rupture.

Localization of Function in the Spinal Cord.—The various purposive movements of the trunk and limbs are controlled by special centers in the spinal cord.

Cervical Enlargement.—The upper part contains the centers for the muscles of the neck (mainly the sterno-mastoid and upper part of the trapezius).

The *diaphragm* is represented by the gray matter at the level of the fourth cervical nerve-roots.

Deltoid, scapular muscles, pectoralis, and serratus at level of fifth and sixth nerve-roots.

The clavicular part of the pectoralis is associated in action with the serratus, the costal with the latissimus dorsi. The centers lie close together, but are distinct.

Flexors of the elbow and supinators at nearly the same level as deltoid—namely, at fifth and sixth nerve-roots.

Extensor of the elbow (triceps) chiefly at level of seventh nerve-root.

Extensors of the wrist above center for elbow, at sixth and partly at seventh nerve-root.

Flexors of wrist and pronators below extensors, at level of seventh and eighth roots.

Long extensors of fingers about level of sixth root.

Long flexors of fingers below extensors at level of seventh and eighth roots.

Intrinsic muscles of hand at level of eighth cervical and first dorsal, the interossei being represented at the lower level, the thenar muscles at the upper.

Lumbar Enlargement.—The localization here is not so definitely known as in the cervical region. The probable positions of the various centers are as follows: cremasteric at second lumbar, psoas at second, iliacus at third, adductors at fourth, glutei at fourth and fifth, extensors of knee at third and fourth, flexors of knee at fifth and first sacral, the muscles of the leg by various centers at level of fourth and fifth lumbar and first sacral, the intrinsic muscles of the foot at the second sacral nerve-root.

Influence of the Cord over Nutrition.—

The nutrition of the muscles is controlled by the large multipolar cells in the anterior gray matter, through the anterior roots and the motor nerves. Disease of these cells, nerve-roots, or nerve-trunks gives rise to rapid muscular wasting with paralysis, loss of faradic excitability, and loss of reflex irritability.

The nutrition of bones and joints is also under the influence of the spinal cord, probably through the motor cells. The nutrition of the skin is supposed to be controlled through the posterior roots (see TROPHIC DISORDERS).

Visceral Control.—The spinal cord contains independent centers for the viscera, of which the bladder, rectum, and uterus are the most important. The centers for these, as well as for that controlling the sexual function, are situated in the lumbar region.

Reference has already been made to the path for the conduction of motion and sensation. Co-ordination and its disorders are dealt with under LOCOMOTOR ATAXIA. The reflex functions of the cord and its varieties are described under REFLEXES, SPINAL.

W. B. HADDEN.

SPINAL CORD, HEMORRHAGE INTO.—**Hematomyelia; Spinal apoplexy.**—Hemorrhage into the substance of the spinal cord may be either primary or secondary, the latter form being apt to occur at any stage of myelitis, and in tumors of the cord. Apart from pre-existing disease, small hemorrhages are occasionally found in the gray and white matter in all conditions causing chronic venous congestion, and in such affections as convulsions and tetanus.

Symptoms.—When motor or sensory disorder has existed for a few days or weeks, a sudden exacerbation is probably due to hemorrhage occurring in the course of acute central myelitis. In more chronic affections, such as tumor, any abrupt change for the worse is also frequently dependent on secondary hemorrhage.

In idiopathic spinal apoplexy the onset is quite sudden, and the symptoms rapidly attain their greatest intensity; violent spinal pain, and sometimes tenderness, local or diffuse, are frequent. The paralyzed muscles are flabby, all the forms of sensibility are abolished. The reflex

actions below the seat of disease disappear, the bladder and rectum are paralyzed, cystitis results, and acute bed-sores form. When the hemorrhage is above the lumbar region, reflex action soon reappears in the lower limbs, and later, descending degeneration ensues. Reflex action, then becomes exaggerated, and contractures of the legs supervene.

Secondary inflammation often succeeds the hemorrhage, and within the next ten days or so death may follow. The symptoms in any case vary according to the size and position of the hemorrhage. Small extravasations may be accompanied by slight and indefinite symptoms. When hemorrhages involve the anterior gray cornua, as they frequently do in the cervical and lumbar regions, permanent wasting, localized to certain muscles, will be the result.

Diagnosis.—For chief points of difference between myelitis and hemorrhage (see MYELITIS). In spinal meningeal hemorrhage, there are signs of irritation, such as hyperæsthesia and spasm; whereas paralysis and impaired sensibility are comparatively slight. In acute anterior polio-myelitis, there is some initial fever, sensory disorders are absent, the bladder and rectum are unaffected, and bed-sores do not form.

Prognosis.—The higher the seat of the hemorrhage, the more grave is the prognosis as regards life. When the cervical region is implicated some of the respiratory muscles are involved, and if the hemorrhage be above the origin of the phrenic nerve, death will ensue.

When recovery follows an attack of spinal apoplexy, some loss of power and, very commonly, some muscular atrophy are permanent.

Morbid Anatomy.—Idiopathic spinal apoplexy almost invariably occurs in the central gray matter, this position being no doubt determined by the fact that the vessels are there more numerous and less supported than in the white matter. The hemorrhage often extends a considerable distance vertically, and the substance of the cord around the clot is broken down, ragged, and, at a later stage, exhibits inflammatory changes. The effused blood undergoes the usual alteration of color, and finally, if life be prolonged, a cyst may be formed. The cord is often swollen at the seat of hemorrhage, and occasionally the white substance is lacerated

and blood may escape into the membranes. The cervical and upper dorsal regions are most commonly affected.

Ætiology.—Spinal apoplexy is more frequent in males than in females, and most often occurs in youth and middle age. Injury is the common exciting agent. Overexertion and exposure are said to be rare causes. It is curious that spinal hemorrhage is but rarely found in those who are subjects of arterial degeneration, this immunity being, doubtless, due to the arrangement of the vascular supply of the cord.

Treatment.—Absolute rest in the prone position should be enforced. An ice-bag should be applied to the spine. A few large doses of ergot, half a dram of the liquid extract of five grains of ergotin, should be given at intervals of two or three hours. Cystitis and bed-sores will demand the ordinary treatment. At a later stage, baths and the use of the constant current to paralyzed and wasted muscles may be found of service.

W. B. HADDEN.

SPINAL CORD; HYPERÆMIA OF.—Hyperæmia of the spinal cord and its membranes has been described as following on various conditions, such as sexual excitement, exposure to cold, suppression of habitual discharges, and some of the acute specific fevers. Acute hyperæmia, however, without doubt occurs in the early stage of inflammation, and as a secondary condition in some cases of hydrophobia, tetanus, and strychnia poisoning. Passive hyperæmia is present in the cord, as in other organs, in chronic diseases of the heart and lungs.

The chief *symptoms* of acute spinal hyperæmia are pains along the spine, relieved by assuming the prone position, slight sensory disorders with subjective sensations in the extremities, tremors and jerkings of the muscles, and erection of the penis.

Treatment.—The remedies suggested are leeching, the application of ice-bags to the spine, the recumbent position with the face downward, saline purgatives, ergot, and belladonna.

W. B. HADDEN.

Symptomatic Indications.—*Aconite* in recent cases from cold, or suppressed menstrual or hemorrhoidal discharges, renders excellent service. *Belladonna*, severe pain in the back, especially if at-

tended with paralysis of the sphincter; pains better from standing and walking about. *Gelsemium* is useful for dull, aching pains in upper part of spine, worse in the morning, or after lying down: paraplegia, with dull, aching pain in the spine. *Nuxvomica*, numbness and paralytic weakness of the lower extremities, with contused and bruised pains in the small of the back; hemorrhoids; constipation. *Phosphorus* in spinal congestion following sexual excesses is very valuable; paralytic weakness of the small of the back; aggravated by lying; jerking and trembling of the muscles.

SPINAL CORD, SLOW COMPRESSION OF.—(See also SPINAL CORD AND ITS MEMBRANES, TUMORS OF.)

The *symptoms* come under three categories.

(1) **Vertebral Symptoms** occur especially in three conditions: caries, malignant growths, and eroding aneurisms. When there is irregularity or curvature of the spine, the cause of a slow compression-myelitis is unmistakable. Apart from deformity, pain in the spine increased by movement, localized tenderness, and rigidity are significant of caries. Sometimes the signs of bone disease are so slight that their importance is apt to be underrated. Since caries is the most common cause of compression of the cord, frequent examinations of the spine should be made in every case of compression-myelitis of doubtful nature, and the possibility of Pott's disease must not be hastily excluded.

Malignant growths involving the vertebræ may give rise to a rounded prominence of the spine, which may be mistaken for caries. The diagnosis between these two conditions may be impossible in the early stage, but it is well to bear in mind that spinal pain from malignant disease of the vertebræ is less severe and less influenced by movement than in caries.

(2) **Extrinsic or Root Symptoms** vary much in degree, in frequency, and in distribution in the various conditions which give rise to compression. A feeling of constriction in the chest or abdomen the so-called girdle-pain may be present, or severe pains of a neuralgic kind, often accompanied by hyperæsthesia and occasionally by the development of an erythematous, vesicular, or bullous eruption

in the course of certain nerves, may be experienced. Patches of anæsthesia are apt to develop in the hyperæsthetic areas, the pains still persisting (*anæsthesia dolorosa*), and at a later period, when destruction of the sensory nerve roots has advanced, marked cutaneous insensibility supervenes. Pressure on the anterior roots gives rise to slow paralysis and muscular wasting.

(3) **Spinal Symptoms** usually succeed those due to compression of the roots. Gradual loss of power attacks the parts innervated by the cord below the seat of disease, sometimes the lower limbs only being affected, sometimes both upper and lower limbs, together with the muscles subserving respiration. The distribution of the motor paralysis and anæsthesia may be irregular. When, for example, pressure is exerted on one side of the cord, hemi-paraplegia results, motor paralysis without affection of sensation being present on the same side as the lesion, anæsthesia with preservation of motion on the opposite side. As the disease extends in the transverse direction the paraplegia becomes of the ordinary bilateral type. The paralyzed members are affected by painful startings and cramps, and become permanently rigid, the muscles preserving their normal bulk and electrical reactions. The superficial and deep reflexes are exaggerated at an early stage, often when the loss of power is still indefinite and trivial. Clonus, spontaneous and induced, is frequently present. Sensation in the paralyzed limbs may be normal; often it is incomplete, occasionally profoundly affected. Loss of control over sphincters is not invariable. Sometimes an acute myelitis supervenes in slow compression on the cord, and then diffuse muscular wasting with profound and widespread anæsthesia rapidly ensues, the bladder and rectum become paralyzed, and acute bed-sores form.

The symptoms of slow compression vary according to the seat of disease. When the cervical region is affected root-symptoms are often present in the arms, such as severe pains and hyperæsthesia followed by anæsthesia, paralysis with muscular atrophy, and abolition of reflex action. Later, indications of pressure on the cord itself make their appearance, the lower limbs become paralyzed and rigid. Other symptoms

sometimes observed in compression-myelitis in the cervical region, are dilatation of one or both pupils, with subsequent contraction, unilateral and bilateral sweating, vomiting, difficulty in breathing, dysphagia, slowness of the pulse with syncopic attacks, and occasional epileptic seizures. When the pressure is exerted on the dorsal region of the cord, girdle pains and intercostal neuralgia, due to compression of the posterior roots, are often early symptoms. Subsequently, the lower limbs become paralyzed and stiff, and the reflexes exaggerated.

The *course* of a compression-myelitis varies according to the pathological cause. Slow improvement often occurs in caries, and sometimes there is practically complete recovery. In tumors of the cord and its membranes the disease is usually progressive, and most frequently rapidly so.

Diagnosis.—Compression-myelitis may be assumed when signs of pressure on the anterior and posterior roots precede the indications of interference with the functions of the cord.

Root symptoms may, however, be slight or absent, and then the difficulty in diagnosis is greatly enhanced. Hemi-paraplegia, followed by signs of a slowly progressing transverse lesion of the cord, points to compression.

The anatomical nature of the compressing agent is often difficult and sometimes impossible to determine.

Caries is usually indicated by the presence of the vertebral symptoms, to which allusion has been made. These may be so slight that doubt as to their significance may arise. It is, therefore, important to bear in mind that in caries motion is mainly or exclusively affected, that the symptoms are usually bilateral from the first, or soon become so, that pains are not generally severe, and that the functions of the bladder and rectum are often intact.

Paralysis with diffuse muscular wasting and anæsthesia of the arms, preceded by severe pain, such as occurs in cervical caries, may be due to primary chronic spinal meningitis, and especially to that variety known as cervical hypertrophic pachymeningitis. The chief distinguishing points are that in the latter the signs of vertebral disease are absent, and the symptoms arise at a later period of life than is usual in caries.

Vertebral cancer or eroding aneurisms may often be diagnosed by local indications. Apart from these, however, the former may be assumed when there is past or present evidence of growth in the breast, stomach, or elsewhere.

Compression from malignant growth of the vertebræ is characterized by the early occurrence of excruciating pains, followed by the usual symptoms of interference with the functions of the cord itself. This form of paralysis has been termed *paraplegia dolorosa*. Meningeal hemorrhage is indicated by the sudden onset of root-symptoms rapidly followed by paraplegia. The nature of other compressing agents, such as tumors of the cord and its membranes can rarely be determined.

The existence of a gumma, or of a tubercular mass, may sometimes be surmised from the history of the patient.

Morbid Anatomy.—The membranes may be thickened and adherent. In caries there is frequently inflammatory exudation between the dura mater and the bone, the membrane itself showing marked thickening externally and sometimes internally. The symptoms in caries are due to the pressure exerted by the inflammatory products and the thickened dura mater, rarely from actual displacement of the diseased vertebræ. The cord at the seat of compression is often much narrowed and flattened; its consistence in the early stage is softer than normal, but at the latter period it becomes hard from the development of sclerotic changes. On microscopical examination some of the nerve fibers are seen to be disintegrated from acute inflammatory changes, others showing little alteration beyond reduction in size. Interstitial overgrowth is commonly present. The central gray matter exhibits the changes seen in acute myelitis, though to a less degree. The nerve-roots are often gray, atrophied, and degenerated. Above and below the seat of compression the usual secondary degenerations are present.

Treatment.—Prolonged rest in the recumbent posture, tonics, cod-liver oil, and counter-irritation by the actual cautery over the diseased part of the spine, are the chief therapeutic agents in paraplegia from caries. The usual methods for the avoidance of bed-sores and cystitis should be adopted.

Suspension has been advised by some authorities. For description of this method *see* LOCOMOTOR ATAXIA. In obstinate cases the spine has been trephined, and the inflammatory products and diseased dura mater removed. Such a procedure should only be adopted in exceptional cases, since recovery of power in caries may take place after a very prolonged period of paralysis. Tenotomy or extension by splints may be necessary to remedy deformities of the limbs when muscular power is regained. Electricity should only be employed when rapid muscular atrophy has supervened. In chronic meningitis, which is sometimes of syphilitic origin, iodide of potassium is of service, and counter-irritants may be used. In meningeal hemorrhage, absolute rest, the application of ice to the spine, and the administration of ergot are indicated. The treatment of other cases of compression-myelitis will be found under SPINAL CORD AND ITS MEMBRANES, TUMORS OF.

W. B. HADDEN.

SPINAL CORD AND ITS MEMBRANES, TUMORS OF.—In describing tumors of the spinal cord and its membranes, it is essential to include growths involving the vertebræ, since these latter, by extension, frequently give rise to symptoms due to pressure on the nerve-root and cord.

The vertebræ are sometimes affected by primary or secondary growths, usually carcinomatous or sarcomatous, less commonly myxomatous. Carcinomatous disease of the spinal column is often secondary to malignant disease of the breast, stomach, or other organ, and occasionally results from invasion of growths within the abdomen and thorax. It may be mentioned here that aneurism of the abdominal aorta eroding the vertebræ may give rise to pressure on the cord and nerve-roots. In very exceptional cases, exostoses growing from the bodies of the vertebræ have extended into the spinal canal and caused pressure-symptoms.

Tumors Originating Within the Spinal Canal.—(a) Hydatid cysts and lipomata are found, though rarely, in the loose alveolar tissue between the dura mater and spinal canal.

(b) The tumors involving the mem-

branes are mainly gummata, sarcomata, fibromata, myxomata, and tubercular growths; more rarely hydatids, cysticerci and lipomati.

(c) Growths originating within the cord itself are chiefly gliomata, gummata, tubercular tumors, sarcomata, and myxomata.

Multiple tumors may arise either from the membranes or in the cord. In the former case they are usually neuromata or sarcomata, in the latter, tubercular. Tumors of the cord have a limited transverse extent, but vertically they may pass for a considerable distance. By the pressure of growths, mainly those connected with the membranes, the cord may become narrowed and flattened, and usually the ordinary ascending and descending degenerative changes occur. Extrinsic tumors rarely extend into the cord.

Myelitis, of more or less acute course, is not uncommon in cases of tumor within the cord, as well as in growths arising from the membranes and exerting pressure from without. Tumors of the cord often originate in the peri-ependymal tissue, and in such instances the central canal, which is obliterated at the site of the growth by pressure, is found dilated higher up (syngo-myelia).

Symptoms.—(1) *Tumors originating in the substance of the cord.*—The symptoms at first are often vague; later, sensation and motion are apt to be affected below the seat of disease, and muscular atrophy from involvement of the anterior cornua may be present. Sometimes, as for example in central tumors, the symptoms are bilateral from the first; in other cases, when the growth is unilateral, cross paralysis is present at the outset, followed at a later period, in consequence of the horizontal extension of the growth, by the slow supervention of other symptoms.

Tumors of the cord are not usually attended with severe radiating pains or with pain, tenderness, and rigidity of the spine. In this respect they differ materially from growths arising from the membranes. The localization of a cord tumor may usually be determined by the level to which the motor and sensory symptoms extend and by the condition of the skin and tendon reflexes.

(2) *Tumors arising from the membranes* usually involve the sensory and motor nerve-roots at an early period.

In most cases there is intense radiating pain, often limited for a long time to a definite spot or to the distribution of certain nerves. At a later period, as the growth extends beyond its original limits, sensory symptoms referable to other nerve-roots supervene. Hyperæsthesia is often present. Gradual impairment of sensation, commonly ending in complete anæsthesia, frequently occurs in the area in which the severe pains are felt. Twitchings and temporary spasm of certain muscles are of frequent occurrence and depend on irritation of motor nerve-roots. Paralysis, sometimes accompanied by rapid muscular wasting, almost invariably follows. The paralysis, which is gradual at its outset, usually affects at first one limb or part of a limb, but as the growth increases and exerts pressure on the cord there supervenes more or less paraplegia, generally attended with rigidity and exaltation of the tendon reflexes. The distribution of the paralysis and the order of the symptoms will depend on the site of the tumor and its rate of growth. Occasionally acute or subacute myelitis occurs, and then rapid loss of motion and sensation are superadded.

(3) *Tumors arising primarily outside the membranes*, such as malignant growths of the vertebræ and eroding aneurisms, involve the neighboring sensory and motor nerves long before the cord is affected. Pain of great severity, often accompanied by hyperæsthesia and followed by anæsthesia, is an early symptom. Muscular paralysis and wasting are frequent. The cord itself is involved late.

Diagnosis.—The chief points of difference between growths of the cord and those arising from without will be evident from the foregoing account. In spinal caries, pains are not usually severe, the symptoms are at the outset bilateral or soon become so, and curvature or irregularity of the spine, with muscular rigidity, makes its appearance.

In cervical hypertrophic pachymeningitis the muscular paralysis and wasting of the arms are usually bilateral from the first, and the sensory symptoms are general in the arms and not limited to the distribution of definite nerve-trunks.

The initial sensory symptoms of tumors, especially those involving the nerve-roots, are sometimes looked upon as neuralgic, but the extreme severity of

the pains and the constancy of their seat are highly suggestive.

Tumors of the cauda equina often give rise to pain in the course of both sciatic nerves. The bilateral character of the pain is significant, but not sufficient to warrant a diagnosis of tumor. The gradual onset of other symptoms will usually make the case clear.

A surmise may sometimes be made as to the anatomical nature of a growth, provided that the symptoms clearly point to tumor, by the existence of a syphilitic or tubercular taint in the patient. Symptoms of irritation of nerve-roots or of pressure on the cord occurring in a subject suffering from malignant disease of the breast, abdomen, or other part of the body are unmistakable in their significance.

Prognosis.—In all cases except gumata the prognosis is very grave. The duration of life varies from a few months to two or three years. In exceptional cases, in which the tumor is of exceedingly slow growth, life has been prolonged for as long as ten years.

Treatment.—When there is any possibility of syphilitic taint, large doses of iodide of potassium, with or without mercury, should be given. In other cases drugs are only of service for the purpose of alleviating pain. Local applications of aconite, belladonna, and the like may be used. Sedatives, such as cannabis indica, cocaine, and opium are almost always necessary. Recent advances in surgery have shown that tumors of the membranes may be removed successfully.

W. B. HADDEN.

SPINAL PARALYSIS, SUBACUTE AND CHRONIC ATROPHIC (Subacute and Chronic Anterior Polio-myelitis; General Spinal Paralysis).—This disease was originally described by Duchenne in 1849, who termed it "Paralysie générale spinale antérieure subaigüe." The affection frequently assumes a chronic course, although not differing essentially in other clinical characters from the subacute form. This distinction into subacute and chronic is arbitrary, and hence the two varieties must be regarded as one disease.

The disease is characterized by paralysis followed by atrophy involving first

the lower and then the upper extremities. The muscles present the reaction of degeneration. Sensation is preserved, and the bladder and rectum are unaffected. The anatomical change is atrophy of the ganglionic cells in the anterior gray matter of the cord.

Symptoms.—At the onset, more particularly in the subacute cases, the patient frequently complains of fatigue, pains in the back and limbs, with tingling and sensations of numbness, and occasionally there is some pyrexia and general constitutional disturbance. The paralytic symptoms begin with muscular weakness of one or both lower limbs. After a variable period there is distinct paralysis, and, later, the affected muscles waste. The flexors of the foot on the leg are apt to suffer first, then the flexors of the thigh, and subsequently the extensors of the leg on the thigh. The paralysis and wasting, whatever be their distribution, attack the muscles in a progressive manner, and extend slowly from the lower to the upper limbs. In rare instances the arms are attacked first, but the rule is for the upper limbs to be involved a few weeks, or even months, after the onset. The fingers and hands are more affected than the other parts of the upper limbs. The extensor muscles on the backs of the forearms are often attacked early, and suffer severely. In some instances the muscles of the back, abdomen, and neck are implicated, usually at a late stage of the disease. In severe cases there is extension to the medulla oblongata, with its attendant dangers. The affected muscles generally present the reaction of degeneration, though it is said that in some of the chronic cases there is simple loss to both currents. There are commonly fibrillar twitchings of the atrophied muscles. The skin and deep reflexes are abolished in the paralyzed parts. It is important to bear in mind that throughout the disease sensation remains unimpaired, the functions of the bladder and rectum are preserved, and there is no tendency to the formation of bed-sores.

The Course of the Disease is variable. In many cases the wasting and paralysis, after slowly progressing for months or years, remain stationary, subsequently undergoing great improvement, and occasionally a practical recovery is effected. Partial recovery is more common, certain

muscles or groups of muscles remaining permanently wasted. Broadly stated, amelioration is more marked in the subacute form, though even in very chronic cases great improvement, and occasionally actual recovery, may take place. When death occurs, it is usually from exhaustion or from respiratory disorder dependent on implication of the medulla oblongata.

Diagnosis.—In the acute anterior poliomyelitis of adults (adult spinal paralysis) the invasion is abrupt and the muscles are affected coetaneously. In this latter respect adult spinal paralysis differs essentially from general spinal paralysis, in which there is slow extension from part to part.

In progressive muscular atrophy the paralysis and wasting are simultaneous and proportional; whereas, in general spinal paralysis, the weakness precedes the muscular atrophy. In general spinal paralysis also the atrophy is diffuse and attacks almost always the lower limbs first, thus differing essentially from progressive muscular atrophy. The course of the two diseases and the electrical reactions of the muscles are different, and in a doubtful case these points should be taken into consideration in differentiating the affections.

As regards amyotrophic lateral sclerosis, the paralysis precedes the atrophy as in general spinal paralysis. In the former, however, the arms are first attacked, and, what is more important, there is rigidity with exaltation of the tendon reflexes from the very onset. Acute ascending paralysis presents many points of resemblance to acute spinal paralysis, to which reference is made elsewhere. Certain cases of ascending paralysis are of slower development than usual, and then this disease has some features in common with the subacute variety of general spinal paralysis. In the former, however, the muscles do not waste, and their electrical reactions are unchanged—two points of primary importance in diagnosis. Until lately many affections of the peripheral nerves, such as alcoholic neuritis, were ascribed to disease of the anterior gray matter of the spinal cord. In multiple neuritis, sensory defects are often temporary, and it, therefore, happens that great difficulty may exist in differentiating between it and polio-myelitis of subacute or chronic course. It should

be borne in mind, however, that defective sensation, persistent pains in the limbs, and the existence of hyperæsthesia of the muscles and nerve-trunks are characteristic of multiple neuritis.

Morbid Anatomy.—In the few recorded cases in which the spinal cord has been examined, there has been found atrophy of the cells in the anterior gray matter together with degeneration of the anterior roots. Some degree of sclerosis, particularly of the anterior columns, has also been described.

Ætiology.—The causes of the disease are obscure. Injuries, exposure to cold and damp, alcoholism, and lead-poisoning have been looked upon as exciting agents. The onset usually occurs between the ages of thirty and fifty.

Treatment.—Reliance is to be placed chiefly on massage of the affected limbs and the use of electricity, especially of the continuous current.

W. B. HADDEN.

SPINE, DISEASES OF THE.—

Spina Bifida.—“Certain congenital malformations of the vertebral canal, with protrusion of some of its contents in the form of a fluid tumor. With very rare exceptions, the malformation affects the neural arches of the vertebræ, and the tumor projects posteriorly; in rare cases, however, the malformation involves the bodies of the vertebræ, the tumor in such cases protruding anteriorly into the thorax, abdomen, or pelvis between the lateral halves of the bodies affected.” The bifid condition of the neural arch is essentially due to defective development of that part of the mesoblast from which the structures closing in the vertebral furrow are derived. The result is a gap, fissure, or cleft in the vertebral arches, whereby the spinal canal at the affected points remains open.

The commonest *site* of the defect is in the lumbo-sacral region, but it may rarely be found in the upper cervical, and much less often in other parts of the column. The cleft may vary enormously in size, and involve the arch of one vertebra or of many. The fluid tumor usually occupies the middle line, and presents every variety, both in size and appearance.

There are three main *varieties* of spina bifida: those in which membranes alone protrude, *spinal meningocele*; those in

which "membranes, together with the spinal cord and its appertaining nerves, protrude, *meningo-myelocele*;" and those where there is "protrusion of the membranes, together with the spinal cord, the central canal of which is dilated so as to form the sac cavity, the inner lining being constituted by the expanded and atrophied substance of the cord, *syringo-myelocele*." The second is by far the commonest, the last the rarest.

Symptoms.—Associated very often with the spina bifida, and indicative of the implication of nerve elements in the tumor, are paralyzes, more or less, of the lower limbs or sphincters, some degree of club foot, talipes equino-varus being the most frequent, with perhaps a general stunted appearance of the whole limb, which may be cold and bluish. There is often also hydrocephalus, and pressure on the sacral tumor may increase the distention of the head and cause convulsions or other grave disturbances.

The form and size of the *sac* vary enormously. It is usually about the size of a Tangerine orange at birth (Fig. 1). "In form sessile, somewhat constricted



FIG. 1.—Spina Bifida.

at the base, circular, ovoid, or cordiform in outline, these tumors occasionally present a slight median longitudinal furrow, or sometimes a more localized depression at or near the summit, the so-called umbilicus. The latter indicates the spot at which the spinal cord meets and becomes incor-

porated with the posterior wall of the sac; but, while its pressure indicates that the tumor is a meningo-myelocele, its absence cannot be held to prove the contrary. The same is true of a median furrow."

The coverings of the sac also show great varieties. "It is very seldom that a normal cutaneous covering exists over the whole protrusion. As a rule, the base alone is covered with normal skin, while in the rest of its extent the covering consists of a thin, white, glistening, membrane-like tissue. In some specimens the skin ends abruptly; in others it merges gradually into the membrane noticed. More rarely, however, the cutaneous covering is continuous over the whole tumor." The cleft most often involves certain vertebræ, "most usually the last lumbar and all the sacral." "The actual extent of the protrusion forms no certain criterion of the extent of deficiency in the neural arches."

In the second and commonest variety it has been mentioned that a depression or furrow indicates the spot where the cord meets and becomes incorporated with the posterior wall of the sac. "The level at which the cord crosses the sac is variable; as a rule, it is somewhat above its center. Occasionally, however, the cord, as it emerges from the vertebral canal, becomes immediately connected with the roof of the sac without the intervention of any space." The integrity of the central canal of the cord is preserved at this part, where there is an absence of true skin. "The nerve-roots which traverse the sac arise from this intramural portion of the central nervous system. . . . The sac wall is really their source, and the nerves within the sac are properly anterior and posterior roots."

It is therefore clear that the *neural furrow* does not remain unclosed in spina bifida. It is the *vertebral furrow* which is at fault.

Prognosis.—The general tendency of spina bifida is to increase in size, and for the coverings to become thinner and thinner until they burst; cerebro-spinal fluid is poured out, and the child dies from convulsions or meningitis. In the smaller tumors, however, where probably the cleft is small, the coverings are of skin all over, and there is simply a meningocele, spontaneous recovery is by no means rare; that is to say, the fluid gets less, the walls shrivel and contract, and it may be that the cleft is closed.

The treatment of spina bifida has always been unsatisfactory, and interference has often caused death. Success has most frequently attended the treatment of the smaller tumors, which have a tendency to spontaneous cure, and it is a question whether in all such cases the surgeon will not do wisely to be content with protecting the tumor from injury, and continuously applying gentle pressure so as to prevent increase in size. It is different, however, with rapidly increasing tumors, which are associated with grave nervous symptoms. Various methods of treatment have been adopted, such as repeated tapping, excision, and ligature, and injection with simple iodine, but none of these can be recommended. We have, in injection of Morton's iodo-glycerin solution (iodine, grs. x, iodide of potassium, grs. xxx, glycerin $\frac{3}{4}$ j) a method of setting up a process of cure which consists in gradual shrinking of the tumor, and which closely imitates that which occurs spontaneously. "The puncture into the tumor should be made at one side of the base, obliquely through healthy skin, and not through membranous sac wall. It is not necessary to withdraw any of the fluid contents of the tumor before injecting the solution." A dram is a suitable quantity in the majority of cases, and the injection may be repeated in about a fortnight.

"The circumstances which contra-indicate the operation are advanced marasmus, great and increasing hydrocephalus, and intercurrent disease. As a rule, it is well to wait until the child is at least two months old before submitting it to operation; but, when the sac wall is threatening to burst, treatment may be carried out earlier."

The cure of the spina bifida offers no prospect of improvement in any paralysis or talipes. Occipital meningocele hanging low down may be mistaken for cervical spina bifida. Spina bifida is more common in females than in males. The tumors may rarely be multilocular.

Congenital sacro-coccygeal tumors.—The neighborhood of the sacrum and coccyx is a favorite site for certain congenital tumors. Of these may be named some portion of a fetus, usually a third lower limb; tumors containing fetal remains such as bone, cartilage, hair, and teeth, deeply seated, perhaps, and adherent to bone, often pendulous, and present-

ing great variety in both size and contents, sometimes associated with and liable to be mistaken for spina bifida, especially when situated higher up than usual and in the middle line; congenital cystic tumors, single or many-chambered, some of which may at one time have been connected with a sacral spina bifida, and when of large size and growing inwardly, surrounding the rectum and other pelvic organs; congenital solid tumors, fibrous, fibro-cellular, and fatty, which may start from the front of the sacrum or coccyx, attain vast dimensions, spread widely in the pelvis, and surround or display all the organs contained therein. It is highly probable that many of these congenital tumors arise in connection with embryonic structures, remaining in parts where the three blastodermic layers are brought into close apposition in the process of development.

Many of the smaller tumors can be easily removed; but no attempt should be made to operate on those which extend deeply into the pelvis until their connection with the pelvic viscera has been as far as possible determined.

Pott's Disease.—Pott's disease of the spine, often spoken of as "angular curvature," a strange misnomer, is a disease commonly of early life, which consists in inflammation and necrotic destruction or caries of some, usually the anterior, parts of the vertebral bodies and intervertebral disks, whereby the natural support given by these structures to the column is lost, and the spine above the seat of mischief falls forward, and a projection is caused in the middle line of the back. In extreme cases, where the bodies of many vertebræ are destroyed, the angular projection is very great, and the stature of the patient is diminished. In company with this bone disease there is, as elsewhere, the formation of an abscess which may present itself externally in various parts.

Pathology.—The morbid process is closely allied to, if it be not identical with, that of caries of other bones. The lower dorsal region is the commonest site of the disease, which usually begins in the anterior part of one or more bodies, or in the epiphysial portion which lies next to the intervertebral substances. It may also begin in the intervertebral disks themselves; but wherever its precise origin, and whether we call it a simple

caries or osteitis, or it be of a distinctly tuberculous nature, the process leads to softening and crumbling away of the bone, and a collection of matter is formed which consists of broken-down bone, inflammatory products, and pus, and which lies in front, or more often a little to one side of the front of the bodies. The position of the abscess is determined by the seat of the disease, by the greater ease with which pus can accumulate in front than behind, a tendency, moreover, which is encouraged by the forward bending of the column. By gravitation the pus makes its way downward along the front of the spine; the abscess assumes a pear shape, and according to the site of the disease, and the rate of increase, will be the exact point at which it ultimately appears. It may, however, remain limited to the seat of disease, and should the destructive process cease it may then dry up, and undergo the same kinds of changes as occur in old abscesses elsewhere. We shall return to the consideration of the abscesses when we have dealt with the various symptoms to which Pott's disease may give rise, and by which the surgeon should, if possible, diagnose it in its earliest stages, before the diagnosis has been made for him by the appearance of an abscess or the median angular projection.

Ætiology.—Injury such as a severe spinal bend or wrench may, it is thought, have some share in starting the morbid process, by bruising an intervertebral disk or stretching the anterior common ligament; but very commonly the disease seems to begin without more definite causes than poor living and general insanitary conditions, such as are found among the children of the poor. These causes will naturally be more potent for evil in children of strumous tendency, hereditary or acquired.

Symptoms.—Far too often cases of Pott's disease come under observation only when the mischief has been done, and the story is told of past ailment, and that the child's back has now "begun to grow out." There are, however, important symptoms, even in the period of indefinite ailing, which, in combination with general malaise and health failure in children, should make the surgeon tolerably certain that he has to deal with a case of Pott's disease.

These symptoms are *spinal stiffness*

and *pain*. The spinal stiffness is the result of an instinctive effort on the part of the spinal muscles and ligaments to hold the column rigid, so that there may be no movement or jarring at the seat of disease. The rigidity can easily be detected by careful observation of the child's movements after it has been stripped, by watching how it will stoop to pick things up from the floor, how it will turn round in bed, or how the back comports itself when the child, flat upon its face, is raised up by the pelvis or legs. It is, therefore, very necessary to be familiar with the range of mobility and flexibility of the healthy spinal column, both in children and adults. In severe cases spinal movement is pretty sure to cause pain, which however, is a less valuable symptom than spinal rigidity, for the inflammatory mischief is far from the surface, it is difficult for a child to localize its seat, and spinal pain is, moreover, a common complaint in other and less important maladies. It may be restricted to the seat of mischief, or in cases where the inflammatory action involves the nerves as they issue from the spine, it may be radiant in character and far removed from the site of the disease. Absence of pain is, at the same time, very common; and it is by no means to be assumed in any case that because pain is absent there is, therefore, no disease. The important practical point for the surgeon to remember is this, that in all cases where there are complaints of pain in the back, or pain or other abnormal sensations in any part of the body or limbs in children, for which no obvious local cause is discoverable, he should make it his unfailing business to examine the spine to see whether there be any rigidity, for this is a symptom rarely or never absent even in the very earliest stages of Pott's disease, when treatment may perchance be of some avail in arresting the caries. The combination of the two symptoms is an almost infallible guide to the diagnosis of Pott's disease.

The spinal deformity, or median angular projection, is due to the destruction of the bodies already named, and is, to some extent, the result of a conservative process, for the gap in the bodies, which no reparative process can fill up, is nevertheless obliterated by the falling together and ultimate union of the healthy vertebræ which form the upper and lower boundaries of the diseased area. When the de-

struction is rapid and extensive the projection may become well marked, even in a very short time, while in others the rate of its formation may be slow; and, in the lumbar region, where the bodies are large, the deformity may be very slight indeed. It is usually most prominent in the dorsal region, in consequence of the length of the dorsal spines. It may be sharp and abrupt, or little more than a general increase in the natural dorsal curve, with rather undue prominence of one or two spines. Much depends on the rate of progress and the extent of the disease. When the projection has existed for any length of time, and, indeed, while it is being formed, the posterior segments of the vertebræ, the spinous and transverse processes, the laminæ and ribs become ankylosed together by inflammatory adhesions, whereby strengthening of the column is effected. The fibrinous material thus produced may ultimately ossify, uniting the various parts into one bony mass. Rigidity is, of course, a marked feature in such conditions, and the wasting of the spinal muscles from disuse makes the angular projection still more noticeable than it would otherwise be. The anterior parts may also become consolidated together by thickening of periosteum and contraction of the abscess cavity, and permanent irremediable deformity is the result. At the same time the patient has been all along endeavoring to keep the head erect, and compensatory curves are formed in other regions. The sternum gets pushed forward, the shoulders are high with the head sunk between them, and the child presents an aspect strangely old.

There are three chief varieties of *abscess* due to Pott's disease: psoas, iliac, and lumbar.

Psoas abscess is the commonest of them, and is so named from its position in the sheath of the psoas muscle. It may be regarded as an almost unfailing sign of Pott's disease in the dorsal region, although occasionally it may be met with as the result of disease lower down. Shaw has given the following admirable account of its formation and progress: "When the abscess is connected with diseased dorsal vertebræ, it encounters, in its descent, the diaphragm. But that barrier is overcome by a particular process. As the abscess comes into contact with the diaphragm and compresses it, adhesive

inflammation is set up in their respective surfaces; the consequence is that they become united over a considerable area; an opening is next formed by absorption without the boundaries of the adhering structures; the abscess then protrudes; and extravasation of pus at the margins is prevented from taking place by the firm union of the parts encircling the opening."

It next "comes into relation with the heads of the psoas muscle;" but as it "travels downward it has to pass through a narrow strait; it is prevented from enlarging, in the fore part, by the resistance of the ligamenta arcuata," which stretch across the two origins of the muscle, "and, at the back, by that of the spine and lowest rib; hence, in order to proceed, it has to force its way in the line of the psoas muscle. That, however, can only be done by penetrating into its interior. It accomplishes this, in the first place, by inserting its most advanced parts, like a wedge, between the two origins; it then splits and distends the fibers; and the psoas at length is converted into an abscess." The connections of the fascia iliaca being looser on the outer than the inner side, the abscess enlarges most freely in that direction, and now chiefly occupies the hollow between the united fibers of iliacus internus and psoas muscles on the inside, and the crest of the ilium on the outside. When the advanced parts reaches Poupart's ligament, a certain retardation occurs; and then a bulging will be observed along the line of the flexure of the groin.

Pus may also travel below Poupart's ligament as far as the insertion of the psoas, and form there a fluctuant swelling, the size of which may be modified both by position and pressure. When the pus has increased so much that there is a distinct swelling both above and below Poupart's ligament, the diagnosis ought to be a matter of no difficulty, for pressure at one part surely causes enlargement of swelling at the other. Unlike a hernia, therefore, of which no trace can be felt in the abdomen when it has been reduced, a distinct abdominal swelling can still be detected in the region of the psoas when the abscess is made solely to occupy a position above the groin. Nor is an abscess reducible with that peculiar gurgle or suddenness which often characterizes the reduction of a hernia. Unlike a femoral hernia, a psoas abscess lies rather to the outer side of the femoral vessels. In the earlier stages of

abscess formation, when pus at first distends the sheaths of the psoas, and little or no swelling can be left, the presence of pus can only be suspected from the tendency of the child to keep its thigh flexed so as to relieve tension on the muscle; and should this posture lead to a suspicion of hip disease, we shall find that although extension may cause pain in the psoas region, yet, nevertheless, the thigh can be flexed on the pelvis in a manner singularly different from the limitation of that movement, independent of movement of the pelvis, which is so striking in that disease.

As an offshoot very often from a psoas abscess, pus may come to lie in the *iliac fossa*, or it may gravitate there from disease of the lumbar bodies. When very large, the iliac collection of pus may make its way over the crest of the ilium, appear in the gluteal region, and seem to have no possible connection with Pott's disease.

Care must, therefore, be exercised in the diagnosis of such cases, and search be made for the real cause, as also in cases where the pus has traveled into the perineum, the ischio-rectal fossa, the back of the thigh, or other unusual sites. When the lumbar vertebræ are affected, it is common for the abscess to point in some parts of the loin, when it is known as *lumbar abscess*. It makes its appearance on the surface, often as a square-shaped swelling, to the outer side of the quadratus lumborum, between the iliac crest and the last rib; and in cases where there is little or no deformity, as may happen in this region, it may be a matter of some doubt whether the abscess is really due to Pott's disease. When, however, there is disease in the dorsal region, and there is obvious deformity, rigidity, or pain, and the abscess is either the offshoot of a psoas abscess, or has made its way to the loin because the pus could not overcome that obstacle to its descent which exists at the "narrow strait" described by Shaw, there is little difficulty in associating it with Pott's disease. In all doubtful cases, whatever may be the site of the abscess, the spine and spinal movements must be carefully examined; for local or general rigidity, even if no deformity has yet arisen, is in such cases highly suggestive of this disease.

Disturbance of the spinal cord.—A remarkable circumstance in connection with Pott's disease is the rarity with which the inflammatory mischief spreads to the

spinal canal, and the frequency with which the cord is undamaged even when it shares, as of necessity it must share, in the bend to which the spine is subjected in the course of the disease. The active mischief, however, is usually at the front of the bodies away from the spinal canal, and the slow rate at which the column bends allows the cord time to accommodate itself to the new conditions under which it is placed.

Unquestionable disturbances of motion and sensation, and even complete paraplegia, may occasionally be met with, and form distinct evidences that the cord or nerves have been somehow implicated. Two circumstances seem prone to contribute to this result; diseases affecting the hinder parts of the bodies and very rapid formation of deformity from rapidity and activity of the disease.

The symptoms rarely indicate complete destruction of the marrow, and, such as there are, are rather due to pressure, either of bone or inflammatory products, than to actual myelitis. Paralysis of bowel and bladder is uncommon, and bed sores are most rare. Paralysis of motion may affect single muscles or groups of muscles with the same nerve supply, and there may be great increase of reflex irritability. Exaggeration of knee-jerk and ankle-clonus are often conspicuous phenomena, which, in any case of paraplegia, should suggest an examination of the spinal column. Disturbances of sensation, hyperæsthesiæ, or peripheral neuralgic pains are, also, not uncommon. Whatever may be the nervous disturbance, recovery is often complete, as the disease subsides and the inflammatory products around and about the nerves or cord undergo absorption. They add, however, to the gravity and anxiety of every case, and call for such treatment as shall best arrest the progress of the disease.

The *treatment* of Pott's disease is always a matter of considerable difficulty, especially among the poor, from the necessity of carrying it out for a very long time, for many months, or even years. Whatever be the special plan adopted, one principle, and one only, should underlie it, and that is to secure *rest* for the spinal column,

In the early stages of the malady, when its existence has been determined by the symptoms named, before deformity exists, whether the disease is slow or acute, or

whatever its site, the child should be kept absolutely at rest in bed. He should lie on a good flat mattress, with the whole spine, from head to sacrum, as straight as possible; and, if needful, this end must be secured by the use of splints to the limbs, or other means, to prevent movement. The earlier the diagnosis is made, the greater likelihood is there that simple rest in bed will stay the disease, and so obviate the permanent deformity which must in the end ensue. Doubly important, therefore, is early diagnosis. There is no credit in making a diagnosis when the hump is already there. When the disease has gone so far that the bodies are falling together, their friction against each other tends to set up irritation and aggravation of the disease, and it is then desirable to secure fixation of the spine in such a position of slight extension of the column that the apposition of inflamed parts of the bodies shall be prevented.

This may readily be accomplished by the application of a *Sayre's jacket* while the patient is in the prone position, or of a jacket made of poroplastic felt, resting satisfied with that amount of extension which may be gained by simple posture, rather than by forcible extension to run the risk of actually fracturing the spine. The jacket often gives immense relief; and, having been applied, it must be a consideration in every case whether the child shall be allowed to run about or whether it shall still remain in bed. Moving about may sometimes be advantageous; in any case it will be less injurious when a jacket is on than when the spine has no support; but the wearing of a jacket should never be the excuse for letting a child run and play as if nothing were the matter with it. Rest in the recumbent posture should at any rate be enforced for many hours a day.

There is probably no kind of *abscess* in which the beneficial results of early opening under Listerian antiseptic precautions are now so manifest, as formerly there was none in which the results of opening, spontaneous or by the knife, were in the pre-aseptic days so often disastrous. The long sinuous cavity of an ilio-psoas abscess provided the very conditions for the origin of septicæmia after contamination with the air, and the opening of a psoas abscess was frequently the beginning of a so-called "hectic fever," really a septicæmia, ending in death. In his descrip-

tion of the opening of a psoas abscess above Poupart's ligament, Mr. Cheyne says that "there are two reasons for choosing this situation. In the first place, the old rule that these abscesses must not be opened early is now done away with, and, under truly aseptic treatment, as soon as fluctuation is detected, an operation is performed of a similar nature to that for tying the external iliac artery, and the abscess is opened after a careful dissection. The sooner the abscess is opened the better, for the abscess cavity is thus smaller than if the surgeon waits till the pus has burrowed its way into the thigh; and, further, so long as the pus is there it irritates by its tension, and thus keeps up the chronic inflammation in the spine. Another reason is, that it ought to be opened as far as possible from sources of putrefaction." The same principle of treatment must be applied to lumbar abscesses; while, for abscesses connected with the twelfth dorsal and lumbar vertebræ, Mr. Treves has proposed to reach the seat of the disease, and drain the cavity by a carefully planned dependent opening in the loin. In one case thus treated by him a large sequestrum was removed. A dependent opening for the evacuation of ilio-psoas abscess has also been obtained by trephining the ilium.

Disease of the Cervical Spine.—The cervical vertebræ differ so much in shape and size from those in other parts that disease in this region is more prone to light up an inflammatory mischief about the meninges or cord. In the region of the atlas and axis it is very prone also to involve the joints between these two bones, and less commonly those between the occiput and atlas. The transverse, odontoid, and other ligaments also are frequently softened or destroyed, and slipping forward of the atlas upon the axis is the usual result, with narrowing of the spinal canal and pressure of the cord against the odontoid process. Sudden death is, therefore, always to be feared when there is disease in this region, and treatment must insure the most perfect immobility of the head and neck.

The *symptoms* of cervical caries are of the same nature as when the disease is in other parts.

Pain is more common and often more definite than in Pott's disease in the dorsal region, and may definitely follow

the course of one of the sensory branches of the upper cervical nerves, which issue from the spine in close proximity to the disease. As Hilton pointed out, the pain is frequently unilateral. Severe neuralgic pain, therefore, increased by pressure on the head or neck, or by any sudden movement of either, in the course of the cervical nerves, the great and small occipital, the great auricular and superficialis colli, or the sternal, clavicular, and acromial nerves, associated with rigidity of any of the muscles of the neck, especially the trapezii, should never fail to raise the suspicion of vertebral disease.

"Rigidity of the trapezii," Owen says, "when associated with stiff neck, is almost pathognomonic of inflammation in the cervical spine;" and when to this sign is added "neuralgic headache," there ought to be little difficulty in arriving at an accurate diagnosis, and the error should be avoided of looking on the case as one merely of "rheumatism" or stiff neck. The same kind of neuralgic pain may be felt in the periphery of branches of the brachial plexus when disease is in the lower cervical region.

Deformity is not so marked in the neck as elsewhere, because the smallness of the parts destroyed makes angular projection an improbable result. In atlo-axoid disease the head is poked forward, from the slipping forward of the first upon the second vertebra. The chin points downward, and perhaps one or more of the spinous processes become unduly prominent. Compensatory curves are established in other regions to remedy this position when the disease has been arrested and there is permanent rigidity.

Swelling makes its appearance pretty soon from inflammatory exudation into the soft tissues, and there may be distinct fluctuation and abscess in the suboccipital region. Oftener, however, the pus travels far from the original seat of the disease, and, guided by the fasciæ around the muscles, and by gravitation, may appear in the posterior triangle, in front of the trapezius, or near the posterior border of the sterno-mastoid muscle. When the disease is strictly confined to the anterior parts of the vertebra, abscess may point in the posterior wall of the pharynx, where it may even burst and cause death by suffocation. The same line of *treatment* must be followed in the case of cervical abscesses in other re-

gions; while the difficulty of emptying and draining a post-pharyngeal abscess antiseptically may be overcome successfully by burrowing down to it from an opening in the side of the neck behind the sterno-mastoid. Absolute rest is again essential in all these cases. In atlo-axoid disease the patient must lie perfectly flat upon his back, and, as recommended by Hilton, the neck must be supported by a small firm pad to fill up the suboccipital fossa, while the occiput itself rests on a cushion or circular pad. Tilting forward of the atlas is thus prevented, and the cord is relieved from pressure. Immobility must be secured by sand-bags on each side of the head or neck, or by fixing the head with bandages. And thus the patient must lie, with head and neck immobile for, it may be, many months; and not until all active mischief has subsided and ankylosis has occurred should there be any experiments in moving the head. When disease involves the lower cervical vertebrae the head must be supported and the neck fixed by a cervical collar. The necessity for absolute rest in bed must be determined by the activity and extent of the disease.

Pott's disease in adults.—Pott's disease is most commonly met with in early life; but it may be seen in adults, and follows precisely the same course, with a tendency more often to be more rapid in progress than it is in children. In adults it may be due to syphilis, and in the cervical region may be set up by syphilitic ulceration in the posterior wall of the pharynx. Constitutional treatment must clearly be directed to this special malady, in addition to local measures for securing rest.

Symptomatic Indications.—*Arsenicum* is useful when there is greatly oppressed breathing and anxiety; constriction and lightness of the chest, as if bound with a hoop; weariness in all the limbs; tremblings and violent startings. *Belladonna*, for severe cramps in the small of the back; lancinations in the vertebrae, resembling stabs with a knife; fainting fits, delirium. *Calcareo carbonica* in children of scrofulous diathesis; swelling of cervical glands; swelling and incubation of cervical and dorsal vertebrae; weakness and emaciation; weakness after exertion. *Phosphorus*, for paralytic weakness of small of the back;

sensitiveness of spinous processes, and muscles lying along spinous processes; burning in small spot in small of back; oversensitiveness to external impressions; spasms of muscles. *Silicea* is one of the most useful remedies. Violent spasmodic pain along the back; inflamed psoas abscess; severe pain in vertebræ increased by pressure; faulty nutrition; spinal irritation; spinal curvature; child is slow learning to walk, wants to lie down; sense of great debility.

Spondylitis deformans is the name given to a disease which affects the vertebral column, and is the same, or of the same nature, as that termed "chronic rheumatic arthritis" when affecting other parts. As a consequence of the absorption of the articular cartilages and of the intervertebral disks, and the development of osteophytic prominences from the edges of the vertebral bodies, and ossification of the ligaments, especially the anterior common ligament, the spine becomes bent and rigid, and a very characteristic deformity is the result.

Symptoms.—Cyphosis is produced, and as the disease affects the whole or major part of the column, there is one long antero-posterior curve, the patient has a constant stoop, his stature is diminished, there is complete rigidity of his spine, and his movements are awkward and constrained. In lesser grades of the disease the cervico-dorsal or lumbo-dorsal regions may be alone affected and the signs are less pronounced. With advance of the disease the spinal muscles waste, and the curvature becomes more prominent, the head is poked forward, the shoulders appear unusually round, and the patient is obliged to support himself with a stick.

Spondylitis deformans, sometimes called "synostosis of vertebræ," is commonly a disease of later middle and advanced life, is seen more often in men than in women, and is, perhaps, determined to some extent by occupations which involve long stooping at work. It is generally associated with evidences of rheumatoid disease in other parts of the body. Rarely it is met with earlier in life, when in all probability the combined effects of heredity, and of those somewhat indefinite conditions, cold, exposure, lack of food, which may be supposed to excite and further the development of any inherited malady, have lighted up the

disease. In such cases it may happen that every joint of the spinal column may become involved, and the term "intervertebral arthritis" may fitly be applied to them. The suffering may be extreme, and the tendency is to early death by exhaustion and pain. In the chronic cases of older people, however, there may be neither pain nor much obvious interference with the general health, and the patient may live for years.

No known *treatment* has any influence on this obscure and little understood disease. It seems probable that in some cases the disease has been started in connection with gonorrhea, a sort of "gonorrheal rheumatism;" but, if on this point there be doubt, there is none as to its having become worse during an attack of special urethritis. Much has yet to be done in elucidation of this strange malady.

HERBERT W. PAGE.

SPINE, INJURIES OF THE.—

Contusions and contused wounds of the back do not differ in the main from the same kinds of injury in other parts. The thickness, however, of the skin of the back prevents it from giving way even after considerable violence, and extensive subcutaneous extravasation of blood (hematoma) may be met with, which undergoes absorption in the usual way. As the result of any severe injury of the kind, stiffness of the back is not improbable from damage to some of the spinal muscles.

In cases of severe contusion in the lumbar region, even without external mark or laceration of skin, it may happen that hematuria soon shows itself after the accident, owing to damage to the kidney. The symptom is not by itself alarming, and it is very rare for hemorrhage to be fatal from this cause. Nay, the tendency is rather for the bleeding to cease spontaneously in the course of a few days.

Punctured or incised wounds of the back may cause grave injury. The horizontal direction of the spinous and transverse processes in the neck renders it by no means difficult for any long, sharp, narrow instrument to penetrate the spinal canal, and so wound the spinal membranes, wound or sever one or more of the spinal nerves, or even the spinal cord itself. The same calamity may also happen lower down.

The *diagnosis* of simple puncture of

the spinal canal can only be a matter of certainty when there is escape of cerebro-spinal fluid, and by an accurate knowledge of the direction of the wound and the form of the weapon which inflicted it.

Symptoms.—Injury to spinal membranes alone in such a wound may cause immediate symptoms, but there is great risk of acute inflammation or meningitis. The symptoms now are well marked and, in varying proportions, consist of pain and tenderness, spinal rigidity, and dread of being jarred or moved, pain or hyperæsthesia in the periphery of the nerves which have their origin at the site of the inflammation, impairment of motion and sensation, rapidly passing, it may be, into complete paralysis in the parts below should the cord itself become involved in inflammation, a tendency to opisthotonos, high temperature, rapid wasting, vomiting, and general unrest.

The *prognosis* is extremely grave. Great, also, is the danger if the cord itself has been injured, a fact which may be told by the existence of paralysis, of interference with and perversion of motion or sensation, or of both combined, over a limited area, or universal in the parts below the seat of injury, according to the site and extent of the wound, changes in the reflexes, and alteration in temperature in peripheral parts: phenomena indicative of disturbance in the conducting paths and central functions of the cord. Even if the external wound and that of the spinal canal be closed, and meningitis has been escaped, complete recovery is in such cases rare, for union and repair of any wound in the cord are both uncertain and imperfect. Some paralysis is too likely to be permanent, and secondary degeneration in the cord may induce other and later symptoms of nervous disturbance.

Treatment.—The surgeon must make it his first care to insure the perfect asepticity and early closure of the wound, and the spine must be kept absolutely at rest. Meningitis is the immediate danger to be feared, and it may be well to begin at once with the administration of mercury or ergot, or of both combined, in the hope of controlling the tendency to inflammation in the meninges and cord.

Sprains of the back and spine are extremely common, and often troublesome. They do not differ, either in cause or pathology, from sprains elsewhere;

but the fact that the spinal column consists of many separate bones connected together by an almost incalculable number of ligamentous and muscular fibers, many of them deeply seated, and that it has also in its constitution a large number of joints, renders the symptoms of vertebral sprains, and their consequences, prone to last longer, to cause more suffering, and to be more obscure than like injuries elsewhere.

The most flexible parts, the cervical, cervico-dorsal, and dorso-lumbar regions, are the most liable to sprains; the stretching, partial rupture, or laceration of muscular and ligamentous structures being frequently the result of violence, which has led to the spine being inordinately bent, or because they have given way in an unwonted muscular effort; as when a man, in lifting a heavy weight, ruptures some fibers of one or both of the erectors of his spine. There is, of course, an infinite variety in the degree of this form of spinal injury, and it is simply a question of degree whether the damage affects only extra-spinal structures which hold the segments of the column together, or whether the more important intra-spinal organs have been injured because of more complete separation of those segments, as occurs in fracture-dislocation.

Symptoms.—Be the cause what it may, and in whatever region, the symptoms of spinal sprain are such as are seen after sprain of the limbs, viz., local pain and local tenderness, and in some cases slight local swelling, with stiffness and rigidity of the affected part.

After bad lumbar sprain, which may be termed *traumatic lumbago*, it is not unusual, as in cases of simple lumbago from cold, for the patient to feel much difficulty in walking; and a state of pseudo-paralysis of the legs may be induced, simply from stiffness and incapacity of the spinal muscles, which no longer give natural support to the spine, or which cannot be called into action without pain. The patient complains, and may fully believe, that he cannot move his legs; but careful inquiry will elicit that he is really afraid to move them because of pain. Difficulty in defecation and micturition, and inability to completely empty the bladder, or even retention of urine may arise from the same muscular incapacity. The combination of such symptoms, spinal pain and stiffness, difficulty in

walking, and interference with the natural acts of defecation and micturition may suggest very grave inferences that the injury has indeed been more serious than it really is, and has even involved the spinal cord.

An accurate *diagnosis* must be sought in the history of the injury, in the existence of local aching and stiffness, and in observing the time of onset of these seemingly paralytic symptoms. In cases of real intra-spinal injury, paralytic symptoms are much more likely to be found immediately after the accident, while after simple sprain they may be entirely absent until the stiffness and pain become pronounced, as they usually do in the course of a few days. Where certain diagnosis is impossible, it is better to err on the side of assuming central injury, than of failing to recognize it. For here arises a dilemma, that the later treatment of spinal sprain is that which we ought specially to avoid, were it known that there was injury to the spinal membranes of the cord. This, unquestionably, is movement, systematically carried out so as to lessen the stiffness and its attendant pain.

Treatment.—As in the treatment of sprains elsewhere, so also is it in the case of the spine, *movement* must be begun as soon as, by rest in bed and the application of warmth with hot flannels or linseed poultices, the pain has been allayed, the tendency to inflammation has been kept in bounds, and nature has set about the work of repair. No precise rules can be laid down as to the length of time during which rest must be enforced. The constipation may be relieved by aperients or simple enemata, and any difficulty with the bladder may be relieved by the use of a soft catheter scrupulously clean. These early troubles having been met, we must have the patient out of bed, so that by the movements of walking and gentle gymnastic exercise the stiffness and pain may be removed. Toward this end massage of the affected muscles may sometimes be of great service. The symptoms, aching and stiffness, are often, however, of long continuance, and it is frequently difficult to carry out the requisite treatment, in consequence of the pain which movement entails. Movement and the application of heat may be beneficially combined by ironing the back with a hot iron, for the heat compels the patient to move, and so calls fibers into

action over which he has no voluntary control. The pain and stiffness are most liable to last for a long time in those who lead a sedentary life, a fact which shows the value of movement, and in those also who have a tendency to gout or rheumatism. In such cases, in addition to constitutional treatment, the occasional application of the combined faradic and galvanic currents to the affected muscles will sometimes give relief when other means have failed.

It is a question how far in some of these cases the continuance of the pain and stiffness, when definitely local and perhaps unilateral, may be due to a more direct involvement of, and effusion into, one or more of the spinal joints. In rare instances *suppuration* in a joint has followed severe spinal sprain, and it may be that simple effusion at times occurs and gives rise to the same sorts of symptoms as effusion in the joints of the limbs.

The spinal injuries of railway collisions are essentially of the same kind as those which have been already described, and are very common after such forms of accident, because the violence is exactly such as to cause undue bending of the spinal column, or strain of muscular fibers when the patient is unconsciously holding his body stiff, as an involuntary means of protecting himself from injury. This form of spinal injury is often more severe in what may be called slight collisions, for then it is that the patient is likely to be thrown to and fro several times in the carriage, a result which does not happen in the severest accidents, when all is over in some sudden crash, destructive to the carriages, and frequently to life and limb. The spinal sprains thus received are of every variety and degree, and cases are sometimes observed where the whole vertebral column seems to have been sprained, is painful and tender throughout its whole length, and the least movement is for a time well-nigh impossible. Then especially is it that the existence of pseudo-paralytic symptoms is likely to cause difficulty and trouble, for it rarely happens that spinal sprains are the sole injury sustained.

Symptoms.—As a consequence, to some extent, of the general violence, but more especially of the alarming circumstances of the accident, the patient is prone to suffer from a train of symptoms

which have their beginning in undoubted collapse, which do not, however, pass away like the usual symptoms of shock after other and commoner injuries, but may be protracted and little amenable to treatment. As the result of the shock, which is largely if not entirely due to fright, there is developed a condition of general bodily and mental depression, a state of neurasthenia, or nerve weakness and exhaustion, which is not dependent on any known structural changes, and which may even arise in those who have met with no bodily injury at all.

This state of neurasthenia is characterized by various symptoms, of which derangements of the circulatory and vasomotor system are the most pronounced; and we meet with palpitation, alternate sensations of heat and cold, coldness of the extremities, sweating, diarrhea, menorrhagia, and sometimes polyuria, together with great restlessness, sleeplessness, and nervousness, as marked, perhaps, in males as in females, loss of control over the emotions, a tendency to hysterical crying, asthenopia from weakness of accommodation, suppression of the catamenia, great languor, and early fatigue and exhaustion after any physical or mental work. The whole condition, which varies much in individual cases, may be summed up in the one word, *neurasthenia*, which indicates that something has occurred to depress and lower the tone, vitality, and function of the whole nervous system, cerebral, spinal, and sympathetic.

The nervousness and depression may be extreme, despondency is a necessary part of the condition, and the patient is prone to give way to his feelings. In this state of neurasthenia it is that the pseudo-paralytic symptoms of spinal sprain are likely to be regarded as of more serious moment than they really are, and to suggest that there has been injury to some parts of the central nervous system. These cases of railway injury are likely to make large calls on the good judgment and tact of the surgeon, for unfortunately the patient is subjected to influences which may seriously retard his progress toward recovery. Prospective compensation may tempt him to fraud and exaggeration, or may quite unconsciously prevent any voluntary effort being made to throw off the invalid state, which is the first necessary step in

the return to work and a healthy mode of life. The worries of litigation are also seriously opposed to convalescence.

Treatment.—Rest, both of body and mind, is essential in the treatment of such cases, and it must be begun soon. Rest, good food, fresh air must supply the chief means of treatment, for no drug has any special influence over this state of neurasthenia, unless, indeed, it be bromide of potassium, which, from its powerful depressant action, has a serious tendency to aggravate the symptoms which already exist, and to develop others of a like kind. In the great majority of cases recovery is complete, but in a small proportion of the severer cases the patients never seem to regain the same strength as they had before the accident, or do so only after a very long time.

Meningitis is a result to be feared in all cases of severe spinal sprain. There are two forms of inflammation of the spinal membranes, the *acute* and the *chronic*. To the former we have already referred in speaking of wounds of the spinal canal, from which this kind of meningitis usually starts. It may, however, arise when there has been no wound, either from septic poisoning, or some ill condition of the patient causing suppuration at the seat of injury, in connection, it, may be, with some inflamed intervertebral joint. Suppuration spreads to the spinal canal, and lights up an *acute meningitis* which may speedily be fatal; and after death the spinal membranes are found bathed in pus, and here and there, perhaps, the cord itself is softened and inflamed.

Subacute or chronic meningitis runs no such violent course, but is most insidious, both in its origin and progress. Although extremely rare, it is nevertheless a result to be feared when the sprain has been severe, and especially in the flexible cervical spine. From laceration or rupture of an intervertebral ligament, one of the ligamenta subflava for example, there starts an inflammation which may spread inward, until inflammatory lymph is poured out upon the spinal membranes, gluing them together, and by pressure implicating either the spinal nerves or the spinal cord. There is thus developed a *local meningitis*, which of itself causes, perhaps, no symptoms, and has never been suspected until some nervous structures have become involved, when the real

mischief has then been done. Persistent local pain and local tenderness, increased by pressure or movement, more especially in the cervical region, should always arouse a suspicion of the existence of some deep-seated inflammatory mischief, and enjoin the necessity of absolute rest.

When the meningitis ("pachymeningitis," as it has been termed) has involved nervous elements, cord or nerve roots, other signs and symptoms help to make the diagnosis certain. We now find, in varying proportion and degree, interference with motion and sensation in the regions supplied by individual nerves, wasting of muscles, peripheral pains, and other evidences of nerve disturbance.

Treatment is in such cases far from satisfactory. Counter-irritation should be used, either by repeated blisters to the spine, or by seton; and the persistent administration of mercury and iodide of potassium should not be withheld, even in cases where no syphilitic element is present.

Intra-spinal hemorrhage is a yet rarer result than the foregoing of any violent twist or wrench of the spine, and is due to some vessel giving way within the spinal canal. The quantity of extravasated blood may be very large, and give rise to symptoms which are dependent on pressure upon the spinal cord. Paralysis may be complete of all the parts below the blood level, which, as it rises in the canal, may speedily cause death from interference with respiration. Intra-spinal hemorrhage may also result from falls on the buttock, or from severe blows on the spine; but from any cause it is extremely rare, unless accompanied with other injuries to the spinal column, such as fracture-dislocation.

Symptoms.—It may be difficult to say whether the symptoms are really due to hemorrhage or to some more immediate damage to the cord; but in the latter case the paraplegia is commonly instantaneous, while from hemorrhage the symptoms may begin to show themselves only after lapse of time, or they may steadily increase as the blood is being poured out in the canal. Should the blood be small in quantity and low down in the canal, there may be few symptoms, and there is hope of its complete absorption and of ultimate recovery; but there is also a risk of inflammatory mischief, and the development of symptoms which

are due either to the pressure of unabsorbed clot, or of subacute meningitis.

Treatment.—Ice must be applied to the spine, while the patient is kept at perfect rest on his face, and ergot or gallic acid should be administered. In the later stages we must follow the same line of treatment as in subacute meningitis. It is, however, but little amenable to treatment, both in its actual progress and in the after-consequences which may ensue.

A very rare result of violent and extreme bend of the spine is hemorrhage into the substance of the cord itself, with such symptoms as must necessarily follow its partial or complete destruction at the seat of lesion.

Fractures and Dislocations.—Injuries of this nature are most commonly caused by indirect violence, whereby the spinal column has been bent beyond the limits of its elasticity and the strength of the ligaments which hold its segments together. Parts of the spine, however, as of the vertebral arches, may be broken by the direct violence of a severe blow. Thus, one or more spinous processes may be detached, and the diagnosis is made by the mobility and crepitus which can be easily elicited. When the line of fracture is more deeply seated, and runs through the laminæ or pedicles, for instance, these usual signs may be more obscure. Any such deep-seated fracture entails the additional risk of being associated with intra-spinal hemorrhage, and of inflammation arising in close proximity to the spinal canal. The precaution, therefore, should never be neglected, after all severe blows on the spine itself, of acting as if fracture had unquestionably occurred, and keeping both the patient and the parts at absolute rest, so that repair may take place with a minimum of inflammatory action. Persistent pain in the region of one or more vertebræ increased by manipulation, and pain or hyperæsthesia in the periphery of one or more nerves emanating from the neighborhood of the injury, should excite the suspicion of fracture. Should paraplegic or other symptoms of nerve disturbance be met with soon or late as the result of a severe blow on the spine, the symptoms are probably due to intra-spinal hemorrhage or to the pressure of inflammatory lymph. It is not common for the spinal cord itself to be affected in such accidents, although it has sometimes been found contused

when the blow has been caused by a bullet or shell striking the spine with the momentum of a great velocity.

Fracture-dislocation.—In fractures and dislocations from indirect violence the cord is almost invariably injured, crushed by the displaced vertebræ, or torn by the sudden and excessive stretching or bend. Among this class of injuries, the commonest by far are those in which fracture and dislocation are combined; but the exact nature of the lesion depends more upon the region in which it occurs than upon the mode of accident.

The smallness of the cervical vertebræ, their horizontal position, and the extreme flexibility of this region render uncomplicated dislocation most frequent in the neck, although examples of it have been met with lower down.

Below the neck, however, the "broken back" is usually a "fracture-dislocation," from the fact that a greater violence is necessary to cause the injury, and that the vertebræ are not so readily separated from each other. This has an important bearing on prognosis and treatment, for in cases of pure dislocation the cord is somewhat less likely to be irreparably crushed, or, at any rate, lacerated, such injuries as it receives being, perhaps, from simple pressure alone. If, therefore, we can succeed in reducing the displacement in the rare cases where the displacement has not undergone spontaneous reduction, the cord may be thereby liberated, the paralysis from pressure on it may disappear, and the risk of destructive inflammation spreading in its substance may be lessened. And although the efforts to reduce a displacement lower than the neck, where probably fracture and dislocation are combined, are not so likely to be successful, it may be well to make the effort, that the cord may have a better chance of repair, should it happen that it has not been crushed to a pulp by the displaced vertebræ.

Signs.—In every region deformity is a sign of displacement; but in the neck, in addition to increased mobility, and the existence of a gap between spinous processes, there may be distinct projection in the pharynx, and the patient may experience difficulty in swallowing. Leaving, then, for a time, the nature of the injuries in special regions, and acknowledging that there may be infinite variety of lesions in different parts, there are cer-

tain characteristics more or less common to all cases where the "back" has been "broken" by indirect violence or inordinate bend. The intervertebral substance is more or less torn and separated from the bone, and the vertebra, which is the upper one at the site of dislocation, rides forward on that which is below it, and carries with it all the parts above, never being separated at the same time from both its fellows. Moreover, one or both of the articular processes may be dislocated, and a line of fracture may run through the vertebral arch. Ligaments are more or less injured, lacerated, or completely ruptured; and in the lower part of the column, in the lower dorsal region, for example, where fracture-dislocation is most common, it is not unusual to find that, in the extreme forward bending of the spine, a portion of the body of the vertebra immediately below the point of separation is broken off obliquely from above downward and forward. The deformity thus induced may be permanent and irreducible; but in the upper parts of the spine, where the segments are small, it is by no means uncommon for the dislocated parts to return to their natural positions instantly after the accident. Whether the dislocation has been momentary or remains permanent, the cord is crushed at the moment of the accident.

Injury to the cord is, then, the source of chiefest danger in all cases of broken back, for inflammation is prone to spread from the seat of lesion, and gradually involve the centers of respiration, and cause death by asphyxia. The higher the lesion, therefore, the sooner is death imminent from spreading myelitis, and if we can liberate the cord by reduction of displacement, we may perhaps remove one cause, at any rate, of continuing injury to it, and give thereby some better chance of life. Of no case, however, is it possible to think hopefully. We are in the presence of an injury which is almost inevitably fatal sooner or later, and the best we can do is, by good nursing, to make life comfortable and free from suffering as long as it lasts. The proposal made to trephine the spine, so as to relieve the cord from pressure, has met with no success, and has made no footing in surgery. Trephining the spine has no analogy whatever to trephining the skull,

Symptoms due to injury of the cord.—

Paraplegia, or paralysis of motion and sensation, is commonly complete, and is of all parts below the seat of lesion. It may, however, be of lesser extent, and incomplete, and often motion is more affected than sensation. The limit of cutaneous insensibility is usually well defined, and may be mapped out with accurate precision, and the boundary between sensibility and insensibility may sometimes be hyperæsthetic, a phenomenon probably due to the nerve-trunks being involved in inflammation, and so irritated at the site of lesion. As myelitis spreads up the cord, so the line of insensibility gradually rises higher.

When there is no deformity the site of lesion has to be determined by the level of the paralysis; and then it must be borne in mind that the nerve cords run with a gradually increasing obliquity downward in the spinal canal; that in the cervical region, with the exception of the eighth, the nerves are named from the vertebra above which they issue, while below this region they are named from the vertebra below which they come out of the column. A nerve, in fact, comes off from the cord considerably higher than its name might imply. The cord, moreover, is most commonly injured at or about the lowest part of the displacement, that is, at the part where the upper or dislocated vertebra rides forward on the vertebra below it.

Speaking broadly, the higher the lesion the greater is the immediate danger, while above the origin of the phrenics, which issue above the fourth cervical vertebra, death is usually instantaneous, unless the cord has not been entirely destroyed.

When the fracture-dislocation is below the second lumbar vertebra the paralysis may be very irregular in its distribution, or there may be none at all, because the cords of the cauda equina are less liable to injury than the spinal marrow itself. In any region the cord may be only partially crushed, and recovery is then more likely to ensue, with more or less of permanent paralysis.

In the upper dorsal region paralysis may seriously interfere with thoracic breathing, which, according to the level of the lesion, will be more and more embarrassed, until there is nothing left but diaphragmatic respiration. The diagnosis of this kind of breathing is not dif-

ficult. The chest walls are not motionless, as might have been expected, but they sink from atmospheric pressure when the diaphragm descends, and rise somewhat suddenly again to their previous position when the diaphragm is once more relaxed. The chest cavity is, therefore, made small by collapse of the thoracic walls just when descent of the diaphragm is compelling the entry of air; extra work is thus thrown on the diaphragm, and the breathing becomes more labored, for hypostatic congestion of the lungs soon arises. The *alæ nasi* work vigorously, the patient is obliged to breathe through his mouth, and his distress is added to by dryness of the throat and tongue.

Paralysis of the bladder is usually complete in all cases of fracture-dislocation when complete paraplegia indicates the severity of the cord lesion. Retention of urine is commonly the first symptom of it, and when the bladder has become full of urine, it runs over and dribbles away. In the course of a few days, perhaps, and more especially after injury to the cauda equina alone, the bladder may gain a certain amount of tone. The normal act of micturition is probably under the control of special centers in the cord, reaching from the level of the second to that of the fifth sacral nerves, some centers being connected with the sphincter vesicæ, others with the detrusor urinæ; and although, in paralysis after injuries, the action of both these muscles is commonly annihilated, it is conceivable that one may be affected while the other remains intact. Thus, for example, the bladder itself might be paralyzed while the sphincter remained normal, and the reflex act whereby the sphincter relaxes in micturition being abolished, the bladder might fill until it burst.

It is often impossible to say what is the precise nature of the paralysis, and the state of the bladder must, therefore, from the first engage the surgeon's attention. A serious matter in these cases is the fact that the urine frequently becomes alkaline and purulent, and presents all those features which, together, are characteristic of *cystitis*. This change in the urine may appear in the course of a few days, and is probably due, in some measure, to the outbreak of lesions in some part of the urinary tract, kidney, ureter, or bladder, of the nature

of those "trophic" lesions which have yet to be spoken of under the name of bed-sores, and to the urine being contaminated with the products of sloughing inflammation.

Cystitis and its symptoms may arise even when no catheter has been used, so that the view which attributes it to the introduction of septic matter into the bladder is not always tenable. In some cases it is doubtless due to the bladder being imperfectly emptied. It is a most difficult thing for some persons to empty their bladders, or even to micturate at all in the recumbent posture, and cystitis of a mild degree may arise from this cause even in persons who have no real paralysis. Cystitis may become a source of danger by setting up or aggravating inflammation in the urinary passages, and in chronic cases may cause death by exhaustion or by the formation of "surgical kidney." The treatment does not differ from that which is suitable for cystitis in other cases, and no catheter should be used which is not scrupulously clean.

Paralysis of the bowel.—Closely allied in its physiological nature to the act of micturition is that of defecation, which also may be variously affected after fracture-dislocations. The immediate effects depend, to a large extent, on the contents of the rectum at the time of the accident. If full, involuntary evacuation will soon take place; while, if empty, defecation may not be until the rectum has become full. Hence the involuntary act of defecation takes place only every now and then. Constipation is very common. Continuous "incontinence" is, indeed, very rare unless the motions are extremely loose. Occasional involuntary evacuation is the usual rule; but sometimes the patient acquires the power of telling when his rectum is being loaded, and the baneful consequences of involuntary and unexpected discharge may be thus avoided.

When the cord lesion is high up, additional distress may be caused by tympanitis, collection of flatus being favored by arrest or diminution of the natural peristalsis of the intestines. This, also, not only adds to the constipation, but may even interfere with the already embarrassed respiration, and call for relief by the use of enemata containing some antispasmodic, such as asafetida or turpen-

tine. The tympanitis may also be relieved by the passage of a long tube into the sigmoid flexure. Aspiration of the gut in such cases is not devoid of risk.

Priapism, from vascular turgescence of the penis, is a common result of injuries of the cord, and is due, in all probability, either to passive distention of vessels from vasomotor palsy, or to irritation of special centers, the exact seat of which has not been determined. The state of semi-erection is most marked during the few days which follow the accident, while at a later period it may only be induced by some local irritation, such as passing a catheter. Most commonly met with after cervical and dorsal injuries, it has in rare instances been seen after fracture-dislocation still lower down. Its import is uncertain, and it is neither influenced by nor demands treatment.

Disturbances of temperature are sometimes very striking in cases of fracture-dislocation, especially when the cord injury is in the cervical region. When the fall incidental to collapse has passed away, there follows in some instances a very high range, the thermometer rising to 107°, 108°, or even 110° F. The cause of this hyperpyrexia is by no means clear, but from recent physiological observations, which have been strikingly confirmed by the results of recent injuries or lesions, it seems probable that the heat production which ordinarily goes on in the body tissues is no longer restrained by supposed true calorific centers, having their seat in the cerebral cortex of each hemisphere near the fissure of Rolando, and having crossed action. A lesion may cut off this inhibitory action of one or both centers; and it is obvious that this result is most likely to ensue when the injury is high up, as in the cervical region when the cord is wholly crushed, and when a larger area of the thermogenetic tissues is thus severed from the inhibitory centers in the brain. Sometimes, also, in cases of cervical injury, the pulse becomes extremely slow, deliberate, and full. The precise seat of the lesions causing these phenomena has yet to be determined.

Of far greater importance is the occurrence of *bed-sores*, to the prevention of which the surgeon must devote his earliest care. In all probability there are two kinds of bed-sores. Some appear at

points of pressure alone, such as the sacrum and great trochanters, and originate only after pressure has been long continued or unrelieved. They do not differ from pressure sores in other cases, but it is more difficult to prevent them, because the paralyzed and helpless patient cannot gain relief by voluntary change of posture. The tendency to their formation may, however, be largely diminished by placing the patient at the earliest moment on a water or spring bed; and by the use of ring cushions, stuffed with horse-hair or cotton-wool, we may insure that such pressure as is unavoidable may be widely diffused instead of bearing on one small point. The skin, moreover, may be protected with plaster, or hardened by bathing it with spirit lotion, and all contact with urine or fæces must be prevented. Bed-sores of the other variety run a more rapid and violent course, and cause extensive destruction of tissue. These also are found most commonly at sites of pressure, but not invariably so, and they may have a destructive rapidity which seems out of all proportion to any pressure which can have been exerted. Sometimes they appear within a day or two of the accident; and from all their characteristics it seems highly probable that they are really the result, directly or indirectly, of some "trophic" disturbance; either due to inflammation of the cord, or through the intermediate influence of a peripheral neuritis which has arisen as the result, in some as yet unexplained manner, of the myelitis. To such bed-sores the name "*decubitus acutus*" and "*decubitus ominosus*" has been given, and more recently that of "*neuropathic eschars*." While ever of greatest import, it sometimes happens that the destructive process is arrested, the sloughs become detached, and healing may ensue. In both kind of sores the detachment of slough may be hastened by linseed or charcoal poultices, and, when granulations have been formed, the ulcer may be dressed with stimulant ointment or lotion, pressure being as much as possible avoided.

Alteration in the reflexes is a common sequence of fracture-dislocation, and the phenomena vary according to the site of the cord lesion. When situated in the dorso-lumbar region, the knee-jerk, for example, may be abolished and may remain so; but it often happens in the

course of a few days, as myelitis sets in, that the reflexes become exaggerated, and a sensory stimulus, such as tickling the feet, or the movement of the bedclothes, may, unknown to the patient, cause spasmodic movements of the legs, which are most distressing and interfere with perfect rest. The character of the reflexes, both superficial and deep, may give, in both recent and chronic cases, most valuable information as to the site and extent of the cord lesion.

Fracture-dislocation in the cervical region.—Separations between occiput and atlas are most uncommon, for the range of movement between them is limited, and the ligaments are strong. The most frequent injury in this part, from falls upon the head whereby the upper spine is violently bent, is separation of the atlas and axis, the first vertebra riding forward on the second, and causing instant death from crush of the cord against the odontoid process. The odontoid is itself sometimes broken off, and one or both of the check, or other ligaments, give way; but, notwithstanding that death is usually instantaneous, there have been cases where the odontoid has become ankylosed in a new position, and recovery has taken place with permanent narrowing of the spinal canal.

Separations between the second and third vertebræ are usually associated with fracture.

Below the third cervical we enter the region where pure dislocations are more common from falls upon the head and neck.

Symptoms.—The cord is usually crushed in its entire thickness, and life is rarely prolonged for more than two or three days, thoracic respiration being annulled, and diaphragmatic alone left. The phrenics come out above the fourth vertebra, and may escape injury even when the separation is at this level, but myelitis will speedily put an end to the integrity of their centers. Below this point, as far as the second dorsal, it is necessary to remember the origin of the cords of the brachial plexus, and the distribution of its branches, in making a diagnosis as to the exact seat of lesion, and that the descending branches of the cervical plexus may allow of perfect cutaneous sensibility in parts much below the level of the destruction of the cord. In partial lesions, when the an-

terior cornua are alone involved, movements may be paralyzed according to physiological rather than anatomical connections. Extension, for example, may be paralyzed, while flexion remains intact, because the correlated muscles, which cause a particular action of a limb, are grouped together in the spinal ganglionic cells.

Injuries to the cord in the lower cervical and upper dorsal region may cause *paralytic myosis*, in which the pupils are unable to dilate because of palsy of the dilator fibers of the iris supplied by the sympathetic, which has an intimate connection with this, the "oculo-pupillary" region of the cord. The myosis is most marked when unilateral, but in any case it is necessary to examine the eyes both in light and shade in order to recognize it.

Fracture-dislocation in the dorsal and lumbar regions.—From the second dorsal vertebra downward, fracture-dislocations are far more common than dislocations alone, and, as a rule, the cord is irreparably damaged. In fractures below the eleventh dorsal the prognosis is more favorable, for the size and strength of the vertebræ in this region render complete dislocation more difficult, and the cord escapes total destruction. Below the second lumbar the cords of the cauda equina are less liable to injury than the spinal cord itself.

Paralysis may from the first be incomplete, and there may be considerable return of motion and sensation, and of control over bowel and bladder. Cystitis and bed-sores are the chief risks to which the patient is exposed. Deformity is likely to be permanent, and when repair is taking place the application of a Sayre's jacket may give comfort by insuring rest and fixation of the spine.

Injury to the sacro-coccygeal joint.—The sacro-coccygeal joint may become the seat of disease from injury, and any movement of it, as in defecation, or in excessive action of the gluteus maximus, which has attachment to the coccyx, may give rise to pain. There may also be local heat and swelling. These symptoms and signs are of importance in diagnosis, because "coccygodynia," or neuralgic pain, is a not uncommon affection, especially among neurotic women. Rest is essential in the one case; it probably has little influence in the other,

and attention should be rather directed to the pelvic viscera, uterus, and ovaries.

Unilateral dislocations of the spine are not uncommon in the neck, from violent bend or even extreme rotation. Here two articular processes are separated from each other, and the inferior comes to ride in front of the superior, the head is turned and fixed toward the opposite side, local deformity may be felt if the neck is thin, and either by some impairment of motion and sensation, or by pain and tingling in the periphery, there may be evidence that the nerve which issues from the spine at the site of injury is being irritated by stretching or pressure. Reduction should be effected at once by extension of the neck, so as to disengage the processes, and turning the head into its right position. Rest must be enforced for some time afterward, and the prognosis is favorable unless there be fracture also, or the cord has been itself damaged.

Concussion of the spinal cord.—This term ought to be restricted to those cases in which an injury has been inflicted on the cord from blows upon the spine, similar and analogous to the effects produced on the brain by blows on the skull. In the case of the head it is well recognized that severe concussion blows upon it may cause contusion of the brain substance both near the site of the blow and at opposite parts from *contre-coup*, and in addition certain effects which are commonly those of collapse from the shock or concussion of the whole brain mass. Although brain and spinal cord are merely different parts of one system, their physical surroundings are yet so different that that which is a common injury in the case of the brain is extremely rare in the case of the spinal cord. There are, indeed, very few cases on record in which it is possible to say that the cord has been locally injured, stunned, or contused by concussion only; and careful examination of many which have been so recorded shows that sufficient attention has not been paid to the effects of direct contusion from displaced vertebræ, of hemorrhage around the cord, or of hemorrhage into and laceration of its substance from violent sudden bend.

Given, however, a case in which the cord has been locally concussed or contused, the resultant symptoms are the same as are met with from local injury due to other causes; and they would

doubtless be the same if the injury merely consisted in local stunning, for a time, that is, until the effects of the concussion or stunning had passed away. Nevertheless, it is extremely doubtful whether this latter condition ever follows local injury.

Railway spine.—It has been thought by some that the severe nervous disturbances which are seen after railway collisions are due to concussion of the spinal cord, but there is no evidence that the spinal cord is any more affected than are other organs of the body by the severe shock of such accidents; and, although it is conceivable that prolonged functional disturbances thus originated may end in structural degeneration, such a result is very rare, and occurs, perhaps, in those only who, by various causes, are predisposed to the outbreak of nervous disease. It must not be forgotten that concussion of the brain is often caused in railway accidents, and many of the after-symptoms of neurasthenia are rather due thereto than to injury to other parts of the nervous system. It has, indeed, been suggested that the term "railway brain" is more appropriate than "railway spine."

Concussion injuries of the spine, much more analogous to concussion injuries of the brain, are sometimes met with in connection with gunshot wound, where the great momentum of a bullet upon the spine may cause contusion of the cord without opening the spinal canal. The term, also, is applicable to cases where many minute lesions, giving rise to immediate paralytic symptoms, have been caused by a fall from a height flat upon the back.

HERBERT W. PAGE.

Symptomatic Indications.—*Arnica* is the most generally useful remedy, to be followed by *hypericum*, if *arnica* alone is not sufficient.

SPLEEN, DISEASES OF.—The spleen is very seldom the seat of primary disease. But little is known of its being acutely inflamed or the seat of suppuration; except in regard to the condition of acute swelling, to which it is liable in certain infectious diseases, as typhoid, acute tuberculosis, or pyæmia. But, obviously, in such cases, the spleen is affected only secondarily. It is almost unknown for new growths to originate in this organ, and, with the exception of

splenic leucocythæmia, there is hardly any condition in which it can be said to be primarily affected. A few only of the more common lesions need be here referred to.

Chronic Venous Congestion.—This condition results from long-standing cardiac disease or obstructed portal circulation, as in cirrhosis of the liver. It is sometimes characterized by enlargement, and always by induration of the organ. In those cases in which the spleen is not enlarged, there is generally great thickening of the capsule (perisplenitis), which may explain the lack of increased size. The induration is due to great fibroid thickening of the trabeculæ. The organ is full of blood, and has a dark color on section. Beyond its palpability, and an increased area of dullness, there are no signs of the condition during life.

Hemorrhagic Infarction occurs frequently in cases of chronic heart disease, the source of embolism being either valvular vegetations or thrombi in the left cavities of the heart. A recent infarction is wedge-shaped, the base of the wedge being beneath the capsule, where it bulges prominently above the rest of the surface of the organ, the apex being directed toward the center. The infarct has a deep red color, and is sharply demarcated from the splenic tissue on section both by its color and also by its consistence, which is firm and solid. The appearance has been aptly compared to that of damson cheese. Careful examination of the branches of the splenic artery will show that the branch supplying the affected area is occluded by a clot, and Cohnheim's explanation of the hemorrhage is that the splenic arteries being "terminal," the territory cut off from its normal arterial supply is engorged with blood which flows back into it from the veins (*see also* EMBOLISM). Later the wedge-shaped area becomes decolorized, of a canary-yellow color, and transformed into granular and fatty detritus with blood pigment; but how long a time must elapse before an infarct undergoes this change is quite undetermined. Later still, it shrinks in bulk and becomes surrounded by a more or less dense and pigmented investment of connective tissue, so that little but a depressed tough cicatrix remains at the site of the original infarct. It is not unusual to find these

lesions in all stages in the same spleen or in the advanced stage only, where they remain as prominent indications of previous blockage of the splenic arteries. Such infarcts do not tend to soften; but if the embolus be derived from a septic source, as in pyæmia or ulcerative endocarditis, *abscesses* will result. In the case of ulcerative endocarditis the infarcts are usually minute, represented in the early stage by scattered hemorrhagic foci, and soon breaking down into minute (miliary) abscesses.

Symptoms.—The occurrence of splenic embolism may be suspected when, in the course of heart disease, the patient suddenly experiences pain in the splenic region, and there is (especially in ulcerative endocarditis) also a rigor and a sudden rise of temperature concurrently with the pain. The organ, if possible, is tender on pressure, and sometimes a friction sound can be heard the following day on auscultation in the lower auxiliary region.

Albuminoid or Waxy Disease.—This condition of the spleen is met with in two forms—one in which the degeneration is mainly limited to the Malpighian bodies (sago-spleen), and the other in which these structures are atrophied and fibrous, and the change involves the walls of the sinuses and blood vessels (diffuse waxy spleen). In the former condition the organ is generally enlarged, and on section presents a number of closely aggregated translucent or glistening areas which correspond to the swollen waxy Malpighian bodies. In the latter the whole organ is increased in consistence, and has a glittering appearance. The “sago” condition is the more common.

The *diagnosis* of albuminoid disease of the spleen is made when, in a chronic suppurative disease, or in a syphilitic subject, the organ is found to be enlarged, its margin firm and rounded, and there is, in addition, enlargement of the liver and albuminuria. At the same time, the degeneration may be more advanced in one organ than in another, and it is not invariably the rule for liver, kidney, and spleen to be all affected.

There is a condition met with in rickets and infantile syphilis which leads to enlargement of the spleen, to which the name of “albuminoid” degeneration is sometimes given. It is not the same

change as that above described, and by some it is regarded as a mere hypertrophy of the organ.

Enlargement of the Spleen.—Apart from the above-named conditions, enlargement of the spleen occurs more or less acutely in most infectious fevers, especially when the pyrexia is high. The organ is markedly involved in typhoid fever, in which disease it may attain considerable size. In all febrile states the swollen spleen is softer than natural, pale, or sometimes engorged. The spleen is also characteristically enlarged in malarial fever, in leucocythæmia, and in Hodgkin's disease.

The clinical evidences of splenic enlargement are: (1) An increase in the normal area of dullness; (2) the detection, by palpation, of the lower and anterior margin of the organ, the “notch” in the latter being sometimes readily felt; (3) the direction taken by the enlarging organ, viz., downward and forward, in front of the intestines; (4) its mobility with the movements of the diaphragm.

A *diagnosis* has to be made from displacement of the spleen, as in left-sided pleuritic effusion of pneumothorax, and from a tumor of the left kidney, which may come into contact with the spleen. In the former case the presence of the thoracic disease is readily determined, and in the latter the relations of the renal tumor to the colon (which is pushed forward in front of it), as well as the existence of urinary symptoms and hæmaturia, may aid in their differentiation, which is, however, in some cases difficult.

Tubercular Disease occurs only as a part of a general tuberculosis, and in two forms: (1) Miliary gray granulations, which may thickly stud the parenchyma, and also be met with on the capsule; (2) large yellow granulations of the size of peas, firm and caseous.

Syphilitic Gummata are occasionally observed, mostly as masses of caseous or semi-calcified substances with dense fibrous investment, and often associated with considerable thickening of the capsule.

Secondary Malignant Growths (sarcoma and carcinoma) are also occasionally found in cases of malignant disease, but the spleen is not a usual site for them. In Hodgkin's disease the enlarged organ is the seat of nodules of lymphatic new growth.

Symptomatic Indications.—*Cinchona* is the most generally useful remedy for splenic enlargement, particularly when malarial. *Mercurius biniod.* is valuable in chronic hypertrophy. *Aconite* is useful for pain, "splenic stitches," induced by undue exertion. *Bryonia*, when the capsule of the gland is inflamed. *Ferrum*, for inflammation of the glandular structure.

SPLEEN, EXTIRPATION OF THE.—*The cases most suitable for splenectomy or splenotomy* are those in which the spleen is involved in an injury, and the gland is, it may be, protruding through the abdominal wound.

When splenectomy is performed for disease, floating spleen, simple hypertrophy, and enlargement from malaria give the best results.

For leucocythæmia, splenectomy should not be performed.

Mode of performing the operation.—An incision varying in length from two to ten inches, according to the size of the injured or diseased organ, is made downward in a line extending from the left eighth rib along the linea semilunaris. All parietal hemorrhage having been stopped, and the peritoneum opened, the omentum, which will probably be found lying over part of the spleen, must be pushed on one side, and if the operator's hand encounter any adhesions, they must be broken through with the same care to prevent hemorrhage as in ovariectomy, clamping and ligaturing as their separation is proceeded with. The organ is then to be raised out of the abdominal cavity, lifting generally the lower end out first, and taking care not to lacerate the soft capsule and parenchyma, which is so liable to bleed freely.

The spleen having been withdrawn, a clamp should be fixed upon the pedicle and the mass cut away. The pedicle should be ligatured in two or more parts with strong twisted silk or whipcord; the clamp removed and the ligatures cut short and dropped back into the abdomen. All blood should be removed from the abdominal cavity by antiseptic sponges. The intestines must not be allowed to protrude at the wound. The external wound is then to be closed with interrupted sutures, as after ovariectomy; and the wound should be dressed with some light antiseptic material. The ab-

domen should be supported by a flannel roller. After the operation, the patient must lie on his back with the knees slightly raised on a pillow; and the urine should be drawn off every five or six hours. The dieting should be the same as after other abdominal operations.

Dangers of the operation.—Hemorrhage may occur from a large vessel in the omentum at a spot where it is adherent, or from rupture of some large vessel, as the splenic vein. Part of the pancreas may be included in the clamp if care be not used. Severe disturbance of the sympathetic nervous system is sometimes witnessed, as is also persistent vomiting.

STERCORACEOUS is a term used in reference to vomited matters which possess a fecal odor and appearance. A condition met with in the course of intestinal obstruction and strangulated hernia. See also **ULCERATIVE COLLITIS AND ENTERITIS**, E. Stercoral Ulcers.

STERILITY.—This may be either absolute or relative. Absolute sterility means that the patient does not become pregnant at all, or, if she become pregnant, miscarries so early that the pregnancy cannot be recognized. Relative sterility means that the patient does not produce as many healthy children during the time she lives in wedlock as women upon the average do. Both kinds of sterility are produced by causes of the same kind, and the causes which in many women produce absolute or relative sterility, in others produce pregnancy resulting in abortions, monsters, plural births, and idiots.

The cause of sterility in a female may be either local or constitutional. The latter are the more common, but the former are the better understood, and more often remediable. Among the constitutional causes are deprivation of health from any causes, especially such as produce amenorrhea. These probably act by preventing the proper formation of the uterine decidua, to which the impregnated ovum should become attached, and so retained *in utero*. The ill-understood condition of health which is attended by the excessive production of fat often causes sterility. Habitual alcoholic excess (not necessarily to the point of drunkenness) may produce it. Marriage

at an unsuitable age is probably the commonest of all causes of sterility. The marriages which most often result in the production of healthy offspring are those which take place when the wife is aged between twenty and twenty-five. Before that age the wife is more likely to be sterile than at that age; and, after twenty-five, the likelihood of her proving sterile increases with age, especially after thirty. A woman may be still menstruating and yet have lost fecundity. Too close intermarriage of families often results in sterility. In some instances a tendency to sterility seems to be inherited, as in the frequent sterility of heiresses. Among the local causes, the commonest, and the one most often curable, is spasmodic dysmenorrhea (*see* DYSMENORRHEA). Barrenness may be due to absence of the uterus, or to deficient development or atrophy of the uterus and ovaries. We can only detect smallness of the uterus, for there is no method of examination fine enough to reveal the condition of the ovaries as to development. But as pregnancy may take place in an undeveloped uterine horn, it is probable that in a woman with a small uterus who is sterile, the ovaries share in the imperfect development of the sexual organs. In such cases the stimulus of marriage may sometimes bring about slow development of the generative organs, but this is rare. Disease of the uterus, such as fibroids, cancer of the body, or diseases of the fallopian tubes, causing them to be blocked, may cause sterility. Excessive sexual intercourse may produce sterility, as is seen in the infrequent pregnancies of prostitutes. This possibly acts by producing a monthly miscarriage. Cervical endometritis has been stated to cause sterility, but there is abundant evidence to the contrary. Endometritis of the body of the uterus has been with more reason credited with sterility as its effect, but we have no exact knowledge as to the forms of this disease which cause sterility. Uterine displacements have had sterility attributed to them, but no evidence has ever been adduced to show that this is so in the smallest degree, and there is no doubt that pregnancy may take place with any displacement except inversion.

Statistics prove that until a patient has been married for three years without pregnancy, there is still a probability of offspring, which seems to show that there

are some causes of sterility existing at the time of marriage which are capable of natural cure. It must be remembered, in the investigation of any case of sterility, that the cause may be in the husband, and not in the wife. As this is so in a large proportion of cases, no treatment of a woman of a dangerous or protracted character should be undertaken on account of sterility, until inquiries have been made on this point. Lastly, sterility in a given couple may not be due to any disease either in husband or wife, but simply to an incompatibility (the nature of which we do not understand) between the germ cell and the sperm cell; for, occasionally, instances are met with in which a woman is sterile in marriage with a man who has had children by another wife, and herself is fertile when married to another husband.

G. E. HERMAN.

Symptomatic Indications.—*Aurum mur.* has been successful when due to ovarian torpor; also in chronic metritis; amenorrhea. *Iodium* is sometimes useful in persons of strumous diathesis; *cinicifuga* is valuable when due to congestion of the cervix, with deficient nervous energy. *Borax* and *pulsatilla* have also relieved.

STERTOR ; STERTOROUS.—The noisy breathing of a person in a state of coma.

It is due to a paralytic condition of the muscles of the lips, cheeks, tongue, fauces, and soft palate, the latter becoming a flaccid curtain, moving to and fro with respiration, a similar movement being often seen in the lips and cheeks. The tongue falls toward the posterior wall of the pharynx, mucus collects within the mouth and becomes frothy by admixture with the tidal air, the result being a snoring noise, in the production of which all the above mentioned conditions have some share.

STOMACH, CANCER OF.—Cancer of the stomach is, as a rule, primary; but the disease may extend to the stomach from other organs. The epithelial, the encephaloid, the colloid, and the scirrhus varieties of cancer all occur in the stomach, the last being the most common. Any part may be affected, but the pylorus is the most frequent seat. The growth may infiltrate or be localized, it may form

tumors or ulcerate, and may extend from the stomach to other organs.

Symptoms.—When the cancer is not pyloric, the symptoms are somewhat similar to those of gastric ulcer (*vide infra*), but hemorrhage is more frequent, and usually occurs in small amounts at a time. Cachexia and wasting are marked from an early period. The bowels are usually confined. Sarcinæ and torulæ may be found in the vomita, which will also present the appearance known as "coffee ground," when there is bleeding from the surface of the growth. In pyloric cases the symptoms agree with those described under PYLORUS, OBSTRUCTION OF.

The *physical signs* vary according to the seat and extent of the growth. Local tenderness is usually present, but is less acute than in cases of ulcer. A sense of resistance may be felt over the gastric area, and when the growth is in front a distinct tumor can usually be detected. For the characteristics of a tumor of the stomach, see ABDOMINAL TUMORS.

Diagnosis.—Speaking generally, it may be said that, in the absence of a distinct tumor, it is rarely safe to come to a diagnosis of cancer of the stomach, so closely are the symptoms in some cases simulated by those of chronic ulcer. See ABDOMINAL TUMORS and HEMATEMESIS.

The *prognosis* is necessarily fatal. Death occurs from exhaustion, usually in about eighteen months from the commencement of the symptoms, rarely later than two years. The progress of the disease is most rapid, as a rule, in pyloric cases.

Treatment can only be palliative. The diet must be restricted until vomiting ceases and tolerance of food is obtained. If necessary, rectal alimentation must be resorted to and the stomach left at rest. Pain may be relieved by the same means as in gastric ulcer, and fermentation by those described under PYLORUS, OBSTRUCTION OF. Hot turpentine stupes, hot fomentations, etc., are at times useful in relieving the pain. In pyloric cases the operation of gastrostomy may be resorted to as a means of prolonging life.

ISAMBARD OWEN.

Symptomatic Indications.—The most generally useful remedy is *arsenicum*, which frequently relieves the pain, and mitigates the suffering; after *arsenicum*

phosphorus is next in value, often relieving.

STOMACH, DILATATION OF (Gastrectasis).—One of the chief causes of dilatation of the stomach is dealt with in the article on PYLORUS, OBSTRUCTION OF (*q. v.*), but this condition may also arise from muscular weakness, from habitual overdistention with food and drink, and from the excessive use of aerated waters. Rarely it occurs as an acute condition. Little or no hypertrophy of the muscular coat is found in these cases.

Symptoms.—The symptoms, generally speaking, resemble those of obstruction of the pylorus, but pain is either less severe or altogether absent. The vomita may contain bile as well as sarcinæ.

Physical Signs.—The characteristic signs of a dilated stomach are given in the article on ABDOMINAL TUMORS.

Prognosis.—This is favorable in fairly healthy constitutions, provided treatment be carefully persisted in.

Treatment.—This mainly consists in giving partial rest to the stomach, so that it may gradually recover its muscular tone. Three light meals should be taken each day at intervals of about five hours. Only bland and easily digested forms of food are admissible; they must be free from excess of starchy and fatty matters, and the quantity must be restricted according to the severity of the case. It is important that the patient should take at least an hour's rest in the recumbent posture after each meal. Alcoholic liquors and aerated waters are to be prohibited. Gas-formation should be checked by carbolic acid, etc., as described under obstruction of the pylorus. Other drugs are of little value, but tinct. nuc. vom., in 10–15 minim doses three times a day, may help to restore tone to the gastric wall.

The stomach may each day be washed clear of the mucus which tends to collect on its wall with warm water, either plain or with 5–10 grains of sod. bicarb., added to the fluid ounce. This is best done by employing a long stomach-tube, fitted with a funnel at the upper end, to fill the viscus, and emptying it by lowering the upper end of the tube into a basin. The tube then acts as a siphon. An antiseptic solution may be substituted for the plain or alkalized water.

The method of proceeding is more fully described in the article on PYLORUS, OBSTRUCTION OF.

ISAMBARD OWEN.

Symptomatic Indications.—*Nux vomica*, *cinchona*, *hydrastis*, are useful in restoring the tone of the stomach. Page's tablets, which combine these remedies in adjusted proportions, are very valuable.

STOMACH, INFLAMMATION OF (Acute Gastritis). See GASTRITIS.

STOMACH, ULCER OF (Gastric Ulcer).—Ulcers may occur on any part of the wall, but are most frequently met with on the posterior surface near to the lesser curvature, and to the pyloric end of the organ. The more *acute* forms are found chiefly in females from eighteen to thirty, the more *chronic* in men beyond middle age.

Symptoms.—The symptoms are, as a rule, well marked. Acute pain is complained of. It is referred generally to the epigastrium, but at times to the back, right or left hypochondrium, right or left flank, according to the position of the ulcer; it is speedily aggravated by food and generally relieved by vomiting. There is often tenderness over the epigastrium, and, if the ulcer be in front, the tender area may be narrowly localized. Vomiting is present from an early period. It occurs, as a rule, within two hours after taking food. Any of the symptoms described under DYSPEPSIA may be added; and the patient rapidly wastes. In about half the cases profuse hemorrhage occurs at rare intervals, the blood being vomited, or passed downward, or both.

Perforation, if it occur, is signaled by sudden severe pain in the abdomen, with collapse; followed by the symptoms and signs of peritonitis.

Diagnosis.—The diagnosis requires to be made from cancer of the stomach and the condition known as ANOREXIA NERVOSA (*q. v.*). As regards the former the reader is referred to the articles STOMACH, CANCER OF, and ABDOMINAL TUMORS, DIAGNOSIS OF.

Prognosis.—In the great majority of cases the ulcer heals, but it is liable to reopen at any subsequent period. Death may occur from perforation, hemorrhage, or exhaustion; or from obstruction of the pylorus by cicatrization. The liability to

perforation is much less in chronic gastric ulcer than in the acute form.

Pathology and Ætiology.—The origin of gastric ulcers is variously ascribed to injury, inflammation, spasm, thrombosis, and embolism of minute arteries, but we have no certain knowledge of their cause. They are usually single, and vary in size from a dime to a quarter of a dollar. The more acute forms have flat, clean-cut edges and smooth floors; the more chronic are thickened in both. They may be merely superficial, or may penetrate the deeper coats, or actually perforate. In the event of deep penetration, adhesions form between the seat of the ulcer and the neighboring viscera (*e. g.*, the pancreas), and these adhesions in most cases obviate the consequences of penetration. When deep, the ulcer is conical in shape.

Treatment.—This must be directed to protecting the ulcer as far as possible from irritation and to the relief of the pain and vomiting. At the same time the patient's strength must be supported. Absolute rest in bed is essential during the presence of any acute symptoms. The diet at the outset must be narrowly limited. It is best to commence with fluid food, milk, and plain broth, or one of the malted "infants' foods," given in quantities not exceeding $\frac{1}{2}$ pint at two or three hours' intervals. In severe cases, no food whatever should be given by the mouth for a period the duration of which will vary with the severity of the symptoms and the strength of the patient. During this time the patient must be supported by nutrient enemata and nutrient suppositories, one of which may be given alternately every four hours. Bism. subnitr. 10 grs. suspended in mucil. acac. $\frac{1}{2}$ dr. may be given every six hours, in order to form a protective coating to the ulcer; and liq., morph. bimec. 3-6 min. and ac. hydrocy. dil. 3-4 min. may be added to this to check the pain and vomiting; tr. belladonna 5-10 min. or tr. hyoscyami $\frac{1}{2}$ dr. may be substituted for the morphine.

At the same time portal congestion may be prevented by mild saline aperients,—*e. g.*, 20 grs. mag. carb. and 1 dr. mag. sulph., with $\frac{1}{2}$ dr. tr. hyoscyami, in 1 oz. of peppermint water, taken the first thing in the morning as required. Violent purgation should be avoided.

The amount and solidity of the food

may be cautiously increased as the pain and other symptoms subside.

Nitrate of silver ($\frac{1}{8}$ gr. doses) or oxide of silver ($\frac{1}{2}$ gr. doses) in pill may be substituted for the bismuth in the later stages.

The treatment of hematemesis will be found under that heading. For the treatment in case of perforation, followed by peritonitis, the article on the latter subject may be consulted.

ISAMBARD OWEN.

Symptomatic Indications.—The most generally useful remedy is *arsenicum* which allays pain and checks the vomiting. *Ipecacuanha* is useful when there is hemorrhage; bright-red blood; pale face; nausea; cough. *Hamamelis* when hemorrhage is venous: *cinchona* is useful for debility consequent on hemorrhage; feeble pulse.

STOMATITIS.—Inflammation of the interior of the mouth. Occurs under several forms, and great confusion has arisen in their classification. The most distinct varieties are:

1. **Catarrhal Stomatitis**, the mildest and most frequent form; produced by irritants, such as, in adults, tobacco-smoke, and in children sour milk; infants are specially liable to it, the mucous membrane being peculiarly vascular and delicate. This, which is sometimes termed "erythema neonatorum," varies much in intensity. In a well-marked case the mucous membrane is much swollen, indented by the teeth or gums, and easily made to bleed; the catarrhal area may be limited, as is often observed in association with dentition. The tongue is furred, the fur being detached in patches, leaving an intensely red surface. The symptoms are pain on sucking, or mastication, and salivation.

Ætiology.—Catarrhal stomatitis is generally present in coryza, whooping-cough, measles, scarlatina, and typhoid fever.

Treatment.—Simply the removal of the irritant and the use of a mild astringent lozenge (*e. g.*, tr. krameriæ) being, in the case of an adult, generally sufficient; in infants and young children, attention to the cleanliness of the bottle, or mammilla, careful cleansing of the mouth after each meal with a soft mop, and the occasional application of glycerine of borax, generally suffice.

2. **Ulcerative Stomatitis** most com-

monly supervenes as an extension or complication of catarrhal stomatitis. Small ulcers form at points where pressure is exerted by the teeth, or where the mucous membrane is liable to be torn, as at the junction of the lip and gum; in other cases where the catarrhal process is more intense, numerous ulcers rapidly appear, on the cheeks, between the lips and the teeth, under the tongue, and on the hard palate; in a third variety the ulceration starts about the teeth, generally the lower incisors, and spreads along the gums; it may involve the periosteum of the jaw, leading eventually to extensive necrosis and exfoliation of bone. The last two forms are infective, and both, but especially that which appears to start on the buccal mucous membrane rather than the gums, are frequently observed in several members of the same family. Copious salivation, great pain on movements of the mouth, and very fetid breath are the marked symptoms; there is commonly some pyrexia, and from the pain and indisposition to eat or drink, the disease is often accompanied by much prostration.

Treatment of mild cases, where there is a single ulcer or but few ulcers, consists in the local application of chlorate of potassium (wash or lozenge); in severe cases, small doses of the same drug should be given internally at frequent intervals, best in a mixture with decoction of cinchona. Locally, the liquor hydrarg. perchlor. B. P., or glycerin of borax, or chlorate of potassium should be applied frequently. Washes of nitrate of silver (one per cent.), permanganate of potassium, or sulphate of copper are also useful. In all cases, but especially where the ulceration has become chronic or relapses have occurred, the general condition of the patient must be attended to.

3. **Apthous Stomatitis**, see APHTHÆ.

4. **Stomatitis Mycosa**, see THRUSH.

5. **Gangrenous Stomatitis** or **Cancrum Oris**, see CANCRUM ORIS.

Various other forms of stomatitis, differing chiefly in their ætiology, are also recognized. Thus, *mercurial stomatitis* begins as a catarrhal inflammation of the gums, which quickly runs on to ulceration; the simultaneous effect of the metal on the salivary glands causes profuse salivation, which is very characteristic. Copper and phosphorus produce similar forms of stomatitis; the ulceration, if

neglected, may in time affect the bones. The mucous membrane of the mouth may become infected by diphtheria, and the disease has been known to commence in this situation. In syphilis there is a liability to catarrhal stomatitis in association with mucous tubercles; in hereditary syphilis a general catarrhal stomatitis, producing a red glazed condition, is an early symptom. The fissures of the lips, or rhagades, frequently extend into the mucous membrane of the mouth, which is then locally inflamed and infiltrated.

DAWSON WILLIAMS.

Symptomatic Indications.—*Mercurius* is the main remedy in most forms, particularly when attended with much salivation; swelling of glands. *Iris vers.* is useful in stomatitis, with much burning. *Phytolacca* in ulcerated sore mouth has done good service. *Eupatoreum*, in aphthous stomatitis in women. *Baptisia* in chronic sore mouth is often useful.

STRANGULATION.—In death from strangulation the fatal result is due to asphyxia brought about by compression of the air passages from without. Strangulation may be the result of an accident, and it is conceivable that a suicide may end his life in this way, but there is always a strong presumption in favor of homicide, and if the marks on the neck showed that manual pressure had been used, this would be conclusive of homicide. Usually much more violence is applied than is necessary to destroy life. The condition of the neck will depend upon the nature of the appliances used; a ligature, for instance, will leave a deep circular mark going all round the neck, the mark may be ecchymosed and sometimes the skin is abraded. It is by no means uncommon to find purpuric spots scattered over the trunk. Internally, fracture of the larynx or of the rings of the trachea may be found, or merely congestion of these parts; the thoracic viscera will present the appearances usual in cases of asphyxia, with sometimes superficial emphysema of the lungs in patches, owing to rupture of the air vesicles. The treatment would consist in freeing the neck from the constricting band, if one existed, a free supply of air, and artificial respiration.

STRANGURY.—An urgent desire to pass urine, frequently recurring, the quan-

tity passed being very small, sometimes a few drops only. The condition is generally accompanied by pain about the neck of the bladder, and the act of micturition is not followed by the sensation that the bladder has been emptied.

The two conditions in which strangury forms a prominent feature are poisoning by turpentine and by cantharides, the latter being sometimes induced by the action of a blister. It is also present in various inflammatory affections of the bladder and prostate, and when those organs are the seat of morbid growths.

The *treatment* will depend upon the nature of the exciting cause. Morphia and hot baths are, as a rule, the most efficacious remedies.

Symptomatic Indications.—*Nux vomica*; *camphor*.

STROPHULUS.—An old-fashioned term used by Willan and Bateman to designate various ill-defined diseases of the skin, which occur mainly in childhood. *Strophulus albidus* is probably identical with milium (see SEBACEOUS GLANDS, DISEASES OF), while *strophulus inter-tinctus*, *confertus*, etc., represent various urticarial and sweat eruptions.

STRYCHNINE, POISONING BY.—This is the alkaloid obtained from the seeds of *Strychnos Nux Vomica*.

Symptoms.—An intensely bitter taste is noticed as the poison is swallowed. The urgent symptoms usually commence suddenly, within twenty minutes of taking the drug. A vague sense of impending danger is experienced, the patient cannot get his breath, declares he is going to be choked, and cries out for more air. Twitching and jerkings of the muscles, followed by general tetanic spasms, soon set in; almost all the muscles of the body are attacked at once, those of the back being most affected. During a paroxysm the patient lies on his bed in a state of extreme opisthotonos, his head and heels alone touching the bed, the arms are extended, the feet arched, the abdomen tense, and the chest fixed, so that respiration is greatly impeded; the face and lips are livid, the eyes staring, and the angles of the mouth drawn up so as to produce the well-known and characteristic “*risus sardonicus*.” From a half to two minutes is the average duration of a paroxysm. The spasm passes off leaving the patient

much exhausted and bathed in perspiration. His sensations warn him of the approach of another paroxysm, and he often screams out or asks to be held. As a rule there are absolutely no cerebral symptoms, and between successive paroxysms the patient often speaks of his impending death. In a case that is likely to terminate fatally the attacks increase in frequency, and the victim dies either from suffocation during a paroxysm or from exhaustion in an interval. The lower jaw is seldom affected until late in the illness. If the patient survive for two hours after the first appearance of the symptoms there is a fair hope of his recovery.

Diagnosis.—The condition has some points in common with tetanus, and might be simulated by hysteria, but a close attention to the symptoms should enable the observer to eliminate the latter without much difficulty. The chief point as regards tetanus is the condition of the lower jaw; in the latter disease the jaw is almost invariably the part first affected, and it remains affected throughout; whereas in poisoning by strychnine it is seldom affected until late, and then only during a paroxysm.

Post-mortem Appearances.—If the patient die during a paroxysm, the body is found in a state of opisthotonos, as at the moment of death, otherwise there is nothing outwardly to suggest the cause of death, nor do the internal appearances help much, as a moderate degree of congestion of the cerebral or spinal systems may be all that can be recognized; the blood may be dark and fluid.

Treatment.—Vomiting should be encouraged, and, if the paroxysms have not set in, the stomach-pump may be used. The patient must be kept as quiet as possible, and should not even be touched unnecessarily for fear of inducing a convulsion. To subdue the convulsions large doses of chloral hydrate or bromide of potassium may be given, separately or together, half a dram of each for a dose, repeated in half an hour if required, or chloroform may be administered; artificial respiration may be required. Patients often derive much benefit during a paroxysm from being held or rubbed.

SUBSULTUS TENDINUM.—Spasmodic twitching movements of the tendons, most easily perceived at the wrist.

It is a condition met with in severe febrile affections, usually in association with delirium, and is of unfavorable augury.

SUFFOCATION.—Death from asphyxia, the obstruction to respiration being more or less mechanical, but not by violence applied to the throat.

It is usually accidental, very rarely suicidal, except among the insane, and occasionally homicidal. Overlying, or smothering the mouth and nostrils with bedclothes, a towel, or cloth, are the methods usually adopted in the latter class, but overlying may be an accident, though this is not likely if the infant be robust and the mother not intoxicated at the time of the occurrence. Among the accidental causes may be mentioned pressure on the chest in crowds, the passage of food into the glottis, either during the act of swallowing or during vomiting, the passage of blood or pus or a foreign body into the air passages, as in hemoptysis, rupture of an aneurism, or the bursting of an abscess in the neighborhood of the larynx, wounds of the throat involving the trachea, and œdema laryngis, from the swallowing of boiling or corrosive liquids or from simple laryngitis.

Diagnosis generally made from the presence of signs of asphyxia, and absence of other sufficient cause of death.

Post-mortem Appearances.—There would be the usual signs of asphyxia (*q. v.*) in addition, sub-pleural ecchymoses. (Tardieu's spots), consisting of small, round, dark, well-defined spots, are usually seen, especially at the root and base of the lungs, and similar extravasations of blood may be found throughout the lungs.

The *treatment* would consist in the removal of the obstruction to respiration, of whatever kind, if necessary by the performance of tracheotomy, and in the adoption of other measures for restoring natural breathing. The mode of performing artificial respiration is described in the article on DROWNING.

SUNSTROKE (Heat Stroke; Insolation; Coup de Soleil).—A condition resulting from exposure to the heat of the sun or to heat from other sources.

Symptoms.—Three varieties are usually described. 1. **Asphyxial form**, in which death may be almost instantaneous, the

onset being sudden, the symptoms of cardiac and respiratory failure, cold skin, gasping, breathing, and insensibility. Recovery, if it take place, is usually complete. This is the true sunstroke, resulting from exposure of the head and back of the neck to the direct rays of the sun.

2. Hyperpyrexial form.—This follows exposure to great heat from other sources as well as from the direct effect of the sun. It may come on after the exposure has quite ceased, while the person is in the shade, or even at night. Usually premonitory symptoms are noticed, such as vertigo, headache, nausea, mental confusion, disinclination for exertion, insomnia, thirst, high fever, disordered bowels, or frequent micturition. Insensibility is an early symptom and supervenes gradually, stertorous breathing in one supposed to be asleep being sometimes the first indication of the condition. There is great restlessness, the breathing is labored and gasping, the face suffused or cyanotic, the pulse quick and jerking, the temperature very high (108° F. or higher). The pupils in the early stages are contracted, later they may be dilated; the pulse may subsequently become irregular and thready, subsultus tendinum may be present, and epileptiform convulsions, followed by deep coma, occur. Hemorrhages into the skin are often seen and suppression of urine is nearly constant. Death from gradual asphyxia or from simultaneous cardiac and respiratory failure usually takes place within two days, often very rapidly. In this variety recovery when it occurs is seldom complete, the patient being afterward unable to endure exposure to excessive heat in any form. Pain in the head, usually limited to one spot, but sometimes diffused, and liable to exacerbations, is a prominent after-effect, loss of memory, irritability, inability to fix the attention, imbecility, and even insanity are common sequelæ, and occasionally paralysis or tremor follows the attack.

3. Syncopal form or heat exhaustion. The chief features are great prostration, lowering of the body temperature, a cool moist skin, and feeble pulse; recovery is generally complete.

Post-mortem Appearances.—Rigor mortis sets in speedily, and is followed by early putrefaction. The left ventricle is usually contracted, the right side of the

heart and pulmonary vessels being engorged. The blood is generally fluid, and its physical characters altered.

Ætiology and Pathology.—The main cause is exposure to excessive heat, not necessarily to the direct rays of the sun, for it is often met with in stokers, engine-men, etc.; overheated air is much better borne when the atmosphere is dry than when it contains much moisture, a fact which is abundantly verified by the experience of the Turkish bath. Predisposing causes undoubtedly have some influence; vigorous persons of temperate habits and in good bodily health are much less liable to be attacked than others. Anything which tends to exhaust or impair bodily vigor will increase the liability to an attack; thus soldiers on forced marches, especially when clothed in a tight uniform, have succumbed in great numbers; sexual or alcoholic excesses are especially dangerous. Acclimatization has some effect, for in hot countries Europeans suffer more than natives, and newcomers more than those who have been some time resident in the district. Persons of spare build are more likely to escape than those who are portly. As regards the actual nature of the affection, it is probable that in the cardiac form the centers in the medulla controlling the circulation and respiration are first stimulated, and then paralyzed. The explanation offered of the hyperpyrexial form is that there is an accumulation of heat, as the body is prevented from throwing off the heat which is constantly being formed, and also there is a sudden outburst of heat production. A center in the pons inhibits the production of animal heat, and another in the medulla regulates the dissipation of heat. On the above theory both these centers must be disturbed (see FEVER, section Hyperpyrexia).

Treatment.—The avoidance of all known predisposing causes will go far to prevent an attack. The assiduous application of cold is the most important point in the treatment; this may be effected either by cold baths, douches, or packing, or by rubbing the body with ice. A careful watch must be kept on the temperature, so as not to push the treatment to such a degree that the patient is unable to rally. The hypodermic injection of quinine in 10-grain doses, or of antipyrin in 20-grain doses is worthy of

trial. The sequelæ are practically always due to chronic meningitis, and should be treated accordingly.

Symptomatic Indications.—The most generally effective remedy is *glonoine*; intense congestion to the head with throbbing pain. For after-effect, particularly continued hyperæmia, *belladonna* is most frequently required. *Aconite* may sometimes be required, if there is much febrile excitement.

SUPPOSITORIES are solid cones for insertion into the rectum, to be there dissolved and their active ingredients absorbed. They usually contain, as their basis, oil of theobroma, glycerin of starch or soap, mixed with which is the special agent it is desired to employ. The substance introduced into them depends upon the purpose for which they are to be used; most commonly an anodyne effect is desired, when morphine is employed, or occasionally belladonna. Astringents are also used in this way to check diarrhea, or in cases of constipation some local irritant may be introduced to excite the expulsive action of the bowel. *Nutrient suppositories* are employed where rectal feeding is necessary, either in addition to or instead of nutrient enemata. The suppository should be oiled and gently introduced into the anus and slowly pushed up until it is beyond the sphincter, where it may be held for a few seconds to meet any temporary tendency to its expulsion that might at first be excited. Occasionally suppositories are introduced into the vagina; when so used, it is generally for some definite local effect, but sometimes for anodyne or nutrient purposes in cases where such a purpose cannot be effected through the rectum.

SURGERY, GENERAL PRINCIPLES OF OPERATIVE.—There are certain topics to bear in mind in seeking for guidance in operative work. Among these: 1. The reciprocal action of wounds in certain constitutional affections. 2. The conditions of health most suitable for operation. 3. The treatment previous and subsequent to operation; and 4. The immediate as well as remote dangers, and causes of death after operative interference.

1. The reciprocal action of wounds in certain constitutional affections.—

We may classify the constitutional states that affect and are affected by wounds into three distinct groups: *a.* Diseases of nutrition: cancer, scrofula, arthritism, scurvy. *b.* Diseases resulting from the introduction *ab extra* of a poison: syphilis, alcoholism, malaria, hydrophobia, septicæmia. *c.* Organic diseases of heart, lungs, kidneys, brain, spinal cord, etc.

These act in a threefold manner in retarding or preventing repair: first, by predisposing to the occurrence of certain complications, such as hemorrhage, inflammation, and neuralgic affections; secondly, by retarding or destroying whatever repair may have already occurred; and, thirdly, by the development of definite diseased conditions at the situation of the wound.

Among the conditions which, it is alleged, signally affect reparative action, old age has been mentioned. Assuming, however, that the patient is generally in good health, old age does not appear to be a factor that influences repair unfavorably. I am of the opinion that the repair of wounds and fractures and the healing of ulcers takes place as quickly in the aged as in middle life.

In the constitutional diseases, it must be noted that in one phase, that of dyscrasia, no special influence, favorable or unfavorable, on either the general condition of the patient or on the wound, is observed. In another phase, where there are distinct local developments of constitutional disease (as, for example, in cases of mammary cancer, or scrofulous articular disease), the process of healing does not frequently run so smooth a course. Not only is the progress of the wound locally unsatisfactory, but, notably in cases of cancer, the operation appears to have the calamitous effect of rousing into activity the hitherto dormant energies of a fatal malady. In one other phase, namely, where there is evidence of disease of important organs, such as the lungs, liver, heart, kidneys, etc., the surgeon has even stronger grounds for grave apprehension as regards the reciprocal effects of trauma and the disease.

Thus, any injurious reciprocal action between a trauma and a constitutional disease is less likely to be observed in the initial stage of such a malady than during any of its later developments, consequently wounds are more likely to run a

smooth course and be unattended with any "surgical calamity," in the so-called dyscrasic period, before the appearance of any specific local disturbances, and *à fortiori* before there is evidence of any visceral lesion.

The reciprocal influence exerted by cancer depends largely upon whether the manifestation of the disease is limited and localized, or not. If it is (as, for example, in a small scirrhus of the breast, or an epithelioma of the lip) without glandular complications, no unfavorable influence, one way or another, is, as a rule, observed. When, however, that stage of localization has been passed, then it may often be noted that not only is the reparative action in the wound unsatisfactory, but also that the operation appears to stimulate the relatively dormant disease into a dangerous and fatal activity. This it is which makes surgeons of judgment and experience so slow in undertaking operations of the kind, and, when they do consent to "give the patient a chance," so cautious and grave in their prognosis.

In cases of scrofulous disease, the development of phenomena analogous to those just discussed need not be dreaded; for although in these cases the reparative process often runs the reverse of a normal course (this is especially to be noted in cases of joint resections, in which not unfrequently fungous growths, abscesses, fistulæ, etc., appear in the vicinity of the wound and prevent its closure), this result is mainly due to portions of diseased structure being left in the wound. As a proof that the existence of a strumous diathesis does not of itself materially militate against satisfactory wound repair, may be mentioned the fact that in such cases (*i. e.*, of joint resection in which union is interrupted), when an amputation at a distance from the local trouble is had recourse to, the healing of the wound pursues, as a rule, a perfectly normal course.

The way in which wounds at times act as immediate exciting causes of erysipelas is well known, and equally interesting are the effects of erysipelas on wounds. On recent wounds, also, erysipelas often seems to exert an influence, although not always one favorable to their recovery; especially where small wounds exist. In five cases, chiefly penetrating wounds, they were attacked by gangrene, which

they recovered from, however, immediately after the termination of the erysipelas. It is possible to explain this peculiar influence, on the supposition that old infiltrations may be more easily brought to softening and resorption by the uniform intense inflammation of the skin, and the altered relation of tension and hyperæmia in the affected parts.

The reciprocal effects of wounds and nerve lesions are also remarkable. Wounds are ætiological factors in inducing neuralgia of a most violent form. In many instances this effect has been the result of injury done some small and purely sensory branches, as, for example, in venesection, or in wounds of the nerves of the fingers. Sciatica, too, is an affection which in many instances has been known to result from wounds, falls, fractures, etc.; and among the causes of true paralysis, also, wounds must ever occupy the foremost place.

As regards the effects of nerve disease on wounds, in cases of tabes dorsalis, treated by nerve-stretching, a peculiarly torpid condition and slow reparative power in the wounds made in performing the operation, even though throughout a perfect condition of asepticism was maintained, has been noted.

The tissue changes that occur in scurvy are also such as to militate strongly against prompt and satisfactory union in wounds. The tendency to the occurrence in and about the wound of blood effusions probably tends largely to delay reparative action. The injurious effects of a scorbutic diathesis I have observed more markedly in subcutaneous wounds (bone lesions) than in any other.

As regards rheumatism and gout, it cannot be said that their pre-existence has any specially unfavorable influence on the healing of open wounds. This does not hold good when they are subcutaneous, as in sprains, luxations, fractures, etc. nor does the converse of the proposition hold good; for operations, some of them of a most trivial nature, appear, in many cases of gout and rheumatism, to stimulate into activity developments of arthritic disease not previously experienced by the patient.

Bright's disease is a serious condition in the face of any operation. The subjects of the disease often recover badly from the anæsthetic, the wound is very apt to take on unhealthy action, and

erysipelas is much more liable to supervene than is the case in a healthy individual.

Among other conditions which have been mentioned and which injuriously affect the healing of wounds, are syphilis, malaria, alcoholism, and diabetes.

2. The condition of health most suited for operation.—Previously to undertaking any surgical operation, the condition of the patient's health generally should receive attention. As a rule, excepting in cases of emergency, an operation should not be undertaken until there has been time and opportunity to ascertain if any unfavorable but remediable conditions connected with the patient's health exist. Should the patient be in a low and debilitated condition, rest should be enjoined, wholesome and easily digested food given, and the surroundings made as cheerful as possible. The secretions should be carefully attended to; but, except when absolutely necessary, all medication should be avoided.

The early and middle periods of life, provided the patient has previously led a steady and regular life, are the most favorable for operative interference. Though more susceptible to shock and less able to bear loss of blood than adults, children, as a rule, bear operations well. Both sexes sustain them equally well, but in females the periods of menstruation and pregnancy should, if possible, be avoided.

A good deal has been written about certain periods of the year being more favorable for operations than others. There is probably not any material influence exercised on operations by any particular season; but, unless there be urgency, it is well to avoid undertaking any operative measure of gravity during the prevalence of any exceptional period of heat or cold.

3. The treatment previous and subsequent to operation.—Before an operation the surgeon should consider what instruments or other appliances may possibly be required. There should be as much pre-arrangement and judgment in their selection as discretion in their use. For the success of the operation it is desirable that such details should be attended to, attention to the *minutiæ* of surgery being, as a rule, associated with a corresponding forethought for all other details and contingencies that may arise.

In operating, ostentatious and unnecessary speed should be avoided and coolness cultivated, the possession of which is so essential to meet any serious surgical emergency.

Before performing an operation necessitating any division of tissues, render the part to be operated on as aseptic as possible. For means for effecting this end, see WOUNDS. When feasible, render the part to be operated on anæmic, which, in a very large proportion of cases, can be done by means of an Esmarch's bandage. When this method is not applicable, digital or instrumental pressure on the main vessel going to the part, or elevation of the limb, or the method by "position," may be had recourse to.

The advantages of Esmarch's method of preventing hemorrhage during operations may be briefly epitomized: 1. Diminution of shock and consecutive anæmia. 2. No embarrassment to the surgeon from obscurity caused by hemorrhage in the field of operation. 3. Facilities afforded in examination of diseased bones and joints, and also in searching for small foreign bodies, such as portions of needles, pins, chips of wood, etc. 4. Fewer assistants necessary, and greater rapidity in operating promoted. The more remote advantages claimed are greater rapidity of healing, diminution of traumatic fever, and a diminished liability to secondary affections such as erysipelas, phlebitis, pyæmia, etc.

As regards diminishing pain and shock in operations, much can be done by anæsthetics; in many instances, when the administration of one is contra-indicated, and the wound is limited in extent, freezing the part by the action of ether spray will be found satisfactory. The use of cocaine injected hypodermically has been warmly advocated; but the alleged advantages of it appear to have been much exaggerated. In addition to anæsthetics, many other circumstances tend to influence favorably the results of operations; among which may be mentioned, greater attention to hospital sanitation, resulting in improved drainage, cleanliness, ventilation, air, space, etc., and better nursing.

As regards the wound, the main object the surgeon should have in view is to keep it thoroughly clean and aseptic. If there be much discharge, ample provision should be made for its exit and absorption, for which latter dry sublimated wood

wool dressings answer very well. Care should be taken, too, that the position of the patient, with special reference to the part operated on, is such as to be least irksome to him, and that the application of fresh dressings should be attended with the minimum of pain and disturbance. The patient's room should be cheerful and airy, its temperature about 60° F. If there be much gastric irritability after the anæsthetic, iced water, taken in small quantities at a time, will be found most effectual. For the relief of pain, reliance must chiefly be placed on anodynes given hypodermically or by the mouth, the former method being the one usually adopted. The diet, after operations of any severity, should be of the simplest and lightest kind. In cases where there is any evidence of surgical fever, iced milk diluted with soda or lime-water and given in small quantities at a time will be found in most cases to answer well. Later, if all goes on favorably, chicken broth, jelly, beef-tea, etc., may be allowed, and subsequently a more generous diet may be given; but so much depends on the particular characters of each individual case that no definite rules about it can be given.

Among the causes of death after operation, hemorrhage, primary or secondary, occupies the foremost place. Although there are many instances recorded in which death from primary hemorrhage occurred during the performance of an operation, so tragical an event could hardly, with the appliances now at our disposal, take place. Secondary hemorrhage, however, resulting from a variety of causes, such as the slipping of a ligature, its too rapid absorption, or undue reactionary hemorrhage from too firm and protracted an application of Es-march's bandage, is not uncommon. At times, especially in connection with the operation of excision of the knee joint, this bleeding may follow from wound sloughing, arterial disease, and an exceptionally rapid re-establishment of collateral circulation. In the pre-antiseptic era, venous hemorrhage was also not unnaturally a source of much apprehension, but now surgeons do not recognize the great peril in ligaturing veins which formerly they had so much reason to dread.

In addition to hemorrhage, there is another cause of death, after operations

connected with wounds in veins, viz., the introduction of air into them. The accident is one of extreme rarity. The large veins in the neck are those the surgeon has the greatest fear of wounding, as these are most likely to be attended with this accident.

Another cause of death after operation is shock, which is produced by several causes, among which may be mentioned hemorrhage, exposure to cold, exhaustion, and mental depression. These causes further the extreme depression of the nervous, circulatory, and respiratory systems which is so characteristic of well-marked shock, and usually act during or immediately after the performance of the operation. In other cases, however, these phenomena are not apparent until some time has elapsed, and then the condition is termed secondary or cumulative shock, and is often fatal. This latter condition is most likely to supervene in delicate, anæmic, and aged persons, exhausted by long continued anxiety and suffering. Among other and more remote causes of death after operations may be mentioned erysipelas, gangrene, septicæmia, pyæmia, sloughing, embolism, and tetanus.

SIR WILLIAM STOKES.

SURGERY, DENTAL.—**Dental caries.**—Dental caries is a process of disintegration, commencing at the surface, and due to external agents. The agents in initiating caries are acids, the products of chemical change and fermentation, set up in fragments of organic matter (food, mucus, and epithelial scales) which are lodged about the teeth. These acids are often assisted in their action by acid mucus secreted by unhealthy gums, acid saliva in some diseases, and acid eructated from the stomach in others. When the dentine is reached, the acids are assisted by the proliferation in the fibrils and organic basis of that tissue of organisms, consisting of micrococci, oval and rod-shaped bacteria, and a fungus (*leptothrix buccalis*). The physical signs of caries (discoloration and softening of the tissues) bear a general resemblance in every case. They differ only in consequence of the mode of onset, the situation, and rapidity of the disease, giving rise to such terms as "spreading," "penetrating," "soft," or "hard" caries. The discoloration in the incipient stage on an

unbroken surface of enamel usually amounts to no more than slight opacity of the tissue. When the disease begins in a fissure, and when a cavity is formed, the discoloration is more marked, the softened dentine assuming a brown tint, or becoming stained to a blackish hue. Cavities in which the disease is progressing rapidly show least discoloration.

When a surface of enamel is affected, it appears eroded, rough, and full of small holes, and is readily scraped away by a steel instrument. When the mischief has commenced in a fissure, little softening may be apparent for a time at the surface, but later the undermined enamel, breaking down, discloses a cavity in the dentine filled with *débris* and decalcified tissue. Such a cavity is formed in every case in the later stages. The enlargement of the cavity in the deeper parts is due to the fact that organisms flourish most in the dentine, in the organic basis of which they find their pabulum.

The predisposing causes of caries are: First, innate structural defects in the teeth which render them more susceptible to the action of agents. Caries may commence on a sound unbroken surface of the tooth, especially on the lateral aspects, where the shelter afforded by the chinks between the adjacent teeth allows decomposing foreign particles to remain undisturbed for lengthy periods; but more frequently it has its starting-point at some part of the enamel and dentine, the seat of structural defect, from which few sets of teeth are altogether free, and when it penetrates to a mass of ill-calcified dentine the disease advances with great rapidity. Secondly, all diseases accompanied by vitiation of the oral secretions, from the occasional foul tongue and clammy mouth accompanying an attack of dyspepsia, to the severe condition associated with the zymotic fevers, such as smallpox or typhoid. The liability of pregnant women to suffer from dental caries is mainly due to vitiation of the oral secretions which frequently accompanies that condition. Thirdly, crowding and irregularity of the teeth, due to smallness and malformation of the maxillæ. These conditions make certain the accumulation of decomposing foreign particles in the unnaturally narrow interstices between the teeth, and in the nooks and crannies formed by the irregularities.

Symptoms.—Enamel being devoid of sensibility, pain during caries does not begin before the dentine is affected, and it is due at first solely to the exposure of this tissue to sudden changes of temperature and contact with irritating substances. In the later stages, more severe pain arises from irritation and inflammation of the pulp, when insufficiently protected by a layer of dentine, or actually exposed. Finally, there becomes added the pain due to extension of inflammation from the pulp to the peridental membrane. The amount and character of the pain in all the phases of caries are much diversified in different persons. In some there is constant pain of a dull, aching character, augmenting from time to time, as decay advances, into severe paroxysms, while in others the teeth are destroyed without any suffering beyond slight occasional pain and uneasiness. It is impossible to account for this difference; but it may be noted that the very young suffer, as a rule, more acutely than adults or the aged, and that in certain conditions of health, of which pregnancy furnishes the most striking instance, toothache, if it occurs, is usually of the severest kind.

Treatment.—Much can be done to prevent caries by maintaining perfect mechanical and chemical cleanliness of the mouth, by use of toothbrush and toothpick, with antiseptic tooth-powders and lotions.

The treatment of incipient caries of contiguous surfaces of incisors and canines, where the decay does not penetrate beyond the enamel, may be confined in many instances to filing away the diseased tissue, polishing the surface, and leaving it of such a form that it may be readily cleansed, and not allow the adhesion of decomposing particles of food. Except in these few cases, caries must be treated by the operation of plugging or filling the tooth. This operation comprises cutting out the diseased tissues, removing fragile and overhanging margins, shaping the cavity for the retention of the filling, and filling it with some suitable material.

Inflammation of the pulp.—This, the commonest affection of the dental pulp, may supervene as the result of exposure from fracture of a tooth, but its most frequent cause by far is caries. It may be either acute or chronic. Pain is the

most prominent symptom of acute inflammation. At the commencement it is dull and aching, confined to the affected tooth; but soon assuming a more intense, lancinating, or throbbing character, it appears to spread to the adjoining teeth, and to the whole side of the head and face. The pain of this form of toothache is more severe than in any other dental disease, and is accounted for by the fact that the pulp, a highly vascular and nervous substance, is confined within the rigid walls of a chamber where swelling is impossible, and whence the inflammatory exudations cannot freely escape. Inflammation of the pulp may be distinguished from dental periostitis by the fact that in the latter the earliest symptom is tenderness upon pressure and slight elevation of the tooth in the socket, while in the former these symptoms are not displayed until a later stage, when inflammation has extended to the periosteum. When the pulp cavity is but slightly opened, or where the pulp is confined beneath a layer of dentine, or beneath a filling, there being no room for swelling, and little or no escape for the inflammatory exudations, such constriction may be produced as at once to cause death of the whole mass. An attack of acute inflammation is, however, usually limited to the exposed surface alone, and slowly subsides, assuming, perhaps, a chronic form. In chronic inflammation the pain is usually of a dull, aching, or gnawing kind; it may be altogether absent if there be free vent for exudation, or be manifested only at a distance, in a neuralgic form.

Treatment.—A vast number of teeth are extracted for the relief of pain from inflammation of the pulp; but a large majority of these teeth could be saved by proper treatment. This consists in destroying the pulp by means of arsenic, extirpating it, plugging the pulp cavity with antiseptic material, and stopping the tooth.

Dental periostitis.—Inflammation of the dental periosteum may be confined to one or two teeth, or may involve many or all the teeth. The former variety is most common, the usual cause being extension of inflammation from the dental pulp. Periostitis often arises after the filling of a cavity in which portions of a suppurating or decomposing pulp have been left, and in which matter penetrates

to the depths of the root canals, and sets up irritation. It may also result from injuries of the teeth or alveoli, or may arise from rheumatism, syphilis, or scurvy, or cold, or the effects of mercury; while, finally, certain cases of general subacute or chronic periostitis (pyorrhœa alveolaris) with absorption of the alveoli, frequently occur, in which the cause cannot be ascertained.

The *symptoms* of acute periostitis commence with a feeling of uneasiness, which increases in the course of a few hours into aching pain accompanied by tenderness of the tooth, especially when pressed into the socket. The pain becomes severe, and the tooth is evidently protruded and loosened, owing to swelling of the lining membrane of the socket. The neighboring teeth become tender, the inflammation involves the gum and spreads to the palate and cheek, which become swollen and œdematous, the œdema often extending to the eyelids when an upper front tooth is the center of the disease. At this stage suppuration takes place, pus is formed, points, and finds its way to the surface, and this is followed at once by diminution of pain and by slow subsidence of all the symptoms. The acute stage of such an attack lasts from three to ten days. Recovery may take place, the inflammation may remain chronic, it may end in necrosis of the tooth, or spreading to the jaw may cause necrosis of bone.

Treatment must be governed by the cause of the disease and other circumstances. If it be resolved to save the tooth, the cavity of decay and the pulp must be dealt with; the gums at the onset may be painted with a mixture of equal parts of tincture of iodine and tincture of aconite. Local bleeding and warm fomentations within the mouth are of the first importance in the next stage of the attack. So soon as the swelling occurs, incisions should be made through the gum down to the bone at the position where it appears probable that matter may form, while at the same time the warm fomentations are persevered with.

Chronic dental periostitis may arise from any of the causes which originate the acute form of the disease. Periostitis due to constitutional causes usually affects several or all of the teeth of one or both jaws, is generally chronic, and rarely passes at all beyond the subacute stage.

The symptoms comprise in a modified degree those present in acute inflammation. The teeth are tender on pressure, are the seat of a varying amount of pain, are more or less loosened and raised from their sockets, and they are surrounded by swollen gum. On pressing the mucous membrane in some cases, either pus or muco-purulent matter oozes from around the necks of the teeth. These symptoms may continue for months or years, until the teeth, becoming completely loose, in consequence of absorption of the alveoli, are at last lost.

Treatment.—Remove the cause of the disease. When the inflammation is associated with the disease of the pulp, that structure must be dealt with. Sources of local irritation, such as tartar deposited upon the necks of the teeth or necrosed roots, must be removed. Blood may at intervals be abstracted by incising deeply with a scalpel the swollen gum between the teeth. When the gum is separated from the necks of the teeth, and a purulent discharge is poured out, the part should be swabbed frequently with a solution of chloride of zinc (twenty grains to the ounce) by means of a small probe and a pellet of cotton-wool passed beneath the free edge of the gum. Detergent lotions may be used to overcome the fetor of the breath. In periostitis due to constitutional causes, attention must be directed to the general health.

Alveolar abscesses.—This class of abscess, seen in its most familiar form in the ordinary "gumboil," consists of a collection of pus between the gum and the bone, external to the root of the tooth from which the disease originates. In severer cases the matter, if it do not find a ready exit into the mouth, may point and burst externally. This termination, although it occasionally supervenes upon suppuration around other teeth, much more commonly follows abscess connected with lower molars. Suppuration in alveolar abscess always commences in the socket at the surface of the tooth, but as soon as matter forms it finds its way into the surrounding tissues. Abscesses connected with diseased teeth are usually traceable without difficulty to their origin. The matter does occasionally, however, burrow through the soft tissue, and appear about the palate, cheek, or jaws, in situations so unusual that the relation of the discharge to the teeth is not at first

sight suspected. In cases of abscess about the mouth or face, the origin of which is not evident, it is, therefore, desirable that an examination of the teeth should be made. When the matter escapes through the cheek, the symptoms closely simulate necrosis of the jaw.

Treatment of alveolar abscess is the same as that of dental periostitis, of which it is but a phase. When pus is forming, poultices and warm applications to the cheek should be avoided, as they encourage the escape of matter through the skin. Most cases either yield to treatment or subside after running a certain course; but the progress of the disease may be, as a rule, at once arrested by the extraction of the tooth, an operation which may be performed without hesitation when the tooth is useless owing to chronic disease or extensive decay, or when the abscess threatens to burst externally. Abscesses, or fistulous tracks, opening externally, must be treated by dressing and syringing with solution of carbolic acid, 1 in 40, or with eucalyptus oil. In cases where no dead bone exists, such treatment, with the extraction of the tooth, which in these cases is always called for, rarely fails to bring about a rapid cure.

Toothache is a symptom, not a distinct disease. It is most commonly caused by caries and the sequelæ of caries. Diseased teeth, which do not themselves ache, and particularly teeth the seat of chronic inflammation of the pulp, excite pain in many cases in neighboring or in distant teeth. In other similar instances it is due to diseased roots or to impacted wisdom teeth. Toothache accompanies chronic wasting of the alveoli. In rare cases it is due to calcification of the pulp in teeth with no external sign of disease. It may be due to true neuralgia. Toothache in the vast majority of cases is due to a local cause, although this is often not discoverable except by careful minute examination of all the teeth. The treatment consists in dealing with the cause by appropriate measures.

Symptomatic Indications.—*Aconite* is useful in congestive toothache; throbbing pain; or hard, aching, pressing pain; headache. *Belladonna*, in burning, throbbing pain from inflammation of dental pulp; cerebral congestion; or neuralgic pains which appear and disappear suddenly. *Arsenicum*, in neuralgic, jerking, burning pains, worse at night; restless-

ness and anxiety. *Mercurius* is the most valuable remedy, when pain in or from decayed teeth; pain worse at night; much ptyalism; periostitis of sockets. *Chamomilla* in rheumatic odontalgia; boring, tearing pains; unbearable pains. *Belladonna*, *chamomilla*, *antimony crudum* in toothache of pregnancy often relieve.

Syphilitic teeth.—It by no means happens that every case of inherited syphilis is marked by typical mal-development of teeth; in most cases no characteristic defect appears. Syphilitic teeth are mostly accompanied by other evidences of the taint, especially by skin affections and interstitial keratitis; and as many honeycombed and defective teeth closely resemble syphilitic teeth, great caution is necessary in pronouncing a diagnosis from the evidence of the teeth alone. The central permanent incisors are most commonly the seat of the characteristic sign, but the laterals and canines may also be affected. The teeth are of bad color, narrow, short, and peg-shaped; the angles being much rounded. The points are ragged, with usually a vertical notch extending toward the gum in front and behind. Horizontal notches and fissures often exist also on the same teeth.

Honeycombed teeth.—This defect is most common in the first permanent molars, and in the incisors and canines, the bicuspid being rarely affected. The enamel is full of small pits, and the teeth are often marked by horizontal grooves. The cusps of the molars have a pinched, elongated shape, and the edges of the incisors are thin and flattened from before backward, the enamel toward the neck being often normal.

Extraction of teeth.—During the operation of extracting teeth, the patient may lie upon a low couch, with the shoulders raised upon pillows, and the head thrown back in a good light, the surgeon standing sometimes on the right, sometimes a little behind the patient's head. This position will serve for any tooth. In removing teeth of the lower jaw, the patient may be seated on a low stool, with the head either firmly grasped between the operator's knees, or held by an assistant, the surgeon in the later case standing in front or at the side. The instrument is held in the right hand, while the left hand, fingers, and arm are em-

ployed in steadying the head, grasping and fixing the lower jaw, drawing back the commissure of the lips, and assisting to direct the instrument. The instruments employed almost exclusively are forceps of various patterns, adapted to fit the various classes of teeth, and to grasp without crushing them. Their edges are sharp, so that they may be readily insinuated between the free edge of the gum and the neck of the tooth, and forced toward the socket. The operation consists of two distinct actions: firstly, the seizure of the tooth; and, secondly, the loosening of its connections and its withdrawal from the socket. It is upon the careful performance of the first step of the operation that its success in the main depends. The forceps is lightly applied to the neck of the tooth, and forcibly pushed along the root, enough force being exercised to drive the blades of the forceps well round the root within the edge of the alveolus, and it is rare for the removal of a tooth so grasped to present any difficulty. The grasp is now tightened, and the next step of the operation is proceeded with. As the tooth yields, the forceps is pressed deeper, so as to embrace the tooth deeply within the alveolus, and to avoid breaking off the crown. In the second stage of the operation the method of applying the force is modified with each class of tooth, the roots varying in number, position, form, and size, and the investing bone offering less resistance in some directions than others. This stage of the operation, although distinct from the first, is really continuous with it, the whole being effected with one even movement. It may be performed rapidly by a practiced hand, but an attempt to wrench a tooth from its socket by force, either wrongly directed or indiscriminately applied, will in most cases result in fracture of the tooth, and may also inflict severe injury upon the jaw and surrounding parts. The upper incisors and canines have conical roots, and their extraction is accomplished by rotating them the slight degree necessary to loosen them, and pulling them downward and a little forward. The upper bicuspid having roots flattened laterally cannot be rotated. They are loosened by forcing them steadily outward, then moved to and fro from within outward, and pulled downward. Two forceps are required for the upper molars: one for the right, one

for the left. The outer blade is formed in two curves, to contain the external roots; the inner blade to grasp the internal root. The force is first applied in the outer direction, for the reason that the external alveolar plate offers less resistance than the inner, while the direction of the palatine root is such that it is likely to be snapped in an attempt to move the tooth inward. As soon as the tooth yields it is moved from side to side, and pulled downward. The upper wisdom teeth are extracted in the same way as the upper molars, and ordinary molar forceps may be used, but they are more conveniently reached by an instrument specially curved to pass to their position at the extremity of the jaw. The lower incisors are loosened by bending them forward, and detached by a to and fro movement from within outward, combined with an upward pull. The lower canines, having somewhat conical roots, are loosened by a rotatory movement, and drawn by an upward pull. The lower bicuspid, having roots flattened laterally, are extracted by forcing them outward until they are felt to give, then moving them from side to side and at the same time drawing them upward. In applying the forceps to lower teeth, the point of the thumb of the left hand may be placed over the joint of the instrument while the fingers press the jaw upward from beneath. In this way the forceps is guided in the desired direction, power is obtained to drive it home, and the instrument is prevented from coming into violent contact with the upper jaw at the moment the tooth leaves the socket, while at the same time the danger of dislocating the jaw is guarded against. The lower molars are loosened by force directed first in an outward direction, then moved to and fro from within outward, and pulled upward. Should the tooth offer great resistance, a backward and forward movement is adopted to free the roots, which are curved more or less in the backward direction. The extraction of these teeth, and any lower tooth, is much facilitated by firm fixation of the lower jaw, the left hand of the operator being used to firmly grasp the chin and press the jaw upward and backward; or this may be done by an assistant. The lower molars are the only teeth which commonly call for the exercise of great force in their removal; and occasionally this will try the strength

of a powerful hand. As it is impossible to discover the amount of resistance in any case until the operation is commenced, it is well always to be prepared with a reserve of power; and this is to be obtained by having the patient seated low, the lower jaw firmly fixed, and employing either "hawk's bill," or American pattern forceps, in which additional leverage is obtained by the blades being at an angle to the handles. The lower wisdom teeth are extracted by the same method as the other molars.

Extraction of the roots of the single-fanged teeth of both the upper and lower jaws is carried out on the principles already described; that is to say, the forceps are steadily pushed along the root and a sufficient grip upon a sound portion obtained before an attempt is made to complete the operation. As the root yields, the thrusting of the instrument deeper may be continued, and by giving the forceps at this time a slightly rotatory movement, the blades are made to penetrate more readily. When the root is extensively decayed or broken within the alveolus, forceps are used with smaller and more slender blades, in order that they may be more easily passed into the socket and insinuated between the root and the surrounding bone. In extracting the roots of molars, the procedure is guided by the extent of the decay. If the roots are firmly united together, they may be removed by the ordinary tooth forceps, great care being taken to insinuate the blades of the forceps along the roots until a firm grip is obtained, and to thrust them deeper as the root yields. Where it appears difficult to obtain a sufficiently deep hold with the ordinary instruments, forceps may be employed provided with long and sharp-pointed blades, which are either thrust into the alveolus, or forced through the alveolar plate. In those cases in which the roots of the molars are detached from one another by decay, or so slightly united as to preclude the possibility of their removal in a mass, they must be extracted separately by means of root forceps. The roots of the upper teeth, being conical, may be detached by a rotary movement; those of the lower, owing to their flattened shape, require a rocking movement from within outward. Roots which are so deeply buried in the socket as to be with difficulty reached with the forceps, may be extracted with the eleva-

tor. In applying the elevator, the blade is thrust deep into the socket, along the root, until a solid surface is reached. The handle is then turned, so that the point of the blade impinges upon the root, and by a levering movement presses it from the socket. In this procedure the fulcrum is necessarily formed altogether, or to a great extent, by the alveolar wall or by the adjoining tooth, and as the force exercised by the elevator is very great, unless care be taken the former may be extensively fractured or the latter dislodged. The elevator should be, therefore, firmly grasped, the fingers reaching close to the blade. The thumb and fingers of the left hand may in some instance serve partly or entirely as a fulcrum, and in every case they should be employed in guiding and supporting the instrument and controlling the force. The elevator should not be, as a rule, inserted between the external alveolar wall and the root, this part of the bone being too thin to stand much pressure; and it should never be used for the extraction of upper wisdom teeth, the bone around these teeth being weak and readily fractured. Roots, the crowns of which have been long decayed away, are seldom difficult to extract; but recently and deeply broken roots, especially in places, as with lower molars, where the bone around is dense and unyielding, call for great skill and caution, lest injury be inflicted on the jaw. Occasionally difficulties arise in consequence of irregular formation of the roots. They may be so curved or, in the molars, so spread, as to require more than ordinary force to remove them; indeed, the roots are sometimes so placed in the jaw that it is impossible to remove the tooth without snapping one or more of the roots or breaking a portion of the alveolus. If unusual resistance be met with, an abnormal arrangement of the roots may be suspected. Such being the case, the operator must proceed cautiously and deliberately to overcome the obstruction; and as it is impossible to ascertain the precise form of the irregularity, it will be found safer, in applying extra force, to follow the directions given for the extraction of a normal tooth. In spite of due care, it will happen sometimes that a portion of a root is left in the socket. The broken piece is commonly loosened, and may be picked out with the root forceps or elevator; but, should a fragment of the apex of the fang remain fixed in its

original position, it is in many cases better to leave it rather than to inflict the injury upon the bone which its withdrawal would entail. It rarely gives rise to irritation, and in due course the changes which take place in the surrounding bone lead to its loosening or expulsion. The separation of a small portion of the alveolar process during extraction, which is sometimes inevitable where the roots are twisted, is a matter of no importance.

Hemorrhage after extraction.—The hemorrhage following the extraction of teeth, in most cases, is slight, and continues but for a few minutes. Occasionally, however, oozing goes on for a considerable time, while in rarer instances the flow is so severe as to require active measures for its arrest. The bleeding may be due to a hemorrhagic condition of the patient, or may result from laceration of an artery situated in abnormal proximity to the root; but capillary vessels may, after chronic periostitis, become enlarged, so as to pour out, when lacerated, a considerable stream. It occasionally happens that hemorrhage, which has ceased, recurs after an interval of hours or days. Slight hemorrhage may be usually arrested by cold, the mouth being freely rinsed with iced water. Should the flow persist, or should it be copious or arterial in character from the first, the alveolus must be at once firmly plugged. The clots having been removed by syringing with cold water, a narrow strip of lint or a twisted rope of cotton is tightly packed into the alveolus with a blunt probe, fold upon fold, care being taken to pass it to the bottom of each division of the socket. A compress of lint is then placed in position, and pressure is kept up by causing the patient to bite forcibly upon it and fixing the jaw by a bandage passed over the head and beneath the point of the chin. The plug, which often gives rise to considerable irritation, may be withdrawn after the lapse of twenty-four to forty-eight hours. Instances are extremely infrequent which call for other treatment, which would consist in the application of styptics, of which the best is perchloride of iron. This application excites inflammation, and should therefore be used only in severe cases. In cases which resist this treatment, the actual cautery may be resorted to, the iron being used at a black heat.

Fracture and dislocation of teeth.—Fracture and dislocation of the teeth may

arise from injury, such as a blow upon the mouth, or when a fragment of bone, a small gritty particle, or a shot in game is bitten upon. If the fracture do not lay open the pulp cavity, it will often suffice to file down the rough surface and carefully polish it. In other cases, if the fractured surface is of such a shape as to form a cavity, or so situated that this appears desirable, a filling may be inserted. If the pulp be exposed and the fracture extend into the root, the extraction of the tooth will be called for; but if the fracture involve only the crown, an attempt may be made to save the tooth, or at least the root. The pulp in most cases must be at once destroyed, after which fang-filling may be performed, or an artificial crown may be attached to the root.

Dislocation of the teeth, and more particularly front teeth, is not an uncommon effect of blows upon the mouth. A sound tooth may be dislocated during the extraction of a decayed neighbor, even where great care is exercised, when, in consequence of the smallness of the jaw, the teeth are crowded and closely impacted.

If partly dislocated, the tooth must be pushed back into the socket. In complete dislocation, if the case be seen within a few hours, the tooth may be replanted. The socket should be first washed out with a syringe and warm water, to clear it of coagulated blood, and the tooth, having been also cleansed, should be replaced in the socket and firmly pressed home. If care be taken to support the tooth by ligatures, and to guard it from injury, it will in favorable cases regain its attachment, and remain firm for years. After this treatment, as also after replacement of a partly dislocated tooth, acute dental periostitis may supervene, and this must be treated as described elsewhere.

Odontomes.—Under this name are classed several varieties of malformed and monstrous teeth, and tumors composed of confused masses of dental tissues. Their ætiology has not yet been clearly made out. At an early period of development the teeth are represented by soft tissues. During this stage of growth the formative elements may become the seat of partial or general hypertrophy, atrophy, or other morbid action, followed by more or less complete calcification. The morbid process may

be confined to the enamel organ, or to the dentine pulp, or may involve all the tissues of the tooth. Sometimes, with hypertrophy of the tissues of the crown, there is found arrest of development of the root; on the other hand, the crown of the tooth may be normal in form, while the root is abnormally large, and composed of a confused mass of dentine and osseous tissue (cementum) inclosing a vascular structure; or the odontome may consist of an irregular mass of dental tissues, without any definite arrangement, and bearing no resemblance to a tooth. Still another variety of tumor having the same origin is mainly fibrous in structure, containing only scattered spots of calcification. Odontomes are usually encysted, having no attachment to the surrounding structures, except such as may have arisen from inflammatory adhesion, and do not necessarily give rise to irritation or disease. Should they, however, constitute a deformity, become a source of irritation, or the center of inflammatory action, they must be removed. Their extraction can be accomplished in some cases by means of an ordinary bone forceps; and, should it be necessary, the bone may be divided by the bone forceps to facilitate the operation. The fibrous variety may be removed by similar means. The cyst having been laid open, the mass may be turned out with the handle of a strong scalpel. Odontomes of considerable size are occasionally met with, so that in all cases of tumor of the jaw of doubtful diagnosis exploratory incisions, within the mouth, if possible, ought to be made to ascertain the true character of the disease before a formidable operation like excision of the jaw is proposed.

HENRY SEWILL.

SURGERY, ORTHOPEDIC.—Wry neck.—Wry neck, or torticollis, is a distortion produced by the contraction chiefly of the sterno-mastoid, and to a less extent of the trapezius and scalene muscles. A somewhat similar distortion may be produced by strumous and rheumatic disease of the cervical vertebræ, or by cicatricial contraction following burns or sloughing of the neck, or by paralysis of certain muscles. See SPINE, DISEASES OF.

Causes.—Wry neck may be congenital or acquired. When congenital it has been attributed to disease of the nervous

system producing a spastic contraction of the affected muscles, to a malformation *in utero*, or to some injury of the neck inflicted at birth. The acquired form may be the result of the head having been held for a long time in a distorted position, as from stiff neck after cold or injury, or from inflammation of the cervical glands after scarlet fever, etc.; or it may be the result of hysteria, or of spasm of the muscles due to irritation of the spinal accessory nerve from some central nerve affection.

Pathology.—When the deformity is of some standing the ligaments are shortened, and the intervertebral cartilages compressed on the affected side; while in severe cases the bodies of the cervical vertebræ undergo rotation and slight lateral compression, and their articular processes are altered in shape and direction. The affected muscles undergo more or less fibrous degeneration.

Symptoms.—The head, supposing the right sterno-mastoid to be affected, is drawn forward and toward the right shoulder, and at the same time rotated so that the chin points to the left. The left side of the neck is unnaturally convex, the right unnaturally concave, while the mastoid on that side stands out prominently, and both sternal and clavicular portions of it can be felt. The features on the affected side are, in the congenital form, markedly smaller than on the other. In severe and long-standing cases slight elevation of the right shoulder and scapula, and some lateral curvature of the dorsal spine are generally present.

Diagnosis.—Usually quite easy. From cervical caries, wry neck may be distinguished by the absence of the characteristic signs of the former, *i. e.*, pain on movement and on percussing the head or vertebræ, rigidity and thickening, the patient's inability or unwillingness to rotate his head, and the tendency of the chin to drop forward. It is also important to diagnose the spasmodic and hysterical from the non-spasmodic and congenital. In the non-spasmodic the sterno-mastoid becomes tense on trying to straighten the head, in the spasmodic it gradually yields; in the non-spasmodic it becomes relaxed on bending the head toward the affected side, but in the spasmodic contracted. The history will further distinguish the congenital from the

other forms. In the hysterical there will be other signs of hysteria, and the head can be straightened under chloroform.

Treatment.—In the congenital form, except in very slight cases in infants where exercises and manipulation alone may suffice, division of the sterno-mastoid is necessary. This, along with manipulation and exercises, will often be sufficient; but in severe cases instrumental treatment will also be required. The sterno-mastoid is best divided immediately above the clavicle, as here it is chiefly tendinous, and further removed from the important structures which lie beneath it. A puncture should be made to the inner side of the tendon, and the sheath having been opened, a blunt director should be passed beneath the muscle and the division made toward the skin with a blunt-pointed tenotome guided by the director. Tense bands of contracted cervical fascia will now generally start up. These it is not safe to divide, but they may be made to yield by forcibly rotating the head and pressing upon them with the fingers. The puncture should be allowed to heal with the head in the deformed position, which it will do in two or three days. The patient should be put through a series of exercises, consisting of various active and passive movements of the head and neck, for a fortnight or so before the operation, and go on with them again, when the wound has healed, till the deformity has disappeared, continuing for some time afterward to prevent relapse. In severer cases india-rubber bands, so arranged as to make traction in the desired direction, are used in the intervals between the exercises and at night. The spasmodic form is often very intractable. When such remedies as bromide of potassium, Indian hemp, or conium have failed, the spinal accessory nerve may be stretched. It is readily found at the spot where it enters the sterno-mastoid, the posterior belly of the digastricus, under which it previously emerges, serving as a good guide to it. In this, as in the hysterical form, the sterno-mastoid should not be divided. I have obtained the best success in hysterical cases by placing the head in the straight position in a poro-plastic collar, while giving hysterical remedies.

SCOLIOSIS, or lateral curvature, is a complicated distortion in which the

spine forms two or more lateral curves with their convexities in opposite directions; while the vertebræ involved in the curves are rotated on their vertical axis, so that the spinous processes turn to the concavity of the curves. It is more common in the young than in the old, in girls than in boys, and in the upper and middle classes than in the lower. Although most frequently met with in delicate and rapidly growing girls from fifteen to twenty-one, wanting in general muscular strength, it is occasionally seen in those who are strong, robust, and country-bred. It may also occur as one of the complications of rickets, and as the result of the falling in of one side of the chest consequent upon contraction following empyema, and in very rare instances as a congenital deformity.

Causes.—When the normal spine is inclined laterally, the pressure on the intervertebral cartilages and articular processes is increased on one side and diminished on the other. If this unequal pressure is continued for long periods, the articular cartilages, under certain conditions, will remain permanently compressed, while the articular processes become altered in direction and shape; in this way a permanent curve, either to the right or to the left, may be produced. Any circumstance, therefore, that causes the spine to incline, for long periods, to one or other side, may be regarded as the exciting cause of lateral curvature; but it must not be lost sight of that, for the exciting causes to become operative, certain predisposing conditions appear to be necessary. These may be summed up as want of tone in the muscles and ligaments, or structural weakness of the bones, such as may be induced by (1) heredity, (2) general debility, (3) the strumous diathesis, (4) rickets, (5) rapid growth, etc. The exciting causes may be classed as:

1. *Any condition causing permanent or habitual obliquity of the pelvis*, and the consequent throwing of the spine over to one side, such as a natural inequality in the length of the legs, knock knee, flat foot, congenital dislocation of the hip, use of a wooden leg, habit of standing on one leg, sitting cross-legged, etc.

2. *A one-sided position of the body* in sitting or lying down, or induced by following certain employments, such as nursing a child, carrying heavy weights, etc.

3. *Contraction of one side of the thorax* following empyema, etc.

4. *Unilateral contractions of the spinal muscles* induced by paralysis of the opposing muscles.

There are various other theories as to the cause of lateral curvature, of which space will not permit the discussion, such as contraction of the spinal muscles on one side, induced either by disease of the nervous system, or by debility of the muscles on the opposite side, unequal contraction of the serratus magnus, etc.

Pathology.—In a typical example the spine presents a double curvature, an upper dorsal and a lower lumbar, or, more correctly speaking, a dorso-lumbar. The dorsal has generally its convexity to the right, the lumbar its convexity to the left. The curvature which depends directly upon the exciting cause is called the primary; and the other, which forms in the opposite direction to counterbalance the loss of equilibrium occasioned by the first, the secondary or compensating. Either the dorsal or the lumbar may be the primary curve, and *vice versa*. Less commonly the spine forms an apparently single curve, with the convexity either to the right or to the left; but in such cases there is always a slight compensating curve above and below, although these may not be observed externally. In other instances there may be four or even five curves duly compensating each other. The intervertebral cartilages, and, to a lesser extent, the bodies of the vertebræ involved in the curve, are compressed wedge-wise, the base of the wedge looking toward the convexity of the curve; while the articular processes are contracted and flattened on the concave side, and elongated on the convex. In addition to the lateral deviation, the vertebræ forming the curves are rotated on their vertical axis, so that the front of the bodies looks toward the convexity, and the apices of the spinous processes toward the concavity of the curve. As a consequence of this rotation, although there may be considerable lateral deviation of the bodies of the vertebræ, the apices of the spinous processes may be but little deflected from the middle line. The cause of this rotation has been variously explained. The theory which has, perhaps, found most favor is based on the fact that the posterior portion of the vertebral column, being a part of the

dorsal parietes of the chest and abdomen, is confined in the median plane of the trunk, while the anterior portion of the column projecting into the thorax and abdominal cavities, and devoid of lateral attachments, is at liberty to, and physiologically does, move to the right and left of the median plane. As a result of the lateral compression and of the rotation of the vertebræ the transverse processes and ribs on the convex side are abnormally separated from one another, and are carried backward, while those on the concave side are closer together than natural and their angles form a hump in the dorsal region, and cause the scapula to be raised and to project, while those on the concave side run more obliquely than natural, so that, in severe cases, they may be in contact with the iliac crest. There is thus much distortion of the thorax and undue prominence of the left breast. The pelvis, except in cases of rickety curvature, is not, as a rule, deformed, although in severe lumbar curvature it may be obliquely placed. Of the condition of the muscles in the earlier stages very little is known; in the later they have been found atrophied and undergoing fatty degeneration.

Symptoms.—The incipient stages of lateral curvature are frequently overlooked, and it is often not until it has become well marked and permanent that the surgeon is consulted. Ofttimes the patient is brought to him for the shoulder or hip growing out, for round shoulders, or pain in the back, the parents, perhaps, declaring, if the question is asked, that the spine is quite straight. In such cases, and whenever there is a suspicion of lateral curvature, a thorough examination in drill posture, with the back fully exposed, should be made. In the earlier stages there may be but little deviation of the apices of the spinous processes, and what little there is may be made to disappear on suspending the patient or placing him in the prone position. There may be a slight projection of one scapula, however, or an apparent prominence of one iliac crest, or it may be a mere want of symmetry on the two sides of the spine, which may best be detected by placing the patient on a low seat and looking down the back from above, while along with this there will usually be more or less obliteration of the normal lumbar curve, and a general tendency to stoop.

In severer cases the deformity will generally be unmistakable, although the amount of deviation of the spinous processes, and prominence of the scapula and iliac crest will vary considerably, according to the character of the curve. In the common form, in which there is a longer dorsal curve with its convexity to the right, and a shorter lumbar with its convexity to the left, the right shoulder is generally elevated, and the angle of the right scapula and right crest of the ilium and left breast are prominent, while the backward rotation of the lumbar transverse processes on the left side cause the lumbar muscles to protrude and give a greater sense of resistance on pressing on this side of the spine. In the long and apparently single curve the deformity is often extreme. The ribs on the convex side project prominently backward, and form a hump in the dorsal region, and cause great elevation of the corresponding shoulder and projection of the scapula, while those on the left side are huddled together and depressed, in some instances overlapping the crest of the ilium. At times the single curve is confined chiefly to the lumbar region; the prominence of the crest of the ilium on the concave side, and the backward rotation of the lumbar transverse processes and the consequent projection of the spinal muscles are then the most marked feature; while at other times the curve is limited to the upper dorsal region, the chief characters then being the projection of the scapula on the convex side and the prominence of the trapezius, which may form an apparent tumor, and give a doubtful sense of fluctuation.

Diagnosis.—Lateral curvature may have to be distinguished from hysteria and from caries of the vertebræ attended with lateral instead of angular deviation. In hysteria there is no rotation, and the curve, although apparently permanent, will generally disappear on assuming the diving position and bending the back with the knees straight till the fingers touch the ground. Other evidences of hysteria will also commonly be detected, but if any doubt remains an anæsthetic should be given. In caries there is also no rotation, and pain will be elicited on motion, or on gently percussing the spine or tapping the head or shoulders.

Treatment.—The treatment must necessarily vary according to the severity



FIG. 1. Exercises for Lateral Curvature.

and nature of the deformity. When there is evidence of general and muscular debility the general health and muscular tone should be improved by appropriate remedies, avoidance of late hours, crowded assemblies, and the like. The exciting causes of the deformity must be sought for, and, if possible, removed. Thus, all occupations necessitating one-sided positions, bad habits of sitting or standing, carrying heavy weights, etc., should be avoided or given up. When there is flat foot or knock knee these should be remedied; where one leg is shorter than the other, a boot with a high sole must be worn. These means, when combined with a judicious selection of muscular exercises and partial recumbency, will generally be sufficient in slight cases to cure or greatly lessen the curvature. In severer cases the degree of improvement will be proportionate to the amount of osseous deformity; while, where there is much rigidity and confirmed structural change, little or no improvement must be expected, and it will generally be found necessary, at least in hospital patients, to employ, in addition to exercises, some form of mechanical support to prevent the curves from getting worse, to relieve pain when present, and to improve the outward appearance.

The exercises should be directed both to strengthening the spinal muscles generally, and those in particular which tend to correct the curves. Among the former may be mentioned swinging by the hands from a bar, forcibly stretching an indiarubber cord attached to the floor, the use of dumb-bells, chest expanders, the extension motions of drilling, etc. An excellent exercise is to bring the patient's body over the end of a couch or table, and then, while he is prevented from falling by an assistant holding the legs, he is instructed to alternately flex and extend the body at the hip, while the surgeon resists his efforts (Fig. 1). For strengthening those

muscles in particular that tend to straighten the curve the back should be manipulated till that posture is found in which the curves are the least marked. In this position the patient can only hold himself by muscular action, and at first for only short periods at a time. By frequently practicing this posture the muscles thus brought into play are gradually strengthened, till at last the improved position is maintained without effort. For further strengthening these muscles, the patient should exercise while in this improved position, especially employing the movements above described. For this purpose, while the patient is thus supported over the end of the table, the surgeon should make forcible pressure with his hand alternately in the dorsal and lumbar curves, at the same time bending the body to the right and left respectively.

Another device, especially indicated in lumbar curvature, is to place the patient on a seat raised several inches on the side corresponding to the convexity of the lumbar curve; the tilting of the pelvis thus produced, when the patient holds himself upright, counteracts the curves by its tendency to produce others in the opposite direction. A similar effect may be obtained by placing a high sole on the

boot, and, during riding, by sitting on the off side of the saddle. None of these exercises should be carried to the extent of exhaustion, and rest on the back for half an hour to an hour should be taken after them. The back should be further supported by the use of a reclining chair, a good substitute for which may be made by raising the front legs of an ordinary chair on two bricks. Where there is much stooping an elastic brace will be found useful, but should only be worn a few hours a day. At night time the patient should sleep on the side opposite to the dorsal curve.

In the advanced cases, where a spinal support is thought necessary, a poroplastic felt jacket or plaster of Paris case, applied during suspension, may be used; or a steel instrument, one of the many forms without arm crutches.

Antero-posterior Curvature of the Spine.—This term is generally restricted to those cases in which the spine is bent either in a backward or forward direction, as a result of unequal compression of the intervertebral cartilages. The antero-posterior curvature of the spine, depending upon disease either of the cartilages or of the vertebræ, is known as angular curvature (*see* SPINE, DISEASES OF.) When the curvature is convex forward it is called lordosis; when convex backward, kyphosis.

Lordosis.—**Incurvation**, or a curving of the spine with the convexity forward, should be regarded as a symptom rather than an actual disease. In the lumbar region, in which it is most common, and in the cervical region, it is merely an increase of the normal curve; in the dorsal region it is a reversal of it. In the *lumbar region* it sometimes appears to be hereditary; generally, however, it is there formed as a compensating curve to restore the equilibrium of the body when this is disturbed by the tilting forward of the pelvis, as in congenital dislocation of the hip, hip disease, rickets, etc. Or it may be formed as a compensating curve in caries with angular curvature in the dorsal region; or it may depend upon contraction of the psoas muscle, consequent upon inflammation or abscesses in its substance. In the *cervical region* it is generally compensatory to occipito-atloid or atloaxoid disease. In the *dorsal region* it is very rare, but occasionally occurs as a compensating curve to caries

of the lower cervical, lower dorsal, or lumbar vertebræ, and sometimes in double lateral curvature. The treatment should rather be directed to the cure of the occasioning cause than to the removal of the lordosis, which in itself is not usually of a permanent nature.

Kyphosis.—**Excurvation**, or posterior curvature, is a general curving of the spine with the convexity backward, or an exaggerated condition of the normal dorsal curve depending upon unequal compression of the intervertebral cartilages. It is often seen in infants and in delicate and rickety children who have been allowed to sit up too early or for too long periods. In girls and lads it is brought on by slouching habits, and in older persons may be acquired by occupations necessitating stooping; hence its frequency in watchmakers, clerks, agricultural laborers, etc. It may also be induced by chronic bronchitis and chronic rheumatism. Sometimes it would appear to be hereditary. In infants the kyphotic curve is most marked in the lower dorsal region, where several of the spinous processes often appear preternaturally prominent. In boys and girls and in old people the curve chiefly affects the upper dorsal region, producing the round shoulders with which all are familiar. The point of chief interest is to distinguish between the comparatively harmless kyphotic curve and angular curvature depending upon caries of the vertebræ. In children and adults it is usually easy, but in rickety infants the surgeon is unable to apply the usual tests for caries, such as the behavior of the spine in stooping or rising from the recumbent position in walking, jumping, etc.; and he is, moreover, liable to be misled by the acute tenderness and evident pain on handling that often occur in rickets. If the infant is placed horizontally with its face downward across the nurse's knees, and gently extended by the arms and legs, the rickety curve disappears or may become posteriorly concave, while the back may be more flexible than natural in its whole extent. In caries, on the other hand, the curvature remains, or is even increased, and the spine is rigid; the infant is, moreover, evidently uneasy in this position, and tries to resist the extension of the back by muscular action and drawing up of the legs. Other indications of rickets will also probably be present.

Treatment.—In the infant perfect recumbency should be enjoined, and such dietetic and hygienic measures taken as to restore the muscular tone, with appropriate remedies when there is evidence of rickets. Local support to the back, in the form of a molded leather or poroplastic jacket, is recommended by high authorities. But I prefer trusting, as a rule, to recumbency. In growing lads and girls slouching habits should be corrected, and a system of muscular exercises instituted, combined, when there is debility, with periods of recumbency and attention to the general health. A spinal brace should also be worn for a few hours daily. In the confirmed kyphotic curve of old age treatment is of little avail.

Club Hand.—Several rare deformities of the hand, depending upon a contracted condition of the muscles or malformation or absence of some of the bones of the forearm and hand, have been included under this term, on the supposition that they were analogous to club foot. The most common of these deformities, perhaps, is that in which the radius and one or more of the bones of the carpus and the thumb are absent, the hand being fixed in the position of flexion and abduction. Space will not permit of a further account of these conditions, nor is this much to be regretted as they can have little or no interest for the practical surgeon.

Club Foot.—See CLUB FOOT.

Bow Legs, or genu varum, is a deformity in which, when the malleoli are placed in contact, with the knees fully extended and the patellæ looking directly forward, the knees, instead of being in contact, are separated from each other by a variable interval. As in knock-knee, both legs, or one leg only, may be affected, or there may be genu varum on one side and valgum on the other. It is frequently associated with a bowing outward of the shaft of the tibiæ, just below the upper epiphysis, or at their lower thirds, and sometimes with a bowing of the femora as well. The symptoms are self-evident, and what has been said of the cause, pathology, and treatment of genu valgum will nearly apply to genu varum, if external be substituted for *internal* in the phraseology. Where the tibia and fibula are much curved, and the bones have become consolidated in the deformed posi-

tion, either subcutaneous linear osteotomy or the removal of a wedge-shaped piece from the tibia, with fracture of the fibula, may also be required.

Deformities of Great Toe.—**Hallux valgus and hallux varus** are terms applied to a deformed and partially dislocated great toe. In *hallux valgus*, the great toe at the metatarso-phalangeal joint is abducted and partially dislocated from the metatarsal bone, and crosses in extreme cases either over or under the second and even the next toe. The deformity is generally attributed to wearing too short or narrow-toed boots, but long-standing gout and rheumatism are thought by some to have some share in its production. The little toe is often dislocated inward at the same time, while the other toes are drawn up claw-like to make room for the great and little toes below them. In long-standing cases the external lateral ligament becomes shortened, and the head of the metatarsal bone distorted and thickened by absorption and the deposition of new bone around; while in consequence of the continued chafing and pressure of the boot the skin over it becomes callous, and a bursa is generally produced. This bursa is very apt to become inflamed, and is then known as a *bunion*; or it may suppurate and produce an intractable ulcer; or, should it communicate with the joint, this also may be attacked, leading to caries and necrosis of the bones or to ankylosis. In old people such an ulcer may become a starting-point of senile gangrene.

Treatment.—Slight cases are readily remedied by wearing properly shaped boots and by avoiding too long standing and over-walking. The boot should have low heels and square toes, be straight along the inner edge and sufficiently long and wide to allow plenty of room for the toes to resume their normal position. In severer cases some form of apparatus for drawing the toe into its normal position must be employed. Thus a chamois leather cap may be worn over the toe, from which a piece of elastic webbing passes along the inner side of the foot and is fixed round the heel by bands of adhesive plaster: or a steel sole plate, having partitions of a soft material for separating the toes, may be worn in the boot, or a wedge may be fitted to such a plate to keep the great toe from its neigh-

bor. At night a light shoe, provided with a bunion spring, may be worn. "This spring has an oval opening over the bunion to avoid direct pressure on the affected joint, and the toe is gradually everted by a small strap passing round it, fixed to the end of the spring."

The bursa should be protected by soap plaster, and, when enlarged and painful, painted with tincture of iodine, or rubbed with biniodide of mercury ointment. Should it suppurate, a free incision should be made and a poultice applied. The ulcer met with in this situation usually requires a stimulating treatment; but when the opening is small and the skin undermined, it should be laid freely open and the redundant skin cut away. In some cases amputation of the toe may be necessary.

Hallux varus is very much less common than *valgus*. In it the great toe is partially displaced inward and carried away from the other toes, instead of toward them as in *valgus*. It may occur in talipes equino-varus, in knock-knee, in some paralytic affections, from contraction of the abductor pollicis, etc. Should it continue after removal of the cause, a properly shaped boot must be worn to keep the toe in place, but tenotomy of the abductor pollicis may be required.

Hammer toes.—This term is applied to a condition of the toes in which the first phalanx is extended and the second and ungual flexed, so that the toes present a clawlike appearance. It is generally present, as has been stated, in talipes equinus and cavus, and in hallux valgus, but may be met with as an independent affection from wearing too short boots. It is then generally limited to the second or third toe, over the dorsal surface of which corns commonly form. Tenotomy of the extensor tendons, and even amputation of the first phalanx, may be necessary.

Supernumerary digits are frequently associated with other deformities as webbed fingers or toes, double hands or feet, club foot, etc. They appear to be hereditary, and often occur in several members of the same family. There may be simply an increase in the number of fingers or toes, the extra digits being either of normal size, or, as is more frequent, shorter and smaller. But the most common abnormality is a shrunken and malformed little finger or thumb, at-

tached excrescence-like by a pedicle, often consisting merely of skin, though sometimes containing a slip of tendon. An extra toe often causes no inconvenience, and need not be interfered with; but a supernumerary finger should, as a rule, be amputated at an early period. As it may articulate with the metacarpal bone by a joint common to it and the normal finger, it is better to saw through the phalanx close to the articular surface rather than to disarticulate.

Congenital hypertrophy.—This rare condition is generally limited to one or more digits, but it may affect the whole of one or more limbs. It may involve all the tissues of the affected part, or be limited to the bone or to the skin and subcutaneous tissue. Sometimes it takes the form of a distinct excrescence consisting of subcutaneous tissue and fat. The removal of the affected part, where this is practicable, is generally indicated.

Deficiency of bones.—Almost every bone in the body has been found in part or wholly deficient. Among the most common of such deficiencies may be mentioned absence of the radius with part of the carpus and one or more fingers in the upper extremity, and of the tibia, with deficiency of some of the tarsal bones, and bones of the toes in the lower. Little can be done in the form of surgical treatment, but in the case of the lower extremity some form of leg iron may be found that will aid the patient in walking.

SURGICAL KIDNEY (Consecutive Nephritis).—These terms have been given to certain affections of the kidney which are secondary to disease of the lower parts of the urinary tract. They are of several kinds.

1. Simple Distention is produced when there is obstruction to the free passage of urine from the bladder or from the ureters. The urine secreted above accumulates, and gradually distends first the ureters, then the pelvis of the kidney. Afterward, increasing pressure causes atrophy of the kidney substance in the manner described in HYDRO-NEPHROSIS (*q. v.*). A certain amount of interstitial inflammation is always found in the distended kidney.

2. Pyelitis, Pyelo-nephritis, and Pyo-nephrosis are occasionally the result of

extension of inflammation from the bladder along the ureters to the pelvis of the kidney.

3. Acute Suppurative Nephritis.—This is the most characteristic form of "surgical kidney." The kidney is enlarged; its capsule peels off easily; the color is yellow, mottled with red; the cortex is increased in size. Scattered through the kidney substance numerous small abscesses are observed, which vary in their distribution and shape. Some are found lying between the capsule and the kidney or but slightly invading the kidney substance; these are rounded in shape. Others are seen to be situated entirely in the cortex of the kidney, and are of an elongated wedge shape, having the base at the periphery of the cortex. A third kind is found in the medullary portion, and has the form of long yellow streaks running parallel to the straight tubes of the kidney.

On *microscopic examination* it is seen that in addition to the abscess formation there is a considerable amount of cell infiltration of the general interstitial tissue of the kidney, together with proliferation, swelling, and degeneration of the cells of the tubules. In fact, combined with the suppuration, there is interstitial and parenchymatous nephritis. By suitable staining agents colonies of micrococci can be demonstrated in various parts of the kidney substance.

4. Interstitial Inflammation.—When this affection is present in the acute stage the kidney has the appearance just described as characteristic of the preceding variety, but without the points of suppuration.

In the chronic stage the kidney is smaller than normal, the capsule is adherent and the surface granular, in color yellow, mottled with gray. The cortex is diminished in extent. On microscopic examination the interstitial tissue is found to be increased in amount, and the glomeruli and tubules more or less atrophied and degenerated.

5. The Cicatricial Kidney is the final result of some of the former varieties. It is produced by the absorption of the abscesses and the formation of a cicatrix, and by the still further contraction of the increased interstitial tissue. The kidney is irregular in form, always diminished in size, and is converted into a mass of

fibrous tissue in which but few renal elements can be detected.

The mechanism of the acute suppurative and of the acute interstitial nephritis, is still a matter of dispute.

A number of theories have been advanced to explain the conditions, but it seems certain that the most typical form of "surgical kidney," the acute suppurative nephritis, is produced by the access to the kidney of septic matter proceeding from the bladder. Dr. Johnson has suggested that, by rupture of urinary tubules, there may arise extravasation of urine into the interstitial tissue. Dr. Dickinson holds that the septic urine, retained in the pelvis and straight tubes of the kidney under some pressure, transudes into the blood vessels. The poisonous matter is then carried by the veins to different parts of the organ, and is here and there localized in septic thrombi of these vessels. Mr. Beck, on the other hand, asserts that it is the lymphatics of the kidney which are mainly concerned in disseminating the poison; that they absorb it from the pelvis and straight tubes, whither it has come from the bladder. The irritating fluid causes desquamation of the epithelium of the tubules and so makes way for its ready absorption.

Dr. Steven has shown that the abscesses which are found in the medullary portion of the kidney are the result of septic poison which reaches the kidney by means of the tubules, but that the wedge-shaped abscesses which lie in the cortex, and between the cortex and the capsule, are caused by septic material absorbed by the lymphatics. He has proved that the lymphatics of the kidney can be injected from those of the ureter, and that they pass in from the border into the cortex of the kidney in the direction of the wedge-shaped abscesses. He believes that the inflammation of the kidney is due to septic poison absorbed from the bladder or the pelvis of the kidney and conveyed by the lymphatics.

Symptoms.—Simple distention of the kidney and ureters causes no symptoms which can be distinguished among those of the cystitis or other trouble which is the primary cause of the condition.

Chronic interstitial nephritis, which usually to a greater or less extent accom-

panies simple distention, may also give rise to no recognizable symptoms. It may, however, cause the urine to be increased in quantity and to be of low specific gravity. Any other signs which might have been expected are masked by the inflammatory products from other sources which are added to the urine.

Similarly, the extension of inflammation from the bladder to the pelvis of the kidney is often accompanied by no increase in severity of the symptoms and no further alteration in the condition of the urine. The cells discharged from the pelvis of the kidney so closely resemble those of the mucous membrane of the bladder that no reliance can be placed upon their discovery, as an indication of pyelitis. On the other hand, in typical cases, the presence of more fever and more severe constitutional symptoms than the bladder or urethral mischief will account for would raise a suspicion of the affection of the higher portion of the tract. Other signs which may be present are a large discharge of pus in a but faintly ammoniacal urine, and tenderness in the loins. Further, it must be remembered that when these symptoms being present are nevertheless not well marked, the fact of the primary trouble having existed for some years renders it very probable that the kidneys are also affected. When the accumulation of pus has reached the stage of pyo-nephrosis (*q. v.*) the ordinary symptoms of that condition will be present.

Acute or subacute interstitial nephritis gives rise to a febrile temperature, sometimes only observed at night, and together with this there are emaciation, pallor or sallowness of the complexion, and great and progressive weakness. Digestive troubles are marked. The tongue varies in its appearance; it may be clean or furred, dry or moist. Nausea, and sometimes vomiting, are noticed. Either obstinate constipation or diarrhea may be found. The pulse is frequent and feeble. The urine gives no reliable indications, nor is there any acute pain or tenderness in the loins, although an aching or dragging sensation may be complained of.

When such symptoms come on acutely, with rigors or chills after the passage of an instrument, or after some operation upon the bladder or urethra, little difficulty will be experienced in diagnosing

the condition. On the other hand, as in the chronic form, the disease may be insidious and incapable of recognition.

Acute suppurative nephritis gives rise to similar but more marked symptoms. Particularly it must be noticed that the temperature is much higher and subject to great variations. Rigors and sweatings are pronounced, and somnolence and torpor, with muttering delirium, may be observed in the later stages. The pupils may be either normal or contracted. Pain and tenderness in the region of the kidneys is often complained of.

Prognosis.—The prognosis of all the secondary forms of kidney disease is very grave. They increase greatly the danger of instrumental interference with the primary affection, and, indeed, no operation should be performed until an attempt has been made to alleviate the symptoms of interstitial nephritis, if these be present. At the same time it may be stated that treatment adapted to allay irritation from the primary disease often leads to great diminution in severity of the secondary affection, and even to an apparent but temporary cure.

Treatment.—These secondary affections must be treated on the same lines as the same conditions when occurring primarily. The rules for such treatment will be found on reference to the articles on these various subjects. It will suffice here to say that the patient must be kept at complete rest, and on a light fluid diet, while quinine and opium are of use to allay the constitutional symptoms. Cystitis, with decomposition and retention of the urine, should be treated by washing out the bladder.

ROBERT MAGUIRE.

SWEAT GLANDS, DISEASES OF THE.—The diseases of the sweat glands are principally of functional origin, being due to an alteration either in the amount or in the nature of the fluid secreted. Anidrosis and hyperidrosis are the affections in which there is a quantitative change; bromidrosis, chromidrosis, and uridrosis, those in which there is a qualitative change in the secretions.

Anidrosis.—A deficient excretion of sweat occurs in the early stage of febrile disorders, in diabetes, and in Bright's disease; it is also found as a secondary

phenomenon in various affections of the skin—*e. g.*, ichthyosis, scleroderma, anæsthetic leprosy, prurigo, eczema, and psoriasis. It may result from personal uncleanliness and the consequent accumulation of effete epidermis blocking the sweat ducts. Occasionally, also, persons are found who never perspire, even after violent exertion on the hottest days, but who present no appreciable structural peculiarity of the skin; such persons are usually of phlegmatic temperament, or in a high condition of "training," which appears to have a steadying effect upon the peripheral circulation.

Treatment.—Turkish or vapor baths are generally useful, and the re-establishment of sweat secretions gives the greatest relief—*e. g.*, in chronic renal disease, scleroderma, and ichthyosis. The undoubted utility of subcutaneous injections of pilocarpin (gr. $\frac{1}{10}$ – $\frac{1}{3}$), in severe prurigo with dense infiltrated patches of skin, is probably also the result of the gradual re-establishment of the sweat secretion.

Hyperidrosis.—A condition of excessive secretion from the sweat glands. It occurs in most diseases accompanied by pyrexia, especially in acute rheumatism and pyæmia; it is a striking feature in the third stage of ague and in the hectic of phthisis and rickets; it is also produced by the action of certain drugs, especially pilocarpin, antipyrin, and the salicylates. In these cases the increased secretion is general all over the body and is purely a symptom, not a disease in itself. The sweat is usually normal in character or rather more watery than natural, and it is poured out freely on the surface of the skin. Sometimes, however, it does not escape so readily owing to blocking of the duct from swelling of the structures through which it passes; the sweat then accumulates under the superficial horny layers of the epidermis to form small, clear, transparent vesicles called **Sudamina**, from their transparency; these have very much the appearance of drops of water on the skin, but, of course, cannot be wiped off. They are principally found on the neck, chest, back, and abdomen; they form rapidly, but when once formed do not increase in size, nor coalesce to form bullæ, but remain always discrete. In a few days the fluid is absorbed, the vesicle dries up, and there is slight desquamation of the epi-

dermis over the part. In a certain number of cases the appearance of miliaria seems to be independent of excessive secretion of sweat. Sometimes the contents of the vesicles become cloudy, milky, or semi-puriform in character, a condition called **Miliaria alba**; it is especially likely to occur over regions to which poultices have been applied.

Inflammation may be set up in the tissues surrounding the sweat glands, secondary to the retention of sweat. This gives rise to some redness round the vesicles, accompanied by slight itching; the contents often become purulent; the eruption is copious and thickly set, so that the skin assumes a vivid red color, hence the name of **Miliaria rubra** applied to the condition.

The **Red Gum** or **Strophulus** of infants is in reality a miliaria rubra, and generally results from too much wrapping up; it was previously described as a form of lichen and confused with lichen urticatus.

Prickly Heat (Miliaria Papulosa or Lichen Tropicus).—A disease which usually occurs among people in hot climates, but persons who have once been affected are liable to suffer from recurrences even in temperate climates, after long intervals, and without the usual exciting cause. A condition of affairs exists opposite to that which obtains in miliaria rubra, in that the inflammation around the orifices of the ducts of the sweat glands is primary and gives rise to obstruction of these ducts and so to retention of their secretion, while in miliaria rubra the inflammation is secondary to retention. The eruption appears suddenly on a portion of the body and usually over extensive areas, but affects especially the forehead and back; it is accompanied by violent itching and there is also profuse perspiration.

Local Hyperidrosis.—Besides the above general hyperidrosis a state of excessive sweating sometimes occurs in which a limited portion of the body or certain definite, symmetrical areas are affected. This occurs under two conditions: (1) as a symptomatic phenomenon associated with lesions or functional disturbances of the nervous system, and (2) as an apparently idiopathic condition. (a) The connection of the nervous system with the secretion of the sweat glands has been clearly demonstrated by physiological experiments. When the sympathetic is paralyzed, or the sensory nerve

is stimulated, or the vasomotor nerves supplying a part are divided, profuse sweating occurs there, and it has been found that in certain cases of hemiplegia profuse sweating has occurred on the affected side, the determining factor of which has, however, not been ascertained; the same has been observed in other cases—*e. g.*, a tumor of the meninges pressing on the spinal cord, division of nerves by injury, the sweating of one side of the face after parotid bubo pressing upon the facial nerve. Local hyperidrosis is an occasional sequela or concomitant of neuralgia affecting the fifth nerve or any of its branches. The writer has also observed a case in which violent suboccipital neuralgia recurred every night for years, lasting about two hours, when a copious localized sweat broke out giving complete relief to the pain and allowing sleep. The patient had syphilitic disease of the bones of the base of the skull.

(*b*) In the other condition, without previous or concomitant symptoms, there is a constant or periodic hyperidrosis of certain definite parts of the body, the feet, hands, axillæ, groins, pubes, and perineum being the regions chiefly affected. The amount varies from a mere clammy moisture of the parts to a copious, continual dripping of sweat, and the subjects of the disease are often neurotic or alcoholic. The sweating produces soaking and maceration of the epidermis of the affected part, which becomes opaque and sodden and soon peels off, leaving a red, tender, weeping surface. A secondary eczematous condition often results, especially when the hands, feet, and genital region are affected, and to this category belongs the disease described as dysidrosis by Tilbury Fox. The affection is fairly common, especially among the lower classes, and is chronic. It is said to be congenital and is sometimes hereditary, affecting various members of the same family.

Associated with this is the affection termed **Bromidrosis**; the connection between the two will be described later.

Treatment.—For general hyperidrosis no special treatment is usually required. For the night sweats of phthisis, when excessive, atropine (gr. $\frac{1}{20}$ – $\frac{1}{60}$), picROTOXIN (gr. $\frac{1}{60}$), arsenic, belladonna, strychnine, and oxide of zinc are especially useful drugs.

In the chronic local form of the disease great improvement can be effected by appropriate means. The clothing worn next to the skin ought to be made of flannel or wool, which absorbs the sweat. Various methods of medicinal treatment have been recommended—*e. g.*, belladonna, atropine, ergot, agaricin, bitter tonics with the mineral acids, etc., etc., while Crocker strongly recommends precipitated sulphur in dram doses in milk, twice daily. The parts may be washed with warm water and carefully dried, after which astringent lotions containing acetate of lead, alum, tannin, or hazeline may be employed. More efficacious, however, is powdering the parts with finely divided boracic acid, which may, with advantage, be dusted over the feet and hands, and into the stockings, boots, and gloves every day. Salicylic acid, three per cent., with starch and oxide of zinc or powdered talc is also most useful, but all these measures are merely temporary, and, after discontinuing their use, the condition is apt to recur. In such cases the following treatment, recommended by Hebra, is generally curative: the feet are to be well washed and thoroughly dried; a dressing made of about equal parts of linseed oil and diachylon plaster melted together with one to two per cent. of salicylic acid and spread on linen, should be applied to the foot, enveloping it entirely, pledgets being inserted between the toes. This dressing is to be removed after twelve hours, the foot rubbed with dry cloths and powdered with starch, and the dressing reapplied. This must be repeated twice a day for a week or fortnight, when it will be found that the outer layer of epidermis will peel off, leaving a white surface, and the hyperidrosis will have permanently disappeared.

Preventive treatment is most important in persons liable to prickly heat; they ought to avoid excessive heat and chills, and should be careful to wear woolen clothes both night and day, instead of cotton or linen. The irritation can be relieved by lead, or lead and milk lotion, by calamine lotion (3 j ad $\bar{5}$ j), or by dusting powders of zinc oxide or salicylated starch.

Bromidrosis (Osmidrosis).—An affection in which the sweat has a disagreeable odor. The condition is generally, if not always, associated with chronic local

hyperidrosis, especially of the feet; the subjects are very frequently female domestic servants, and the disease is peculiarly distressing as the odor is sickly, rancid, and penetrating. In a few recorded cases, the odor has been considered agreeable, as of flowers—*e. g.*, roses, violets. A specific decomposition takes place in the sweat, due to the presence of demonstrable micrococci and bacteria (*bacterium fetidum*) which, however, are always present in the macerated epidermis between the toes of uncleanly persons. The sweat, when first secreted, is inodorous, and probably a great part of the stench is due to the simultaneous decomposition of sebum and the formation of acids of the fatty series. The situations affected are those of hyperidrosis generally, and the treatment is similar, special value being attached to powdering with salicylic acid and starch. German soldiers, who appear to be very prone to the affection, are in the habit of rubbing suet containing two per cent. of salicylic acid into the feet night and morning. When the palms are affected, pure silicic acid (*terra silicea*) is even more effectual than salicylic acid.

Chromidrosis (*Colored Sweat*) is of very rare occurrence, but authentic cases are on record of all the following:

(a) *Black sweat* (*Seborrhea vel Steatorrhea nigricans*) occurs usually in hysterical girls, the part affected being the face, generally above the eyelids; the affection is usually symmetrical. It is certainly frequently associated with chronic constipation, which probably stands in causal connection to it, indican being excreted by the sweat and sebaceous glands, and becoming oxidized to give rise to the dark color. The amount of pigmentation varies from day to day, and is generally worse before a menstrual period. It forms a deposit on the skin which is washed off with great difficulty, unless ether or chloroform be used. The condition is sometimes simulated by hysterical or designing women.

(b) *Blue or green sweat* is sometimes seen in copper workers; it has also been attributed to taking large doses of iron medicinally.

(c) *Red sweat or hematidrosis* may be due either to a micro-organism causing decomposition of the sweat after its secretion, in which case it occurs especially in the axillæ and genital region, or it may

be due to an exudation of blood into the sweat gland. This condition sometimes occurs in hysterical persons.

Uridrosis, or the excretion of urea in large quantities in the sweat, is observed in cholera, atrophy of the kidneys, and uræmia, when the renal functions are in abeyance. The sweat assumes a distinctly urinous odor, and the urea reactions in it are easily obtained.

J. J. PRINGLE.

Symptomatic Indications.—*Belladonna* is useful for general sweat, with enuresis; sweat during sleep; sweating of phthisis. *Cinchona*, in exhausting night sweats, profuse sweats, with chilliness on moving. *Opium*, in exhausting diseases, burning sweat on body. *Veratrum alb.*, general cold sweat, worse on forehead; clammy, yellow; deathly pale face. *Calcarea carb.*, profuse sweat from least exercise, most profuse on head and chest. *Mercurius*, sour sweats. Fetid sweat, particularly on the feet, may be relieved by *silicea*. For strophulus *apis mel.* is the best remedy.

SYCOSIS (*Folliculitis Barbæ*; **Sycosis Non-parasitica**).—An inflammation of the hair follicles and perifollicular tissue, usually chronic, characterized by the presence of pustules, tubercles, and occasionally dermic abscesses or fungating excrescences, accompanied by tenderness or burning sensations, and sometimes resulting in scarring and permanent loss of hair. The disease is almost exclusively confined to the male sex, and affects chiefly the hairs of the mustache, beard, and whiskers; it occurs between the ages of twenty and fifty, and, if not treated, may persist for years. An absolutely identical process, to which the name of **Folliculitis** is attached, may affect the hairs of the scalp, axillæ, and pubes, either primarily or as a sequela of eczema in these situations.

Eruption.—The appearance presented by true non-parasitic sycosis is subject to great variation according to the duration, acuteness, or chronicity of the affection, but pustules perforated at their apex by a hair are invariably present. The mustache is frequently the original site of the disease. The hairs in the earlier stages are firmly attached, and their extraction is painful, but afterward they lie loosely in the disorganized and patulous follicles, and are easily extracted without pain.

In either case they exhibit no fungus under the microscope, but are swollen down to the root from serous infiltration, and the inner root-sheath, which is often detached along with them, may be mistaken for a fungus. Serum, pus, or sanguineous fluid oozes out along the hair-shafts or is poured out from the distended follicles after the hairs have fallen or been removed, and the discharges collecting among the neighboring hairs dry up to form yellow crusts. The progress of the inflammatory process in the perifollicular tissue (which appears generally to be primarily involved) leads to the formation of large, indurated, prominent tubercles, practically identical with the condition of the scalp known as kerion; these, however, are a more prominent feature of parasitic sycosis (*Tinea Barbæ*); from their inflammatory destruction fungoid excrescences or dermic abscesses are formed, the healing of which is accompanied by cicatrization. The scars are frequently the starting-point of cheloid formation. Relapses are common, and persistent treatment is indicated even after apparent recovery.

Ætiology.—The disease affects all classes, and persons who shave as well as those who do not; personal uncleanliness is, nevertheless, undoubtedly a predisposing cause. A large proportion of its victims are in poor general health or suffer from overwork. A specially severe form is sometimes communicated from cattle to man. The immediate causative agent is not known; some attribute the disease to the irritation produced by the growth of a young hair into a follicle before the old hair has fallen, or to excessive size of the hair-shaft; irritant cosmetic applications, blunt razors, etc., may produce it. There is reason to believe that the exuded pus is infective, suggesting the possibility of a specific micro-organism. The use of the microscope is in all cases necessary to establish a certain diagnosis, especially to distinguish it from *tinea barbæ*. It may also be confounded with acne, eczema, lupus, and pustular syphiloderma.

Treatment.—(1) Constitutional treatment is beneficial; iron, quinine, strychnine, arsenic, and cod-liver oil being the remedies generally indicated. In some cases the perchloride of mercury appears to be very serviceable, and Donovan's solution has been specially advocated.

(2) Local. The hair must be cut short or very carefully shaved with a sharp razor every day or two. All crusts must be removed by poultices or oil; if the process be very acute and painful, soothing tepid lead lotions ought to be applied. If more chronic, epilation is certainly the best means of cure; the skin having been steamed or bathed in hot water, epilation of the loose hairs only ought to be effected with forceps; each hair being seized separately, a small area ought to be epilated daily, mild mercurial or sulphur ointment being smeared on afterward, and applied on strips of lint during the night. In the latest stages Unna's zinc-ichthyol salve-muslin is very useful. After recovery, enjoin great personal cleanliness.

J. J. PRINGLE.

Symptomatic Indications.—*Thuja, nitric acid.*

SYMPATHETIC SYSTEM, AFFECTIONS OF.—It is necessary to consider separately the affections of the sympathetic nerves and of the sympathetic ganglia.

Sympathetic Nerves.—**A. Cervical sympathetic nerve.**—Many attempts have been made to stimulate this nerve in the human subject during life by placing one electrode over it, usually just beneath the lobule of the ear, and the other on some indifferent point. The nerve is so deep that by the time the current reaches it, it must have diffused through so many important structures that it is impossible to be sure that the results which follow its passage are due to its influence upon the nerve. We are, therefore, in our study of the cervical sympathetic nerve in man, confined to cases in which it has been damaged by wounds, tumors, abscesses, or aneurisms.

(1) The cervical sympathetic nerve contains fibers whose section causes *dilatation of the vessels of the head and neck* on the same side, and whose stimulation causes them to contract. Many cases prove that when in man the sympathetic in the neck has been destroyed from any cause, the affected side of the head shows well-marked dilatation of the blood vessels which derive their nerve-supply from the nerve above its point of destruction. No observations have yet

been made in man which prove that the vessels of the brain are dilated. The retinal and conjunctival vessels, as a rule, are normal, although in some of the lower animals they are dilated after section of the cervical sympathetic. It must be remembered that there are many individual differences in different animals in the distribution of the sympathetic nerves; probably in some the whole of the intracranial contents receive their sympathetic supply from the nerves which accompany the vertebral arteries. In man, as in rabbits, the vascular enlargement may last for years. If a tumor irritates the nerve the vessels contract.

(2) There has been a *rise of temperature* on the affected side after destruction of the sympathetic in the neck in all cases in which it has been carefully taken. For example, in one case it was 36.7° C. in the ear on the affected side, and 35.8° C. in the ear on the other side. In one patient in whom the nerve was supposed to be irritated the temperature was lower on the affected side.

(3) *The Pupil*.—All the recorded cases show that, if the sympathetic in the neck be destroyed, the pupil on the same side contracts; if the nerve be irritated, it dilates. The contracted pupil reacts to light, to accommodation, to atropine, and to eserine. Contraction of the pupil is the most constant symptom of destruction of the sympathetic nerve both in man and in the lower animals. It remains contracted for years. As the sympathetic fibers for the pupil leave the spinal cord chiefly by the second thoracic nerve, affections of the roots of the spinal nerves in this region such as, for example, occur in spinal pachymeningitis and in certain cases of aneurism, cause contraction of the pupil, and as the pupillary sympathetic fibers pass down in the cord from the brain to the second thoracic nerve, it follows that disease of the cervical spinal cord will, if it destroy these fibers, cause contraction of the pupil. Irritation of the cervical sympathetic causes dilatation of the pupil.

(4) *Retraction of the Eyeball* is in the lower animals often observed to follow destruction of the sympathetic nerve, and it has also been seen in some cases in man. In the lower animals it is apparently due to paralysis of the orbitalis muscle of Müller, but in man this is so

imperfectly developed it is difficult to believe it can have any functional activity.

(5) *Narrowing of the Palpebral Aperture* follows upon destruction of the cervical sympathetic in about eighty per cent. of the cases. It is almost always observed after experimental division in the lower animals. The narrowing is due to an affection of the smooth muscles of the lid, its striped muscles are unaffected. Irritation of the sympathetic in the neck has been known to cause a widening of the opening.

(6) *The Secretion of Sweat*.—In the lower animals a diminution of the secretion is observed on the same side of the head and neck as that on which the nerve was divided. In man the evidence on this point is conflicting. In the majority of cases the secretion is diminished on the side of destruction of the nerve, but in a few it is increased; we cannot explain these differences.

(7) *The Secretion of Saliva*.—In the lower animals there is usually a diminution on the side of destruction of the nerve; in man sometimes there is a diminution, sometimes an increase. The reason for these differences is unknown.

(8) *The Lachrymal Secretion*.—In the lower animals this secretion has been observed to be deficient on the side of section of the nerve, and the same result has been noticed in two cases in man.

(9) *Trophic Changes*.—In young animals, if the cervical sympathetic nerve be divided, there is often slight hypertrophy upon the affected side, and also an increased growth of hair. In man, four cases are on record, in which, after injury of the nerve, there was slight facial hemiatrophy; the bones and hair were not affected. It will be observed that these changes are just the reverse of those which occur in the lower animals. The cause is not clear.

No other symptoms than these nine are known to be due to extrinsic lesions of the cervical sympathetic nerves in man, except that occasionally, if the nerve be destroyed, there is slight internal strabismus, because the external rectus is to a small extent supplied by the cervical sympathetic.

The order in which the commoner symptoms appear after destruction of the nerve is usually the following: Contraction of the pupil, narrowing of the palpe-

bral fissure, vascular dilatation, rise of temperature, and alteration in the secretion of sweat.

Wagner stimulated the cut sympathetic in the head of a decapitated criminal, and obtained dilatation of the pupil.

Migraine, exophthalmic goiter, angina pectoris, and facial hemiatrophy have all been attributed to intrinsic disease of the cervical sympathetic nerve, but this nerve has never been shown to be diseased in these maladies, and there is no doubt that the theories which attribute them to disease of it are incorrect. We do not know of any intrinsic lesions of the cervical sympathetic.

B. Vasomotor nerves.—In peripheral neuritis, the vascular and trophic changes sometimes observed are no doubt due to affection of vasomotor fibers which form part of the nerve which happens to be inflamed (*see* TROPHIC NERVES). Fagge has recorded a case in which a growth involving the nerve-roots at the upper part of the thorax caused vasomotor changes in the fingers, due no doubt to implication of sympathetic vasomotor fibers. Dr. Sharkey has recorded a case in which alcoholic neurosis of the vagus caused acceleration of the heart (*see* also Splanchnics).

C. Splanchnics.—There are few cases in which these were diseased. In one, injury to them was followed by paralytic distention of the stomach, and in another diabetes was associated with neuritis of the splanchnics. This is possibly the explanation of some cases of diabetes, for the splanchnics are the vasomotor nerves of the liver, and irritation of them will lead to dilatation of the hepatic vessels, a condition which, in the lower animals at least, is followed by glycosuria.

Sympathetic Ganglia.—Many authors have described as extrinsic lesions of these bodies œdema, hyperæmia, accumulation of fat, and hypertrophy. The only extrinsic lesions of the sympathetic ganglia, however, that are known are their invasion by neighboring malignant growths. The writer has examined two cases in which the semilunar ganglia were involved in cancer of the pancreas. In both of them it was interesting to see how the cancer cells grew along and replaced the nerve fibers in the ganglion, so that, in section, masses of cancer cells could be seen surrounded by the hard fibrous tissue of the ganglion. This

mode of growth was probably due to the fact that the nerve fibers offered least resistance. We know of no symptoms which can with certainty be ascribed to destruction of sympathetic ganglia. No conclusions can be drawn from the size of the larger sympathetic ganglia, for even in health they vary more in size than do any other organs in the body.

Many diseases have been attributed to intrinsic lesions of the sympathetic ganglia, but it is normal in the human adult for the cells of the superior cervical and semilunar ganglia to be small, granular, and pigmented. It is probable that the larger sympathetic ganglia in man are functionless, being, like the appendix cæci, remnants of organs which, in the lower animals, have some function. The reasons for this statement are that in human fetuses, and in animals lower in the scale than man, the cells are well formed, typical nerve cells, not atrophic, as in man; that the size of the larger ganglia is in human fetuses, and in most species of lower animals, constant, but in adult man it is very inconstant; and, lastly, that in man destruction of the ganglia by disease produces no symptoms which can be referred to the loss of the ganglion.

The following diseases have been attributed to lesions of the sympathetic ganglia:

Diabetes.—The changes which have been described in the semilunar ganglia in this disease are pigmentary atrophy of the cells and an increase of the connective tissue; but both these conditions may frequently be met with in patients who have not had diabetes.

Addison's disease.—The medullary part of the suprarenal capsules is derived from the sympathetic system. Probably it is, like the larger sympathetic ganglia, functionless in adult man, for it is often small in proportion to the size of the whole organ, and even shortly after death is frequently found broken down, while, in fetuses and the lower animals, it is larger in proportion to the whole organ and is firm and hard. It is extremely likely that the change often found in the suprarenals in Addison's disease is not the cause, but only a very frequent symptom, of the malady. Congenital absence, cancer, and lardaceous disease of the suprarenals in man and their extirpation in the lower animals do not produce

Addison's disease. Occasionally the characteristic change may be found in the capsules without any other symptoms of Addison's disease ; and lastly, sometimes the other symptoms of Addison's disease are found, and the characteristic change in the capsules is wanting, for they are only atrophied. These considerations have led some pathologists to believe that disease of the semilunar ganglia is the cause of Addison's disease ; but this view is probably incorrect, for extirpation and cancer of the semilunar ganglia do not give rise to Addison's disease. Those cases which have been examined microscopically have only shown changes common in many persons who have had no symptoms of Addison's disease, and lastly, it is probable that in adult man the semilunar ganglia are functionless. We are, in fact, completely in the dark as to the cause of Addison's disease.

Exophthalmic goiter.—The view used to be held that this malady depended upon disease of the superior cervical ganglion, but it is now discarded because physiology gives no support to the supposition that the superior cervical ganglion can influence the heart or thyroid, and because the changes in the ganglion observed in exophthalmic goiter can frequently be found in other diseases.

Myxœdema.—In this disease the connective tissue of the sympathetic ganglia shows the same sodden appearance that it presents elsewhere.

The sympathetic ganglia have been said to be diseased in chronic Bright's disease, epilepsy, acromegaly, progressive muscular atrophy, tabes dorsalis, general paralysis of the insane, lead poisoning, and syphilis, but all these statements are based upon faulty observation.

Numbers of maladies have been ascribed to functional disease of the sympathetic ganglia and nerves, but in no case is there any sound justification for such an hypothesis. We have no knowledge that the smaller sympathetic ganglia are ever diseased in man.

W. HALE WHITE.

SYNCOPE (Faintness).—A sudden loss of consciousness and motor power due to cardiac failure.

Symptoms.—The onset is more or less sudden (where heart disease exists it may be very sudden), the person turns pale, becomes giddy, and, if not seated, staggers.

The skin is pale and clammy ; the pupils are dilated and the eyes closed ; the pulse is weak, frequent, and irregular ; the heart sounds weak, and the respiratory movements imperceptible ; there may be vomiting, then complete unconsciousness follows, and the patient falls to the ground. From this state after a variable time the patient gradually recovers, slight sighing or movements of the limbs being often the first sign ; color then returns to the lips and warmth to the hands. As a rule, an attack does not last more than a minute or even less ; but in cases of organic disease the duration may be considerable. When due to loss of blood there are sometimes general convulsions. A relapse, when it occurs, suggests that hysterical tendencies are present.

Ætiology.—Syncope may be due to organic disease of the muscular substance of the heart, but, on the whole, it more often occurs apart from that condition. Either the nutrition of the ventricular walls or the nervous mechanism of the heart may be at fault, or, owing to hemorrhage, an insufficient quantity of blood may reach its cavities. Among the exciting causes, apart from organic disease, exhaustion plays a prominent part, induced it may be by hunger, by breathing a vitiated atmosphere, by exposure to excessive heat, or by wearing tightly fitting clothes. Sudden emotion, especially fear, is often the cause, while an unpleasant sight or smell or even a sudden sound may cause syncope.

Treatment.—If the person be seen at the commencement of the attack, and if there be no cardiac disease, loss of consciousness may generally be prevented by making him sit down and stoop forward with his head between his knees, the feeling of faintness will soon pass off, and fresh air and a glass of water will complete the cure. When actual fainting has occurred the patient should be placed flat on his back and the clothes about the neck, chest, and abdomen loosened, the windows should be opened and every means taken to secure a free access of air. In most cases spontaneous recovery will take place, but this may be aided by the administration of a little alcohol or sal volatile in water, or by the use of smelling salts. Should these measures fail, 5 to 15 minims of ether in water may be injected subcutaneously. Artificial respiration, galvanization of the phrenic

nerves, and, in desperate cases, transfusion may be resorted to.

Symptomatic Indications.—*Aconite*, when from fright; *cinchona*, from weakness; *arsenicum*, with much debility; *veratrum alb.*, coldness and blueness of the skin; clammy sweat: *nux moschata*, in neurotic patients.

SYPHILIS.—Syphilis belongs to a group of diseases termed infective granulomata, which comprises, besides syphilis, such diseases as tuberculosis, glanders, leprosy, actinomycosis, and the like.

Syphilis, in its clinical and histological features, is a typical example of the group. It is due to the introduction into the body of a virus from another individual, all the diseases of this group being inoculable or infective. The place of inoculation in syphilis becomes the seat of tissue-change, and then the poison spreads throughout the body. After a period varying within certain well-known limits, the skin and mucous membrane exhibit characteristic lesions, and after a variable time, swellings, resembling in structure granulation-tissue, form in the various organs of the body. It is usual to divide the course of syphilis into three stages, primary, secondary, and tertiary.

Primary Stage.—This varies in duration from six weeks to three months: it dates from the appearance of the initial sore, or chancre, until the advent of the constitutional symptoms which indicate the commencement of the secondary stage.

The *primary sore* or *chancre* appears from three to five weeks after inoculation as an excoriation, pimple, or vesicle. This may increase in size and remain as a hard, spherical, dusky red pimple, but in the majority of cases it gradually enlarges and the center breaks down, leaving a circular ulcer, the base and sides of which are hard and gristly to the touch. Sometimes the ulcer is at first soft, the induration ensuing subsequently. Under the microscope these indurated sores appear as an infiltration of small cells into the connective tissue. Gradually larger cells make their appearance, and occasionally giant cells are seen. The greater part of this tissue breaks down, a part resolves, and the remainder becomes converted into cicatricial tissue, which persists and indicates the situation of the original lesion. As syphilis is most commonly contracted during sexual congress,

the most frequent place for chancres is on the external genitals of both sexes, but indurated chancres may occur in such situations as the lips, cheeks, tongue, nipple, eyelid, and finger. These are known as erratic chancres, and they often remained unrecognized until the appearance of the secondary rash unmistakably discloses their true meaning.

Soon after the appearance of a chancre the adjacent lymph-glands enlarge. In the case of the genitals it will be the oblique inguinal set, often on both sides; for the hand, the epitrochlear gland; for the mamma, the axillary set; for the lips and tongue, the submaxillary; for the eyelid, the pre-auricular glands. This enlargement and induration of lymph-glands may subside as the chancre heals; often they persist much longer and even remain obdurate in spite of treatment.

Secondary Stage.—This may commence at a period varying from six to twelve weeks after the initial sore. It is ushered in by a roseolous rash in typical cases, accompanied by a slight rise of temperature and a sore throat. As the roseola fades a papular or pustular eruption appears, which may mimic almost every known form of skin eruption. The spots are fairly symmetrical, cause little local discomfort, tend to disappear in the course of a few weeks, generally exhibit a coppery hue, and leave a pigmented stain after the papule has disappeared. The eruption of the mucous membrane takes the form of smooth raised circumscribed patches, mucous plaques; these are best seen on the tongue, near the tip, the soft palate, tonsils, and lips, the margins of the anus, and on the labia of women. These mucous plaques are due to inflammatory change and infiltration of the upper layer of the corium and epithelium. Often raised patches, resembling mucous plaques, are seen in the soft skin between the toes.

Some weeks after the skin rash has appeared more serious lesions may become manifest, such as iritis, periostitis without the formation of nodes, and painful affections of joints and tendon sheaths, frequently mistaken for rheumatism. At this stage the hair may fall (alopecia), and inflammation may affect the margins of the nail (syphilitic onychia). Epididymitis is an occasional complication and, coincident with such symptoms, the general health suffers and anæmia supervenes.

During the course of the next few years, that is between the manifestations of the early secondary symptoms and the more typical lesions peculiar to the third stage, a syphilitic patient may be troubled with such affections as inflammation of the skin of the palms and soles (palmar and plantar psoriasis), a peculiar form of choroiditis, inflammation of the internal coats of arteries (syphilitic endarteritis), especially those of the cerebrum, white patches upon the tongue (leucoplakia), gyrate unsymmetrical rashes on the skin, especially on the forehead (corona Veneris), and occasionally an acute form of laryngitis. These are sometimes referred to as late secondaries, or the *intermediate* symptoms.

Tertiary Stage.—Although the lesions of the third stage are characteristic enough, they begin at no definite period like the secondaries; they may appear four or five years after the initial sore, or be delayed for ten, fifteen, or even twenty years. This stage is characterized by the formation of circumscribed patches of morbid tissue like granulations, in the organs, and known as *gummata*. A gumma is a very unstable body; it is somewhat spherical in shape, and in the early stage soft and gummy, hence the name. Often it undergoes absorption and gives rise to no trouble. As it is poorly supplied with blood vessels the central parts break down or caseate. The cells may become converted into scar tissue, the gumma then contracts, and a cicatrix forms. When seated in or near the surface of skin or mucous membrane gummata exhibit a strong tendency to soften and ulcerate, especially if irritated. A gumma may occur in any organ; lung, liver, spleen, kidney, brain, heart, testes, muscles, suprarenal capsules, in periosteum, where it is often called a node, and in connection with the dura mater and skin. Often the formation of a gumma is determined by injury. In one case a gumma formed beside a small hydatid cyst in the liver. A blow or crush of the testis may be followed by the formation of a gumma in the organ; a blow on bone, which, under ordinary circumstances, would be of no moment, produces a node; an irritant tooth induces a gumma in the tongue; a strain of the biceps or rectus may be followed by an intramuscular gumma.

Gummata vary considerably in size.

Usually they are noticed when of the size of a ripe cherry. In viscera they attain the dimensions of walnuts or Tangerine oranges, but visceral gummata rarely break down. When of large size in connection with joints and periosteum, there is little doubt that they are frequently confused with sarcomata, a mistake of obvious disadvantage to the patient.

Pathology.—The clinical and morbid anatomy of syphilis indicates that it is identical with those diseases known to be due to the entrance and multiplication in the system of pathogenic organisms. As yet, no one has succeeded in isolating the syphilitic virus, and no positive facts are forthcoming as to whether it is due to a micro-organism or a chemical poison. Micro-organisms have been detected in syphilitic lesions, but they have not fulfilled the conditions necessary to establish the fact that they are the cause of this disease, that is, they should be constantly present in the lesions; secondly, they require to be cultivated in media apart from the body, and, lastly, when the products of pure cultivation are introduced into an animal, they should produce the lesions peculiar to the disease. So far as syphilis is concerned, these conditions have not been fulfilled; this may, in part, be owing to the remarkable fact that syphilis, so far as our present knowledge goes, is a disease peculiar to human beings. No one has detected syphilitic lesions in the lower animals, nor satisfactorily produced "complete" syphilis by direct inoculation, even in monkeys.

Treatment.—Two drugs are specified for this disease, mercury and several of its salts, and iodide of potassium. It is impossible to give modes of treatment for every case that comes before the practitioner, but it is important to bear in mind that the primary stage requires mercury, and this is easily administered in the form of blue pill or gray powder. The induration of the chancre and glands rapidly disappears during its administration. When the secondary rashes appear, iodide of potassium must be given as an *adjuvant* to the mercury. The latter drug should be exhibited for at least a year, the dose being varied according to the constitution of the patient and the practitioner's experience of the case. Even in the anæmia of syphilis, mercury acts as a tonic, but, in the tertiary stage,

its effects are often detrimental; then iodide of potassium is usually a most potent drug. In this stage, it is well to begin with small doses, gradually increased, for patients rapidly acquire a toleration of iodide of potassium.

Minor, but distressing, troubles arising in the course of the disease, such as the sores on the lips, mouth, throat, anus, etc., require special applications and modes of treatment apart from the general therapeutics of syphilis, and are considered elsewhere (*see* SYPHILITIC AFFECTIONS OF THE SKIN; *also*, SYPHILIS, CONGENITAL).

J. BLAND SUTTON.

Symptomatic Indications.—*Mercurius* is the main remedy in the treatment of this disease. *Mercurius sol.*, for recent, untreated chancres; *mercurius ox. rub.*, for neglected cases; *mercurius cor.*, for phagedenic chancre. *Nitric acid*, for chancre, treated with too large doses of mercury; mercurial results; ulceration of mouth; soft sores. *Kali iod.* is useful for tertiary symptoms. *Aurum* is valuable in many tertiary manifestations, particularly in sarcocoele, lupus, ozena, diseases of bones, suicidal melancholy. *Stillingia*, in syphilitic periosteal rheumatism; secondary nodes, with torturing pain. *Kali bich.*, indolent ulceration of tonsils, affections of throat, eyes, skin, and peritoneum.

SYPHILIS, CONGENITAL.—The variations in the clinical characters of inherited syphilis are very numerous, and may be of every possible kind. In practice, certain combinations of symptoms are of frequent occurrence, and others are rare. No proposition is more true than that inherited syphilis may exert an influence on the nutrition and function of every tissue in the body; at the same time some tissues are much more prone to be affected than others. To draw hard-and-fast distinctions between hereditary and acquired syphilis is warranted neither by clinical nor pathological observations. Syphilitic semen appears to be the commonest source of a syphilitic child, the ovum of the mother being tainted, but the rest of her organism frequently escaping.

Hereditary syphilis, rickets, and improper feeding are the most potent causes of disease during the first months of life, and there is often adequate proof of the

influence of each of them having been in operation in the same infant. This very mixture of causes is a fruitful source of difficulty in diagnosis. Syphilis may cause lesions and death of the fetus, and of the newly born as well as of infants of all ages. Miscarriages, premature births, and still-births are its familiar consequences.

Early Manifestations of Congenital Syphilis.—The commonest manifestations after birth are inflammatory changes and their consequences about the junctions of the mucous membrane with the skin. The eruption about the nates in syphilitic infants differs from that produced by the napkin, in its coppery tint, and in not being strictly limited to the region covered by the napkin, but spreading down the calves and legs. Some believe that syphilis may cause an eruption indistinguishable from one due to indigestion or other form of irritation, except in that it disappears when mercury is administered. The nature of the syphilitic lesion varies widely. There may be redness and infiltration with slight desquamation of the skin, or a weeping surface, or a more squamous area; tubercular infiltrations, coppery maculæ, and roseola are also met.

An inflammation of the nose, rhinitis, is commonly present, and may proceed to ulceration and caries, with the result of bringing down the bridge of the nose to a varying extent. In the early stages, the coryza of rhinitis causes "snuffles."

Pemphigus neonatorum is rare, and generally appears during the first days of life; large bullæ arise on the buttocks, palms, soles, and even elsewhere; they are generally flaccid, and contain a sero-purulent fluid; the disease is frequently fatal; some cases are probably not syphilitic; in two fatal cases the writer found no syphilitic or other internal lesions.

Other early manifestations are: Infiltration, redness, and desquamation of the soles, and sometimes of the palms; pigmented areas on which blebs or bullæ may arise; crusts and scabs resulting from bullæ, and red raised scaly patches spreading in rings, differing very little from ringworm in external appearance. There may be a very general infiltration of the skin, which may feel tough and suggest scleroma, or tough and dry, reminding one of parchment or wash leather.

The finger and toe nails are sometimes cylindrical and stained, as if with picric acid; the palms and soles may show a similar staining; there may be hard swellings of the testicles, with or without hydrocele; the tongue may present "wash-leathery" looking patches, serpiginous ulcerations, and gummata; the so-called superficial migrating glossitis (mapped or geographical tongue) is not always syphilitic; ulcers may appear in the mouth, with diffuse stomatitis and gingivitis, leading rarely to alveolar necrosis. Subcutaneous tubercles, differing from scrofulous indurations in being more numerous, more prone to suppuration, and to bleed freely when opened; condylomata, more often found after the seventh month, and not accompanied by other cutaneous lesions and craniotabes of the occipital and postero-parietal region, constitute other evidences of the condition. A hoarse cry from laryngeal disease, diffuse catarrh, mucous tubercles, or general hyperplasia and ulceration may appear.

Syphilitic pseudo-paralysis of the limbs, due to inflammatory disease at the junction of the shaft and epiphysis in the most growing area, is characterized by immobility, tenderness, and symmetry. The faradic irritability of the nerves is not impaired, the knee and elbow jerks are not lost; indeed, the faradic, galvanic, and mechanical irritability of the nerve-muscle seem rather increased. The knee-jerk is not lost, even when the epiphysis is separated from the shaft. The affection is very common about the knee-joints, elbow, and wrist, and is most frequently observed before the age of ten months; it may be mistaken for infantile scurvy, but the cachexia and tenderness are more marked—as a rule—in the latter affections, and the induration involves the shaft more than in the syphilitic disease. Cases of mixed scurvy, rickets, and syphilis are occasionally seen.

The Later Manifestations of Congenital Syphilis may occur at any period after two years of age; they are apt to appear at the beginning of the period of second dentition and at puberty.

The rhinitis may smolder for a long time, and may appear to have died out, and then may light up again. From this may result bloody discharges and pharyngeal secretions, ulceration, sloughing, and, finally, scarring; the soft palate get-

ting united more or less extensively to the back and sides of the throat. To distinguish this from scrofula is sometimes difficult. The soft palate and nasal septum may be perforated by ulceration. Ear disease of almost any kind may arise in connection with the disease of the nose and throat. Deafness may result from changes in the true, internal ear, exudation taking place into the cochlea and semicircular canals. The commonest signs of past congenital syphilis are found in the bones, teeth, cornea, and in radiating linear scars about the mouth, nose, and anus, involving the mucous and cutaneous surfaces. Occasionally, within the oral and nasal circles, a vein-like marking, recalling that of leaves, may be seen; this is really a furrowing, but the cuticle has not been thrown off; beneath the cuticle there has been syphilitic tissue which has been absorbed.

The protuberant frontal eminence may be the expression of a past syphilis, but true bossing is found around the site of the anterior fontanelle. It is doubtful whether pure syphilis delays or quickens the closure of the anterior fontanelle. A want of clearness in the complexion is often present; opacity of the cornea is very common; the cornea may be simply foggy, or the opacity may equal that of white porcelain. The keratitis is of the well-known interstitial type, it is most frequent during second dentition, but may be seen as late as thirty years of age; females suffer more than males; the rate of its appearance and disappearance varies much, but one eye is usually affected before the other. Iritis without keratitis is a rare symptom. Diffuse disseminated choroiditis, resulting in irregular pigmentation and atrophy, is also due to inherited syphilis; the color of the pigment may be rusty or coppery or black. The ulnæ, lower ends of humeri, clavicles, tibiæ, and the calvaria should be examined for diffuse or nodose enlargement; in the tibiæ pains may be complained of, but rarely in the other bones, unless, which is unlikely, the headaches are to be attributed to Parrot's bossing. Dome-shaped molars, and notched and pegged upper central incisions of the second set, are the most characteristic dental changes in syphilis; stunted teeth and wide spacing of the teeth are also observed. The bones, teeth, and cornea are apt to be affected at much the same time in the same patient,

but any variety and any combination may be noted.

Morbid Anatomy.—Bone changes in syphilitic fetuses are most manifest in the area of junction of the shaft and epiphysis, where growth is most active. Contrasted and compared with rickets, the changes are of great interest. The calcified lamina on the shaft side of the proliferating cartilage is much thicker and more irregular than in health; the marrow itself is more fluid and vascular; a considerable formation of soft bony material appears beneath the periosteum; excessive calcification, periostitis, and endostitis of the fungating kind being, briefly, the most marked changes. The process may lead to the separation of the shaft from the epiphysis, with or without the formation of pus. Sometimes a thin shell of periosteal bone can be separated from the endosteal bone, much as a pea can be removed from its pod. The changes are like those which cause syphilitic pseudo-paralysis.

The lungs may present white hepatization in the newborn—large tracts or even a whole lobe of a lung having a pale, smooth aspect, the section not being granular, the consistence generally increased, and the microscope revealing a fibrous interstitial overgrowth with atrophy of the pulmonary vesicles; the same condition as results from atelectasis. Probably this hepatization is always a subacute process, at any rate it is rare to find a markedly cellular non-fibrous specimen. Nodules resembling gummata occur in the liver, with or without perihepatitis and adhesion to the abdominal parietes. The spleen may be enlarged, its section being uniform in appearance, of a dark-red color, its consistence firm, and its borders unusually notched or lobulated, as the result of inflammation of the capsule. The capsule is thickened and puckered, and sometimes adherent to the abdominal parietes; the color of the thickened tissue may be opaque white or buff colored. The heart muscle may be the seat of diffused syphilitic tissue—the color of the affected areas being milky white—and rarely of caseous gummata. Interstitial nephritis has been described. Typical arteritis, choroiditis, meningitis, gummata in the substance and on the membranes of the brain and cranial nerves, and enlargement of lymphatic glands have been found in post-mortem examinations of syphilitic children. The brain may be atrophied

and sclerosed, with or without meningitis and arteries. Lepto-meningitis infantum—posterior meningitis—is sometimes syphilitic.

The thymus may be the seat of supuration, the pus being laudable or cheesy. Even lardaceous disease of the liver, kidneys, spleen, and intestines may arise.

Treatment.—Attention to the dietary, and to other matters on which the general health depends, may suffice to enable the child to overcome its syphilitic taint. The syphilitic child may be nursed by its mother. A cotton-wool dress should be ordered if the infant is shriveled and has the “old man” look. As such children are specially susceptible to the influence of bad air, bad food, and cold and damp, great attention must be given to all these particulars. Ulcers and fissures may heal without the aid of mercury, by simply keeping the parts clean and protected from every kind of irritation, including the atmosphere; but mercury promotes the soundness and increases the rate of the cure.

Hydrargyrum c. creta is the best mercurial preparation; it should be given in grain doses, three times a day. Should it appear to derange the intestines or stomach, which is seldom the case, bismuth or bicarbonate of soda may be given with it. In bad cases, rubbing blue ointment into the thin skin of the belly or armpits is the only mode which should be practiced. The skin should be cleansed freely with soap and water before each inunction. Syphilitic meningitis, laryngitis, and hepatitis (with or without ascites) should each be treated by local inunction of blue ointment. The head and neck should be shaved in the first-mentioned disease and the ointment freely rubbed into the skin of the back of the neck and into the shorn scalp. The enlarged spleen does not diminish to any appreciable extent under the use of mercury; probably the repeated and prolonged congestion has led to the overgrowth of fibrous tissue, and this form of fibroid overgrowth is not so easily removable as that which is the product of syphilis alone. Any antiseptic preparation is useful for skin and mucous lesions—*e. g.*, iodoform, calomel, boric acid; but rest, cleanliness, and avoidance of irritation are of equal importance. Ozena is best treated by sea air, local medication, and good living. Cod-liver oil and syrup of the iodide of iron are

as useful in syphilis as in scrofula. If the chalk preparation cannot be borne, the liquor hydrargyri perchloridi in half-dram doses may be used.

ANGEL MONEY.

Symptomatic Indications.—In congenital, as in acquired syphilis, the main reliance is mercurius, *mercurius sol.* being most generally useful; when the disease is quite active the *corrosivus* may be substituted; when the syphilitic cachexia is marked *mercurius iod.* gives the best results; when combined with the strumous diathesis, *calcareo iod.* is the most useful remedy. *Aurum* may be valuable when the bones show signs of the disease; *arsenicum*, when there is much prostration and emaciation.

SYPHILITIC AFFECTIONS OF THE SKIN (Dermatosyphilis, Syphiloderma).—It is still usual to describe syphilodermata as “secondary,” “late-secondary,” and “tertiary,” although there is no clinical or pathological justification for drawing so artificial a distinction. Certain characteristics are usually ascribed to early or “secondary” rashes, and although no single one among them is peculiar to syphilitic lesions—which differ in no sense morphologically from non-syphilitic—their *ensemble* constitutes, nevertheless, a striking picture, which may, with advantage, be retained in the mind.

Characters of Early Syphilitic Eruptions.—Of reddish brown, coppery or raw ham-like color, and leaving pigment stains; the transudation of blood-pigment upon which this depends is common to all rashes where there is blood stasis, especially in dependent parts.

Exhibit marked symmetry—like the erythemata and many other groups.

Frequently affect the forehead (corona veneris), the sides of the mouth and nose, the soles and palms, the flexor aspects of the limbs and the nape.

Are polymorphous—*i. e.*, various types of eruption, or various grades or stages of evolution of the same type, are frequently present at the same time. Although not an exclusive appanage of syphilides the character is an important one; hence the necessity for the fullest possible exposure and examination of doubtful cases.

Show a tendency to circular grouping—a minor point.

Seldom itch or cause subjective symptoms except when markedly desquamative, or when irritating applications have produced secondary eczema.

Develop slowly as compared with certain exanthematous rashes which most closely resemble them.

The so-called “tertiary” rashes are always ulcerative, and result from the breaking down of gummata in the skin or subcutaneous tissue. Their general characteristics are:

Occur on any part of the body—as contrasted with simple ulcers, which almost invariably are situated on the legs.

Are unsymmetrically distributed, although not usually confined to one side of the body.

Extend centrifugally by a raised, infiltrated edge while healing in the center; horseshoe-shaped, kidney-shaped, and serpiginous ulcers being thus formed.

Affect the palms, soles, and roots of the nails with great frequency.

Form rapidly, and the pain accompanying them is usually less than that caused by the disease in the same situation which most closely resembles them (lupus).

Leave flat white scars.

All syphilides possess these essential characteristics, which serve to distinguish them from all other eruptions—*viz.*, (*a*) they are always sharply defined, uniform, cellular infiltrations of the papillæ and corium, varying only in size; (*b*) these cells never organize forming permanent tissue, but are either absorbed or break down and pustulate; (*c*) the lesions always extend centrifugally, the oldest—*i. e.*, central portion—disappearing first.

For descriptive purposes following classification may be adopted.

Group I.—*Circumscribed Hyperæmia of the Papillæ with slight Infiltration.*—The macular or roseolous syphilide is usually the first symptom of syphilis which succeeds the primary sore and adenopathy, both of which it may occasionally precede. It generally occurs from six to twelve weeks after the inoculation, or as a symptom of relapse within the first twelve months; in the former case its appearance is often heralded by a few days' malaise and evening pyrexia, often considerable (103° F.), and is accompanied by symmetrical congestion and superficial ulceration of the tonsils. The rash consists of discrete, erythematous spots varying in size from a

lentil to a finger-nail, the edges not well defined, at first of a bright pink color obliterated by pressure, afterward dull and pigmented, causing a "marbled" appearance, brought out well by exposure to cold. They last from a few days to two months, and do not desquamate. Generally they occur on the abdomen and flanks, then on the fronts of the arms, the back and sides of the neck; they are rare on the face and backs of the hands. Occasionally an undue amount of effusion may cause them to resemble urticaria. Up to the end of the third year a form of erythematous rash, consisting of large, persistent ringed spots, occasionally shows itself (*roseola syphilitica annulata*).

The disease must be differentiated from measles, r  theln, urticaria, tinea versicolor, seborrhea corporis, pityriasis maculata, and many medicinal rashes.

Group II.—*Marked Infiltration of the Papill  .*—*The large or lenticulo-papular syphilide* is perhaps the commonest and most important syphiloderm. Smooth, shining, dusky red papules, the size of a lentil or larger, and at first circumscribed, develop in the flexures, on the front of the arms, forehead, back of the neck, borders of the scalp, in the groins, between the mamm  e, round the mucous orifices, and in receding angles of the skin (*e.g.*, *al   nasi*). They do not suppurate, but after absorption leave atrophic depressions, at first pigmented, but afterward brilliant white. Often one of the earliest syphilodermata, they may occur along with the macular syphilide and constitute the commonest relapse form during the first five or ten years. Their abundance is usually proportional to the earliness of the period at which they appear. In late relapses they tend to affect the angles of the mouth and the "web" of the toes, where they may cause painful and obstinate rhagades.

They may become (*a*) squamous, (*b*) moist, (*c*) circinate.

(*a*) *The large papulo-squamous syphilide* is characterized by the presence of scanty, thin, dirty-looking scales on a dull red papular base. The scale is the result of the shrinkage of the formerly tense epidermis after the absorption of the central portion of the papule. Its distribution has already been described. The condition frequently miscalled psoriasis palmaris et plantaris is the result of the development of this syphiloderm on

the palms and soles, modified by the anatomical peculiarities of the parts, especially by the thickness and resistance of the epidermic layers. The papules are scarcely at all raised, and appear as dusky blotches, over the center of which fine scales may form; more frequently the epidermis splits and becomes opaque; sometimes minute perforations may occur, or the central portion may be shed, leaving an irregular breach of surface with frayed, ragged edges and dusky red base. The condition affects the center of the palm and ball of the thumb, and may extend to the wrist, where its raised spreading edge is speedily recognizable, but it never affects the dorsum of the hands, and is not accompanied by pain, burning, or itching. If it occurs as a late manifestation, it is often one-sided and obstinate to treatment. It must be carefully differentiated from palmar eczema and psoriasis.

(*b*) *The moist papular syphilide, flat condyloma, or mucous patch* is the result of the maceration and removal of epidermis from papules where subject to contact, friction, warmth, moisture, and dirt; thus they occur about the anus, perineum, genitals, navel, armpits, and in the flexures; their surface is covered with grayish detritus, and their secretion is very infective, usually producing condylomata rather than hard sores.

Mucous patches are the commonest starting-point of the condition known as syphilis cutanea vegetans vel framb  siformis, which consists in the rapid outgrowth of red, warty cauliflower excrescences; these, although formidable in appearance, are very amenable to local treatment. They sometimes also originate from gummatous lesions.

(*c*) *The early circinate syphilide* is a very rare form, chiefly affecting the forehead, nose, and chin; it probably begins as a papule, the center of which is rapidly absorbed, leaving healthy looking skin, while the edge only persists as a delicate, thread-like ring. Several of these generally coalesce to form elaborate gyrate figures; they may be mistaken for tinea circinata.

Group III.—*Marked Infiltration especially implicating the immediate vicinity of the Hair Follicles.*—*The miliary, lichenoid or small papular syphilide* is of comparatively infrequent occurrence. The papules vary from the size of a

poppy-seed to that of a pin's head, are closely packed in groups or circles, and each is pierced by a hair. They occasionally develop rash as an early relapse in cachectic individuals, when they affect the shoulders, arms, trunk, and thighs; they are extremely obstinate to treatment. More frequently a few papules appear in late relapses about the mouth and eyes, and in the flexures.

(a) *The miliary papular syphilide* is the typical form just described; it often itches and heals, leaving deep atrophic scars, after copious desquamation; or it may develop into the two following forms. It closely resembles lichen ruber, lichen scrofulosorum, keratosis pilaris, or even psoriasis guttata.

(b) *The miliary vesicular or herpetiform syphilide* is a very rare syphiloderm, which occurs usually in successive crops on regions where the skin is thin, especially the face and genitals, in the first six months of the disease, along with other manifestations. The vesicles may or may not be umbilicated, the fluid in them remains clear for many days, and after its absorption light gray crusts and minute umbilicated depressions are left.

(c) *The miliary acuminate pustular syphilide* is also derived from the miliary papular syphilide, and is commoner than the herpetiform variety; a bead of pus forms at the apex of each papule, and after separation of the resulting crust, a minute, deeply pigmented scar is left.

(d) *The large acuminate pustular or acneiform syphilide* is closely allied to the last form, but its base is more extensive, and deeper suppuration occurs; it follows closely upon inoculation, in association with other syphilodermata and tends to affect especially the scalp, face, and trunk. It is commoner in negro than in white races, and its course is usually rapid and benign; it may closely resemble bromide or iodide rash. *The vari-celliform or varioloid syphilide* is the highest grade of this syphiloderm. The vesicles are sometimes umbilicated, the pustules may be as large as a pea, the dusky halo round the base of each is marked, the pyrexia attending their development is high, the scars following their subsidence are deep and honey-combed.

Group IV.—Deep Infiltration with subepithelial Suppuration and superficial Ulceration.

(a) *The superficial ecthymatous syphilide*, which begins as a flat papule, soon forms a flat pustule and desiccates, forming a brown scab, which, when separated, leaves a flat cicatrix. It occurs most commonly on the back, shoulders, and limbs from the sixth to the eighth month after inoculation.

(b) *The deep ecthymatous syphilide* is distinguished by the increase of suppuration and the deeper extension of the ulcerative process. It forms the basis of the form of syphiloderm known as *Rupia*, and characterized by the limpet shape, lamination, and imbrication of its crusts, due to continuous formation from beneath. The condition is a somewhat rare one and occurs in cachectic individuals, either within the first twelve months of disease or later; it requires special tonic treatment.

(c) *The bullous or pemphigoid syphilide* exhibits larger blebs and a less marked areola than the last form; it is seldom present in other than congenital cases.

Group V.—Gummatous Infiltration with Ulceration may be either cutaneous or subcutaneous.

(a) *The tubercular or lupoid syphilide* is the result of infiltration of the papillæ and corium; the nodules are deep red, brownish, or yellowish in color, vary from the size of a pea to that of a bean, and are commonest on the face and back, usually grouped in circles or corymbose clusters. They never occur until at least two years after inoculation; they are chronic and usually painless. They leave serpiginous scars; their differentiation from lupus is frequently a matter of extreme difficulty. The age of the patient, the duration of the disease, the rapidity of its extension, the characters of the scars, the presence of other syphilitic manifestations, and the result of treatment will usually guide to a correct diagnosis.

(b) *Subcutaneous gummata* form the basis of the so-called "tertiary" ulcers already partially described. They are at first deeply situated, hard, elastic, and frequently painful; they occur in small numbers and generally in regions where the tissues are lax,—e. g., flexor surfaces of limbs, abdomen, thorax; the resulting ulcers are sharply cut, "punched out," with undermined edges and uneven base covered with dirty-looking gummy deposit; they often cause necrosis of subjacent bones or cartilages.

Pigmentation in Syphilis is usually the result of antecedent roseolous, papular, pustular, or ulcerative lesions, but a special and independent form of pigmentary syphilide is comparatively common in young women and weakly lymphatic men with thin skins. This shows itself as brown spots or patches on otherwise healthy skin, from six to twelve months after inoculation; usually first on the back of the neck, to which it gives a "dappled" appearance, or on other exposed parts, from which it may gradually spread over the whole body. If slight, it may only cause some "muddiness" of complexion; if severe, the pigment is irregularly distributed, and the condition exactly resembles, on the one hand, leucoderma, on the other those diffuse forms of chloasma which accompany many cachectic diseases. It probably does not depend directly upon the syphilitic virus, and this view is borne out by the complete futility of antisiphilitic treatment directed toward its removal. Leucodermatous patches, independent of antecedent pigmentary rashes, have been occasionally observed, although their existence has been disputed, especially by German writers.

Alopecia in Syphilis.—Baldness frequently accompanies the various stages of syphilis. In the first three to six months it usually results from the development of erythematous or papular rashes on the scalp; the hair falls uniformly all over the scalp, and frequently also from the eyebrows and genitals; permanent baldness from this cause is very rare. Seborrhea causing partial baldness is also common. Occasionally baldness appears to result from disordered innervation or cachexia, the scalp presenting a normal appearance. Late ulcerative lesions cause permanent baldness. Syphilitic infants are frequently quite bald.

Treatment.—Most English authorities approve the internal administration of mercurials as soon as the diagnosis of syphilis seems fairly established, without waiting for its confirmation by the appearance of roseola. The Vienna school condemns such treatment, and considers that although the "secondary" efflorescence may be thereby delayed, it is usually aggravated in intensity, and so altered in type as to become confusing to the medical attendant. No such differ-

ence of opinion exists as to the value of mercury after the appearance of rash. It may be administered by the mouth, by inunction, by fumigation, or by hypodermic injection. Gray powder and blue pill are the preparations usually given in the earlier stages internally, and preferably in small, oft-repeated doses. The liquor hydrargyri perchloridi, often advantageously combined with bark, and the green proto-iodide of mercury, are those most frequently used at a later period. It is necessary in every case to watch the effects of the drug with care, not only because individual susceptibility varies greatly, and even minute doses are occasionally not tolerated, but also because in non-susceptible individuals the dose ought to be cautiously increased up to a point just short of the establishment of its physiological effects. Meanwhile, any tendency to diarrhea must be counteracted by combining the mercurial with opium or hyoscyamus. Quinine, iron, cod-liver oil, and other tonics are often imperatively indicated, and general hygiene is of the greatest importance. The diet ought to be simple, and alcoholic excess is specially harmful. Flannel clothing ought to be worn to guard against chills. Particular attention must be paid to the condition of the mouth and gums; tartar ought to be removed, carious teeth extracted, a soft toothbrush used several times daily, and astringent gargles and mouth-washes sedulously employed. Smoking ought to be prohibited. It is well to continue mild mercurial treatment for one year after the initial lesion, even if the skin lesions have been slight. Some think that the use of mercury in any form is contra-indicated by albuminuria, and it appears occasionally to cause phagedena, when its discontinuance in favor of opium is desirable.

For inunction twenty grains of blue ointment or of a five per cent. oleate of mercury ointment with lanolin may be rubbed into the groins, axillæ, or popliteal spaces every night, the site being varied to avoid local irritation. This method is invaluable for children. For fumigation calomel is usually employed, twenty or thirty grains being evaporated over a spirit lamp, beneath a wicker-work chair on which the patient is seated naked, and covered with a blanket. Both inunction and fumigation sometimes suddenly produce severe salivation.

The subcutaneous injection of mercurials has hitherto not found much favor in England, although its action is rapid and effectual, and it does not interfere with the digestive functions. One-third of a grain of the perchloride, dissolved in twenty minims of distilled water, may be injected once, or at most twice a week, deeply into the gluteus maximus muscle. The tannate, albuminate, formate, and peptonate are also employed, their efficacy being apparently proportional to the slowness with which they are eliminated from the system.

The iodides of potassium and sodium have little or no influence on the earlier stages of the disease, but act with remarkable certainty and rapidity on gummatous infiltrations and ulcers. They are frequently prescribed at first in combination with the perchloride of mercury, the compound decoction of sarsaparilla being a favorite vehicle. As individual susceptibility to their effects varies greatly, and small doses are often very efficacious, it is generally advisable to begin with such, and gradually increase the dose. In the earlier secondary stage the iodides have probably little curative influence, but they remove the insoluble albuminate of mercury from the tissues, and may then aggravate salivation and other symptoms of mercurialism. Occasionally iodides directly aggravate the severity, and modify the characters, of syphilitic eruptions; the simultaneous administration of arsenic frequently prevents this puzzling complication. Some obstinate old syphilides are much benefited by the vigorous eliminative treatment carried out at many spas. The local treatment of syphilodermata, although of secondary importance to the constitutional, is often a very useful adjunct. Diluted white precipitate ointment is good for papulosquamous lesions, especially about the face; condylomata ought to be frequently dressed with black wash or mild perchloride lotion, and subsequently dusted with some drying powder. Mercurial plaster and ointment are especially useful for localized patches of papules and tubercles; obstinate "lupoid" lesions are sometimes advantageously destroyed with the acid nitrate of mercury solution, while iodoform or iodol is invaluable for ser-piginous ulcers. Congenital syphilodermata are best treated by gray powder in-

ternally, and the inunction of mercurial ointment into the palms, soles, and abdomen, or by dusting powders containing calomel—3j ad ʒj of starch powder.

J. J. PRINGLE.

Symptomatic Indications.—*Mercurius sol.* is the principal remedy for syphilitic skin lesions and usually all that is needed; after mercurius, *aurum* and *platina* may be serviceable. *Nitric acid*, for coppery, violet-colored spots on the skin, drawing pains, as from splinters. *Kali bich.*, for papular and pustular eruptions with periosteal pains, and ulcers which look as though they had been punched out. *Arsenicum*, for tubercular syphilides; *silicea*, when mercury has been given to excess.

TABES MESENTERICA (*Tabes, a wasting disease*).—An old-fashioned term for chronic wasting disease characterized by enlargement of the lymphatic glands of the mesentery. The majority of such cases are instances of tubercular disease of these glands (*see* LYMPHATIC SYSTEM, DISEASES OF); others of chronic adenitis, with perhaps caseous degeneration secondary to intestinal catarrh; others of malignant disease, especially lymphadenoma. Strümpell defines it to be general tuberculosis of the abdominal organs. Henoch uses the term "atrophia meseriaca," by which he understands a more or less general tuberculosis chiefly concentrated in the abdomen, the mesenteric glands having been affected secondarily to the peritoneum or intestinal mucous membrane.

TÂCHE CÉRÉBRALE is the name given to the pink streak which, under certain circumstances, appears when the nail or any pointed instrument is drawn across the skin. It has but little clinical value except as an evidence of an irritable condition of the vaso-dilators throughout the body. It is frequently present in tubercular meningitis, but may be seen quite apart from any cerebral affection; for example, in Graves's disease and in enteric fever.

Another form of tâche, called the "white tâche," in which the vessels of the area irritated by the nail undergo contraction and remain empty, can be occasionally produced in the same manner, especially in typhoid fever.

TAPEWORMS (Tænia).—The cestodes or tapeworms have an exceedingly small head and neck and a long flat white body, which widens out gradually. The body is divided transversely into a number of segments, called *proglottides*, joints or links. The head is provided with suckers, by means of which it is able to fasten itself on to the mucous membrane of the intestine. From the slender neck the segments are gradually produced, becoming more and more distinct as they get further from the head. Each develops a bi-sexual generative apparatus, with a uterus in the form of a central passage traversing its entire length, and giving off numerous branches at right angles. After impregnation, the uterus becomes filled with ova, and eventually the segment, when it is ripe, separates from the rest of the worm, and is expelled with the fæces. Each segment is capable, under favorable conditions of moisture and warmth, of maintaining a separate existence for a short period. It has been calculated that the segments require for their full development a period of about three months, and as fast as they are thrown off others are ripening to take their place, so that the worm, when it has once reached a state of maturity, probably remains much the same length. The proglottides may rupture and discharge their ova while still in the intestines, but they are usually passed entire, and spontaneous movements of contraction and extension may be observed in them while still alive. If the segments and their contained ova be swallowed by their proper intermediate host, the gastric juice dissolves the covering of the ova, and the embryos are set free. Each embryo is armed with minute spicules, by the aid of which it passes through the coats of the stomach. It is then probably carried away by the blood, ultimately reaching the liver, or muscles, or some other part of the body, where it establishes itself permanently. It then loses its spicules and becomes the *scolex*, having a head exactly like that of the mature worm with a neck terminating in a cyst, within which the head and neck are inverted. In this situation the scolex may die and be converted into a calcareous mass, but if not, and if the portion of the animal containing the living scolex be eaten, it will be liberated in the stomach, its sac will atrophy, and

the scolex, passing into the intestine, will affix itself to the mucous membrane and develop into the complete tapeworm.

Varieties of Tapeworms.—Several species of tapeworm have been found in the human body.

(1) *Tænia Medio-canellata*, the beef tapeworm, is the one by far the most commonly met with, and may attain a length of twenty feet. The head has four hemispherical suckers, but no hooklets. The segments, which are very numerous, are at first wider than they are long, then almost square, and subsequently of greater length than width, the fully developed ones being sometimes an inch long and a quarter of an inch wide. The branches from the uterus are very numerous, and terminate in club-shaped extremities. The *tænia medio-canellata* inhabits the small intestine. In beef the scolices appear as minute whitish oval bodies about the size of a mustard seed; such beef is called “measly.”

(2) *Tænia solium*, the pork tapeworm. The mature worm is not so long as the one just described; the head is smaller, with four hemispherical suckers, and presents at the summit a blunt papilla or proboscis with a double circle of about twenty-five hooks. The segments differ from those of *tænia medio-canellata* in that the uterus gives off fewer branches, which terminate in flat pouches. The hog is the host; the scolices appear in its flesh (measly pork) as oval, hard, whitish bodies about the size of a hemp-seed, and possess already the double circlet of hooks. This worm is also occasionally met with in the human subject in its larval form, the *cysticercus cellulosæ*, affecting chiefly the eye and the brain (see BRAIN, TUMORS OF).

Symptoms.—The symptoms resulting from the presence of a tapeworm rarely form a sufficiently distinct clinical group to allow of the diagnosis being made until some of the segments are passed. Among the most common symptoms are itching about the mouth and anus, uncomfortable sensations in the abdomen, disordered appetite, colicky pains, pallor, a furred tongue, foul breath, headache, and tinnitus aurium. Various reflex neuroses may be due to this cause, and in some undoubted cases insanity has owed its origin to the presence of a tapeworm. Sometimes the worm gets rolled up, giving rise to constipation, and may even

produce intestinal obstruction. The symptoms are relieved when the worm is expelled.

Treatment.—The treatment of a case of tapeworm requires considerable care and attention to details to insure a successful result. This is proved by the fact that it is by no means uncommon to meet with cases in which five or six separate attempts to dislodge the worm have ended in failure. The patient should go to bed and remain there until the treatment is over, for, if allowed to take exercise, he will be unable to undergo the prolonged fast which is an essential preliminary to the administration of the vermicide. The period of fasting usually recommended—twenty-four hours—is quite inadequate to clear the intestines of their fecal contents. For three or, preferably, five days before attacking the worm the patient should take only food sufficient to sustain life, and this must be such as will be almost entirely absorbed by the stomach. Two pints and a half of beef tea or an equivalent quantity of Brand's essence may be given, with, if necessary, a glass or two of port wine, but no solid food or milk should be allowed. The period of starvation must be regulated by the strength of the patient; its duration should never be less than three days, and is preferably five days, or even a whole week. Every morning a small dose of some laxative, such as cascara sagrada in capsules, should be administered. Castor oil should not be given during this stage of the treatment, as it is believed to protect the worm from the action of the anthelmintic to be subsequently administered.

When the period of fasting is over the anthelmintic drug must be given. The oil of male fern is the most efficacious remedy against tapeworms. It is best prescribed in capsules each containing 15 minims, at intervals of a quarter of an hour, until four capsules have been taken. Administered in this way it is more efficacious, less nauseous, and less likely to cause vomiting than if given in a single dose of a dram, in an emulsion, as is usually recommended. The last capsule should be followed in half an hour by one-half ounce of castor oil. When the bowels act the motion should be passed into an utensil loosely covered with muslin. Water should be gently poured over it, and the doctor must examine the worm

before its removal and search carefully for the head, as, if this be not passed, the animal is certain to grow again. In addition, by placing the fragments end to end, he must determine whether all belong to the same worm, as two or more may be present. When the examination is finished, the worm should be burnt.

If the head be missing, the male fern should be given again in four doses as before, to be followed by a dose of castor oil. If the head be not found at the second attempt, unless the patient be too weak to bear it, the male fern and castor oil should be administered again after an interval of an hour. In a case under the care of the writer the head was not found until the third attempt, although all but about an inch of the worm was passed after the first dose of the male fern. If the head be found and the examination of the portions of worm passed show that only one is present, the patient is cured; but if the head be missing at the conclusion of the treatment, it is still possible that it may have been passed but overlooked.

As the period of maturation is almost invariably three months, or it may be exactly thirteen weeks, it follows that should no segments appear in the motions after an interval of four months, this has probably happened, and the case may be regarded as cured. If large portions of tapeworm, including part of the neck be passed, and segments spontaneously appear in the motions after an interval of less than two months, it may be certainly concluded that two worms were originally present in the intestine. The only prophylactic measure against tapeworms is to avoid eating raw or imperfectly cooked meat. Children have been known to acquire them from raw meat taken under medical advice.

Oil of turpentine is also used, in doses of from 1 to 2 ounces, emulsified with white of egg and sugar. Pomegranate root, 3 ounces, macerated in water for twelve hours and then concentrated to one half, is also recommended, but it is apt to produce digestive disturbances. Kouso, kamala, and areca nut are other remedies sometimes prescribed.

TASTE, DISORDERS OF.—The sense of taste may be impaired or lost from a variety of causes which may be thus classified:

1. Morbid conditions of the mucous membrane of the tongue and palate.

2. Lesions of the nerves concerned in the condition of the sensory impressions.

3. Certain cerebral conditions.

Many of the sensations ordinarily spoken of as sensations of taste are really due to the perception of flavors by the olfactory nerve. As stated under ANOSMIA (*q. v.*), loss of smell implies the loss of all these sensations, the true taste impressions being limited to such as are either bitter, sweet, sour, or salt.

1. Morbid conditions of the mucous membrane of the tongue and palate are more often concerned in causing an impairment of the sense of taste than in its total loss. The parts of the mouth capable of receiving taste impressions are the tongue, the palate, and the palatine arches. A dry condition of the tongue and a very thick coating of fur on its surface are sufficient to cause a dulling of the sense of taste, and it may be completely lost over limited areas of disease, although, owing to the large surface over which the impression may be received, such a loss will probably be unnoticed by the patient.

2. The nerve chiefly concerned in the conduction of impressions of taste is the fifth. It is stated in the article on the glosso-pharyngeal nerve that it is the nerve of taste for the posterior part of the tongue and the soft palate, a view which is perhaps the most generally accepted, but as no case is on record in which taste has been lost over these parts from a lesion limited to the glosso-pharyngeal nerve, and as disease of the root of the fifth nerve has been known to cause complete loss of taste in these parts, and also in front of the tongue, it is more probable that the fifth nerve subserves this function; and that, if fibers apparently distributed with the glosso-pharyngeal nerve are concerned in conveying taste impressions, they subsequently leave that nerve and pass to the brain by the fifth. When paralysis of the fifth nerve occurs without loss of taste it is probable that the taste fibers escape owing to the lesion being partial only, or to its being situated within the pons, where these fibers are probably separated from the fibers conveying common sensibility.

The impressions from the tip and sides of the tongue are almost certainly conveyed by those fibers of the lingual or gustatory nerve which it obtains from its

communication with the chorda tympani, and it is also almost certain that the latter is the nerve of special sense for these parts of the tongue, a view which accounts for the loss of taste in the front of the tongue so often observed in disease of the middle ear, through which the chorda runs, and also in cases of facial paralysis of rheumatic origin. But as in disease of the facial nerve within the skull there is no affection of taste, it follows that the fibers of the chorda leave the facial again. It is believed that they pass from the geniculate ganglion of the facial, through the Vidian nerve, to the sphenopalatine ganglion, and thence ascend, in the superior maxillary division of the fifth nerve, to its root and to the brain. In caries of the middle ear there may be loss of taste on both the back and the front of the tongue.

3. In certain lesions of the hemispheres, in general hemianæsthesia, and also in hysteria, there may be complete loss of taste on one or on both sides.

Tests.—The condition of the sense of taste may be tested by placing various substances on the protruded tongue, the patient's eyes being closed. The quantity of the substance must be small, so that it may not be diffused over the surface, and the taste must be perceived before the tongue is withdrawn. The best substances for the four varieties of taste are for bitter, quinine; for sweet, honey; for sour, vinegar; for salt, common table salt. On applying a feeble electrical current to the tongue a metallic taste is perceived; this constitutes one of the best tests.

Treatment.—When the sense of taste is lost, the treatment depends upon the causal condition.

TENESMUS is the name given to a group of symptoms referable to the large intestine, of which the most constant and important is straining during defecation. There may also be a sense of weight and fullness about the rectum and a frequent inclination to stool. The motions are usually slimy and may contain blood. Tenesmus is a marked feature of dysentery.

DISEASES OF THE TESTICLE AND SCROTUM.—**Abnormalities of the testis.**—To follow the various diseases and abnormalities with understand-

ing, it is necessary first to remember that the testicle is at first an abdominal viscus; that up to the seventh month of fetal life the testicle lay below the kidney, but at the beginning of that month it began to descend until, by the end of the eighth month of fetal life, it had traveled through the abdominal wall and reached the scrotum. The testicle itself is developed on the inner aspect of the Wolffian body, the seminal ducts from the tubes of that body, and the vas deferens from the duct of the same. Such being the developmental history, the following irregularities will be understood.

The testicle may fail to be developed, or be obliterated, and therefore be absent.

The testicle may be developed, but the vas deferens fail in its whole extent or in part.

The testicle may be perfect, and the vas deferens also, but, through some failure in the tubules of the Wolffian body, the testicle remains unconnected with its duct.

The testicle may be *undescended* or descend into an abnormal position; in the abdomen it may remain near the kidney, or at the internal ring; externally, it may remain in the inguinal canal or at the external ring. It has been known to descend into the crural canal and into the perineum. In some instances, a cause may be found for the retention, such as abnormal adhesions; the meager size of the internal or external abdominal rings; abnormality in the size of the testicle, either too large or too small; malformations of the genital organs. With undescended testes, impotence does not of necessity follow.

Diagnosis.—With ordinary care an undescended testis may be distinguished from a hernia in the form of a bubonocoele, and from such conditions as hydrocele of the cord. If the testicle be not in the scrotum, but in the inguinal canal, then it can be felt as a nodule with definite outline, movable, and giving the sensation on pressure peculiar to the organ. If not in the scrotum, or in the inguinal canal on either side, then it is known to be in the abdomen, and healthy, should the man beget children. It may happen, however, that the testicle is in some one or other of the abnormal positions mentioned. A testicle in the inguinal canal is liable to diseases, such as inflam-

mation, sarcoma, or other morbid growth. In addition, an undescended testis may be complicated by hernia or hydrocele. Hernia, when reducible, is easily diagnosed; so is hydrocele by its fluctuation; but an inflamed retained testicle and a strangulated hernia are more liable to be mistaken. In such cases, reliance must be placed on the history, constipation, sickness, the character of the pain, and the associated signs and symptoms of strangulated gut.

Treatment.—The treatment of a testicle retained in the inguinal canal depends on many things. If it is inflamed, then must the remedies recommended for orchitis be employed. If it is complicated with hernia, then must a horse-shoe-shaped pad be accurately fitted to repress the hernia and leave the testicle free. Should malignant growth attack the organ, it must be removed. Finally, should it be desirable, the testicle may be cut down upon, and the tissues around it stitched to the bottom of the scrotum, in the hope that traction will by and by bring about a normal state of things.

Hydrocele.—In the widest acceptation of the term, hydrocele signifies a fluid effusion, in connection with either the testicle or cord, be that effusion simple or inflammatory. The division of hydroceles into simple and encysted is hardly in harmony with precise pathology; hence it is intended to place all encysted hydroceles in the class "spermatic cysts," to be discussed farther on. Inflammatory fluid effusions, within the serous coverings of the testicle or cord, are dealt with when considering the diseases which give rise to them, whether simple orchitis, syphilitic orchitis, etc.

Hydrocele of the tunica vaginalis is a collection of serous fluid in the covering of the testicle, derived from the peritoneum. It may be: 1. Simple. 2. Congenital, when the funicular process of the peritoneal prolongation with the cord and testicle (the processus vaginalis) remains unobliterated, allowing of direct communication between the peritoneal cavity and that of the tunica vaginalis. 3. Infantile, when the funicular portion of the processus vaginalis is closed at the internal abdominal ring only. 4. Serous fluid may accumulate in the partially obliterated sac of an old hernia.

Ætiology.—It has been a matter of discussion how far hydrocele is due to

inflammation, and how far it is of the nature of a dropsy. That it is inflammatory in origin appears from the following facts: (*a*) it frequently occurs in acute inflammation, or in syphilitic affections of the testis; (*b*) the fluids in dropsy contain less albumen than hydrocele (four per cent. in the former, six per cent. in the latter); (*c*) hydrocele fluid sometimes coagulates spontaneously, and always contains fibrinogenous material, while the opposite obtains in dropsical fluids; (*d*) in hydrocele there is often a history of inflammation, while there is no such history in dropsy; (*e*) finally, hydrocele is rarely found in connection with general dropsy. It is possible, on the other hand, that the disease may commence as a passive effusion, and the presence of this abnormal fluid may set up inflammatory changes of a low kind.

Pathology.—The fluid is usually of a pale straw color, quite transparent, with a sp. gr. 1030, and loaded with albumen. This latter fact is made plain either by heat or nitric acid. Sometimes the fluid coagulates spontaneously when withdrawn, probably by the escape of a few blood corpuscles into the fluid from the puncture made in the skin by the tapping process. In older cases the fluid is thick, treacly, and dark in color. It may contain cholesterine in such quantity as to give a shimmering, opalescent covering to the fluid, when it cools after withdrawal. It may also contain blood or spermatozoa, from the rupture of a vein or a spermatic cyst respectively. In some cases fibrinous loose bodies may be met with in the cavity of the tunica vaginalis.

The wall of the sac in recent cases is but little thickened, and its internal surface retains a smooth appearance. In cases of long standing, or in those which have undergone frequent tapplings, the sac wall becomes more vascular and thickened, the internal surface less smooth, being frequently spotted with vegetations; the connective tissue of the wall is increased in quantity, arranged in layers, and much more fibrous than normal. Later on, this thickened and condensed wall may be sclerosed, having a density and hardness almost like cartilage.

Frequently, growing from the visceral portion of the tunica vaginalis are small bodies of about the size of peas, sessile, or sometimes attached by a long pedicle.

Microscopically, these are composed of somewhat laminated fibrous tissue, but, on the other hand, they may become calcareous.

Simple hydroceles are usually pyriform in shape, but there may be some adherent points, the one surface to the other, giving various shapes to the swelling (constricted, hour-glass shape); or one portion may be quite separated from the other, two cavities being formed.

Signs and symptoms.—Simple hydrocele presents a smooth, pyriform swelling, the base being downward. It may be soft or tense; fluctuation can be obtained, and translucency is usually present, except in old cases where the walls or the fluid is thickened.

To discover the translucency, the scrotal tumor should be grasped firmly behind and above, and a light held on the opposite side to the observer, close to the scrotum. Assistance may be had by looking through a tube made of paper, or a stethoscope. The testicle is usually placed behind, and a little below the middle of the tumor; in old cases it may be slightly atrophied. Hydrocele, for the most part, either occurs in infancy or middle age.

Diagnosis.—Hydrocele of the tunica vaginalis has to be distinguished from hernia, hematocele, spermatic cysts, and solid or cystic tumors of the testicle. Hernia is diagnosed from hydrocele by the neck of the hernial protrusion being in the inguinal canal; but, when the hernia is reducible, by its being capable of being pushed back into the peritoneal cavity; by the history of the growth in that it grows from above downward, whereas a hydrocele accumulation develops in an opposite direction. Hernia is resonant on percussion when intestinal; it never fluctuates, nor is it translucent. The testicle is always at the bottom of the hernial protrusion, while the opposite conditions exist in hydrocele. Where the hernia is omental no mistake can be made, if its lobulated character be remembered. Where there is any doubt a careful antiseptic incision will reveal the truth.

Hematocele has no translucency, is heavier, and the fluctuation is obscure; then also will the history of the case be important.

The diagnosis of tumors of the testicle can only be obscure when the walls of

the sac or the contents are so thick that they simulate a solid growth. The history of the case must then be relied upon, or an exploratory incision must be made.

The spermatic cyst tumor is of a globular shape, and the testicle is usually above and behind.

Spermatic cysts.—Cysts of the testicle or epididymis (encysted hydrocele of the testicle of most authors). These will be considered as cysts of the surface of the testicle, cysts of the epididymis.

Cysts of the surface of the testicle are very rare. Single, and small in size, they are but rarely of practical importance. They are found *on* the anterior surface of the testicle, between the serous coverings and the tunica albuginea; some few have been described as occurring *in* the layers of the tunica albuginea. It is thought that they may have taken origin by an encapsulation of extravasated blood. They must not be mistaken for cystic disease of the testicle itself.

Cysts of the epididymis are found of two kinds, small subserous cysts and spermatic cysts proper.

The small subserous cysts, found on the epididymis beneath the serous layer are only of pathological importance. They never occur in young people, but increase after forty years, as age advances.

Never larger than a pea, they are sometimes pedunculated, sometimes sessile; the cyst wall, usually thin, contains yellow, limpid, or opalescent fluid, but never spermatozoa.

Spermatic cysts proper are found most frequently about the head of the epididymis, or between it and the upper border of the testes, and grow out from among the ducts, especially the vasa efferentia. Although usually single, nevertheless two or more may be found together. The cyst walls are composed of delicate connective tissue, sometimes showing plane muscular fiber, and lined by flattened columnar epithelial cells. The contents are limpid, opalescent, or milky. Albumen is not usually present, but chlorides and phosphates are found in quantity. The most remarkable thing is the presence of spermatozoa; in most cases these are alive and active, in others they are defunct and partially decomposed.

Their *origin* can only be briefly discussed. They are variously believed to be: dilatation of seminal tubes; rupture of a seminal tube, the extravasated mat-

ter becoming encysted; primary cystic formation, having a seminal tubule afterward communicating with it; and lastly, embryonic remains may undergo development in after life; *e.g.*, the organ of Giralde; hydatid of Morgagni (Müller's duct); vas aberrans of Haller.

In whatever way originating, there is formed a slowly growing swelling, having the testicle usually below and in front. The swelling may be smooth or irregular, tense or bossy; with a sac wall, thin and translucent, or thick, and so rendering the diagnosis difficult.

Treatment of hydrocele and spermatic cysts.—*Palliative* consists in external applications of evaporating lotion, or stimulating and irritating paints, as iodine and the like; wearing a suspensory bandage to prevent the dragging sensation; and, finally, tapping the hydrocele when it is sufficiently advanced.

Tapping a hydrocele.—Select a trocar and ascertain that it is well made and clean. The patient is to be placed in a good light, either standing straight up with his back to the wall, or reclining on a couch. Dip the trocar and canula, separately, into carbolized oil before commencing. The surgeon now grasps the scrotum with the left hand, making the swelling tense and light. The surgeon's forefinger of the left hand should be touching the testicle as the hand grasps the scrotum. The trocar is now thrust into the scrotum at a spot in front, and at the lower part of the swelling, taking care to avoid the superficial veins. The trocar is pushed smartly through the skin in a direction directly backward at first, but, when the skin is punctured, it should be carried upward for a short distance, the trocar being withdrawn from the canula while such is being done. The fluid is now allowed to run off, and the scrotum gently compressed toward the end of the flow. The canula is then withdrawn, the orifice is pinched between the finger and thumb, the parts around are wiped, and a piece of strapping or collodion is applied. A suspensory bandage should be applied immediately afterward, and worn some time. It is but seldom untoward consequences result from tapping, but now and again, especially in the thick-walled sacs of old men, the whole of the sac wall may slough, involving also the skin of the scrotum.

Curative treatment.—Of the various

methods employed, the injection of irritant fluid is the most practiced at the present day; but, besides this method, we have antiseptic incision, the introduction of setons, and acupuncture.

1. Injections are thrown into the cavity of the tunica vaginalis with the purpose of restoring the balance of secretion and absorption to the serous surfaces of that membrane. Most frequently, however, this treatment ends by causing adhesions between the parietal and visceral surfaces.

A great variety of substances has been used, viz., port wine, carbolic acid, sulphate of zinc, iodine, nitrate of silver, etc.

The method in general use is as follows: the fluid of the hydrocele is first drawn off, then about two to four drams of tincture of iodine, pure or diluted with half water, is syringed in by a glass syringe. The canula used should be made of platinum, and not of silver, as the iodine solution will not corrode the former as it does the latter. Beware of the nozzle of the syringe not fitting the canula.

After injecting the iodine, the canula is plugged, and the injection allowed to remain about ten minutes, care being taken to bring it fully in contact with the whole surface of the cavity. After this period of time the whole fluid may be allowed to escape, or half of it may be retained. The patient ought to be made to lie up for two or three days after the operation. Succeeding this form of treatment, a considerable irritation and inflammation may develop. Under such circumstances the usual anti-inflammatory applications are to be applied.

The hydrocele fills rapidly during the inflammation after injection, but at the end of a week or ten days as rapidly subsides. A suspensory bandage should be worn, and, subsequently, strapping the swelling is very useful.

2. Seton is only used in exceptional cases, *e. g.*, where iodine has failed; it often sets up an alarming amount of inflammation.

3. Antiseptic incision is performed where injection has failed, or when the patient is so feeble that sloughing of the scrotum is feared. It is more certain in its results, and complete cure is earlier obtained than by any other method.

The operation is performed under an

anæsthetic by making an incision, after shaving the skin, about two inches long in the anterior and lower part of the tumor, and allowing the fluid to escape. Then a few carbolized catgut sutures are introduced, and a drainage-tube is laid in the wound, when the whole of the genital organs are wrapped up in dressings, a hole being made for the penis. This may be removed and reapplied every four days. The patient may get about in a fortnight, and the parts will probably be healed in three weeks or a month. This treatment is certainly best in old men, especially with a very thick cyst wall, or where there is the complication of hernia,

Spermatic cysts are best treated with injection of iodine.

Congenital hydrocele, as already stated, is peculiar in that its cavity and the cavity of the peritoneum communicate. The only difficulty is to diagnose it from hernia. Translucency is the most important sign, a hernia never being translucent. Again, the sudden manner in which a hernia slips back, and with a gurgling sound, as compared with the slow manner in which the hydrocele is reduced. The treatment is to apply pressure by a truss over the internal ring and inguinal canal to obliterate the opening. Evaporating lotions should be applied, or iodine should be painted over the scrotum, or antiseptic incision may be advisable. In such cases injections of iodine are not contra-indicated.

Infantile hydrocele occurs early in life. It is known from congenital variety by the impossibility of squeezing the fluid into the abdomen.

The *diagnosis and treatment* are similar to the preceding.

Acupuncture, is performed by introducing a needle rapidly at several points through the scrotal tissues down to the fluid. Some fluid escapes externally, but most of it escapes into the cellular tissue around and is rapidly absorbed.

Hydrocele of a hernial sac is found but rarely, and can only exist when the peritoneal communication has been closed.

The fluid resembles that found in vaginal hydrocele. It resembles vaginal hydrocele in every respect, except that it extends higher up the cord.

The *treatment* is the same as for that class of cases.

Hematocoele is the name given to an extravasation of blood in the neighborhood of the testicle or spermatic cord. It may take place in one of the cavities or cysts found in hydrocele; or the effusion may occur into the spermatic cord, scrotum, or tunica vaginalis, independently of previously existing hydrocele.

Hematocoele of the testicle may be classified as vaginal, encysted, and intratesticular.

Hematocoele of the tunica vaginalis is the common and most important kind; it is usually the result of injury, but may occur spontaneously; in the latter case it is probably due to diseased vessels, or to some changes in the inner surface of the tunica vaginalis. When the result of injury, it is found with or without previously existing hydrocele. In the former it is caused by a blow or kick over the hydrocele, or by tapping, in which case a vessel may be punctured, or, the pressure being removed from the large vessels, hemorrhage takes place into the sac; the blood may be absorbed under favorable conditions, but usually secondary changes take place in the wall and its contents. In the latter it is caused by a blow, a kick, the lifting a heavy weight, or by straining. The contents of a hematocoele may be a red or chocolate-brown-colored fluid, with or without clots; it is sometimes as thick as treacle. On opening an old, slowly formed hematocoele a dark fluid will escape, when the walls will probably be covered by a soft, flocculent blood clot.

The walls of hematocoele vary in condition, from many circumstances. The outer part of the wall is always thickened; internal to this usually is a layer, varying in thickness, of laminated, decolorized fibrin; within this, again, is a layer of softer laminated clot, and most internally of all, recently coagulated blood. Sometimes the outer layer becomes hard, or subject to calcareous deposit. These laminated false membranes are derived from the blood which escapes into the tunica vaginalis becoming coagulated; in other cases it may result from inflammatory changes in the tunic, the plastic products forming the false membranes.

Signs and symptoms of hematocoele.—Whether originating slowly or suddenly, hematocoele of the tunica vaginalis presents a heavy, pyriform swelling in the scrotum, with its base downward. The

swelling is somewhat tense, and indistinctly fluctuating; the scrotum will be livid or ecchymosed, and the veins over it unusually prominent. The testicle occupies the lower and back part of the tumor.

There may be a good deal of pain at first, but this may wear off, to be succeeded by severe pain again, should inflammatory mischief appear. As is to be expected, it is neither translucent nor resonant.

Diagnosis.—Hematocoele has to be distinguished from hernia, hydrocele, orchitis, or other enlargements of the testicle, malignant or benign.

From hernia it is distinguished by inability of reduction, non-resonance, the history of having commenced below, the possibility of isolating the upper end of the hematocoele from the abdominal ring, and by there being no impulse.

From hydrocele it is distinguished by being heavier, less fluctuating, non-translucent; and the history (whether there had been a blow sustained or not) may help a little.

As to malignant or other solid growth of the testicle, hematocoele may be diagnosed therefrom by the history, size, form, weight, smoothness, or irregularity of surface, *e. g.*, the swelling is globular in hematocoeles, oval in affections of the testicular substances; in malignant or cystic diseases the swelling is firmer, heavier, bossy, and irregular. This absence, or otherwise, of testicular sensation is an important element in diagnosis.

When there is doubt, as often happens, the diagnosis may be verified by puncturing, or, better still, by making an exploratory incision, with due antiseptic precautions.

Treatment.—This will vary according to the condition of the hematocoele and that of the patient.

When the case is recent, the patient must be sent to bed, the scrotum supported on a pillow, and ice or evaporated lotions applied over the swelling, care being taken that the ice does not induce sloughing of the scrotum. If the swelling do not go down in a satisfactory manner, it may be tapped. In some cases, where the coverings are thin and the contents very fluid, the sac may be injected with iodine, as in hydrocele.

If the hematocoele does not subside, or threatens to suppurate, or the patient

be very feeble, antiseptic incision into the sac will be the best treatment. Where the patient is old and much debilitated, the walls of the sac much thickened and calcified, and suppuration threatening, it is probably the safer treatment to make an opening into the front of the scrotum, about two inches in length, then carefully open the cavity of the hematocele, turn out the clot, wash it out with a solution of zinc chloride (1-40), introduce a drainage-tube through the bottom of the opening, and put in one or two carbolized catgut sutures; finally, dress the wound with complete antiseptic dressings. If there be hemorrhage from the inner wall of the cavity, stuff it with carbolized lint and apply pressure.

Encysted hematocele is a rare occurrence; it is due to effusion of blood into one of the spermatic cysts found in connection with the epididymis, or between the tunica vaginalis and tunica albuginea, as described under hydrocele. The treatment must be on the principles already laid down.

Intratesticular hematocele is of post-mortem interest only. Spurious forms exist with malignant disease.

Diseases of the Spermatic Cord.—Independently of affections connected with arrest in development and non-closure of the processus vaginalis, the diseases to be dealt with are: hydrocele, hematocele, tumors, and varicocele.

Hydrocele of the cord occurs in a diffuse or encysted form.

Diffused hydrocele of the cord is a very rare affection; it consists in a sort of dropsy of the areolar spaces of the covering of the cord. The swelling produced is smooth in outline and cylindric in shape. The testicle is found to be normal; the disease gives rise to no pain; firm pressure will cause its disappearance, but it returns immediately.

This disease might be taken for a hernia, unless the history of the case, the absence of impulse, and the obscure fluctuation be remembered. No treatment has proved satisfactory.

Encysted hydrocele of the cord is a collection of fluid in a distinct cyst, such a cyst being formed (1) in the imperfectly obliterated funicular process of the tunica vaginalis; (2) in an old hernial sac; or (3) in a cyst of new formation; the latter probably taking origin in the fetal remains connected with the testicle, either

the hydatid of Morgagni, the organ of Giralde, or the vas aberrans.

The affection is most frequently met with in children. The walls and fluid are similar to those met with in hydrocele of the tunica vaginalis. Spermatozoa have been found in some of the cysts. The vas deferens and its accompanying vessels are behind the cyst.

Signs and symptoms.—A well-defined swelling, oval in shape and fluctuating in character, is usually easily made out. The growth is painless, freely movable, and somewhat slow in its development. The usual place of growth is near the external ring, but it may occur in any portion of the cord, between the internal ring and the testis. The usual size is that of a pigeon's egg, but it may grow larger. Sometimes more than one is present, probably such condition being due to the irregular obliteration of the funicular process. On the other hand, the funicular portion may be patent in its whole extent to the testicle, being only closed above.

Diagnosis.—Hernia is the most likely condition to be mistaken for encysted hydrocele. However, when it is remembered that hernia has no transparency, no fluctuation, has a neck that cannot be isolated from the internal abdominal ring, and that a well-marked impulse is perceptible, while exactly the opposite obtains in hydrocele, there ought not to be much difficulty in diagnosis.

Treatment.—With children, usually, some evaporating lotion or painting with iodine will cure the disease. If not, it may be tapped, or acupuncture may be tried. In older patients, if simple treatment be not successful, injection of iodine may be tried. If more active treatment be needed, opening the hydrocele antiseptically should be practiced.

Hematocele of the cord may occur in two forms, diffuse and encysted.

Diffuse hematocele of the cord is due to extravasation of blood into the loose connective tissue surrounding the cord; it is caused by rupture of either an artery or vein from straining.

The signs and symptoms are plain enough; a swelling suddenly occurs during a strain, which swelling is ill-defined and irregular, but following more or less closely the course of the cord. It is to be distinguished from an omental hernia by its being irreducible, ill-defined,

and frequently associated with discoloration of the skin over the swelling.

Treatment.—Rest, ice, and evaporating lotions; should all other means fail, or suppuration threaten, free incision with antiseptic precautions.

Encysted hematocoele of the cord is so rare that its discussion is useless.

Varicocele.—The pampiniform plexus of veins met with in the spermatic cord immediately above the testicle very frequently becomes varicose. It is the left side almost invariably which is first attacked, and, should both sides show signs of varicosity, the left usually precedes the right.

Ætiology.—Although many reasons have been advanced to explain the origin of this affection, yet a certain amount of obscurity remains. The causes may be classed under two heads, general and local.

General or constitutional causes are feebleness of system, debility, a loss of tone, each and all inducing a relaxed condition of the tissues generally.

Local causes assigned are: Mechanical, such as the pendency of the testicle, the looseness of the cellular tissue surrounding the veins, and the peculiarly large plexus of vein involved. Functional causes are early and irregular excitation of the sexual organs.

As already stated, varicocele occurs much more frequently on the *left* side; the reasons for this are: (1) The lower position of the left testicle; (2) the longer course of the left spermatic vein, the right opening into the vena cava, and the left into the left renal; (3) the peculiarity of the valve at the opening of the left into the renal vein; (4) the difference in the current of the blood stream on the right and left side; thus, on the left it is at right angles to the spermatic vein, but on the right side it follows a parallel direction; (5) there is also a difference in the blood pressure, being less in the vena cava than in the left renal vein; (6) the left vein is further crossed by the sigmoid flexure, and consequently subject to the pressure of fæces in this portion of the bowel.

Signs and symptoms.—There is in the scrotum, and extending up the cord, a swelling very variable in extent in different cases. The swelling is irregular in shape and described as giving the sensation of a "bag of worms"; it may be seen to

undergo changes with the respiratory movements, and exhibits a slight impulse on coughing. The skin of the scrotum is much thinned, and the veins may be seen through it; the cremaster muscle is much wasted, but responds to irritation. The testicle lies at the bottom of the mass of veins, it is usually diminished in size and softer in consistence; probably in all cases there is a certain amount of atrophy; this must be clearly the case when interference with the nutrition of the part is considered, but probably complete atrophy hardly ever occurs from this cause alone. The swelling slowly diminishes in size when the patient assumes the recumbent position, to return on rising, even if the finger be kept firmly pressed upon the internal ring.

Usually the pain of varicocele is not marked, but there is a decided feeling of discomfort from dragging. When the varicocele comes on later in life, there is often pain of a neuralgic character. In most cases there is more or less tenderness of the testicle.

This affection is often productive of great mental distress and anxiety, induced either by the habits of the patient or his fears of impotency.

Diagnosis.—Varicocele is, by a careless practitioner, now and again mistaken for hernia.

Treatment.—The general principles of treatment, short of operation, are to restore tone to the system and calm to the mind. Dispel the dread of impotence, encourage exercise and the use of the shower bath and local sponging, correct constipation and treat the dyspeptic troubles. To still further support the veins than can be done by a suspensory bandage, a portion of the lower part of the scrotum may be drawn through a ring; Wormald's silver ring is the best.

The *operative* treatment has for its purpose the obliteration of the hypertrophied veins of the spermatic cord. This will be required when palliative treatment has failed to give any relief, the varicocele going on increasing in size, and threatening complete or nearly complete atrophy of the testicle. If this affection prevents a man entering any of the public services, or if the existence of varicocele in itself is having a pernicious influence upon the mental state of the individual, then operative interference to insure radical cure is necessary.

Many different kinds of operation have been practiced; of these one of the following three will be found to answer all purposes. The most important danger to avoid is that of exciting septic thrombosis, as this may end in septicæmia or pyæmia. This is almost beyond the power of the surgeon to provide against; hence no operation should be forced on any patient by the surgeon, as repentance for the proffered advice may follow all too late.

Whatever plan of operation is followed, it is necessary to recognize and separate the *van deferens* from the mass of veins.

(1) Mr. Erichsen's plan of operation is as follows: Make a small incision in the scrotum on either side of the offending mass of veins. A needle threaded with silver wire is passed in at one incision and out at the other, transfixing the tissues between the mass of veins and the *vas deferens*; the needle is next returned between the veins and skin, so that only the veins are included in the loop of wire. The wire is then tightened by twisting, the twist being increased from day to day. Gradually, in eight or ten days, the wire ulcerates its way through the mass of veins. During the process the patient is kept in bed, and the part dressed with iodoform or wet boracic lint until healing is completed.

(2) Mr. Curling's operation consists in passing two hare-lip needles, one about one inch above testicle, the other three-fourths of an inch higher up the cord, behind the vein, in front of the *vas deferens*. A piece of cardboard is placed beneath the pins, and a strong silk ligature, applied in a figure of 8 over the needles, is made to constrict the veins between the needles and the ligature.

(3) Dr. Clark's method consists in excising a portion of the redundant scrotum by taking up a fold of it between the blades of a forceps, or with Ricord's fenestrated forceps for phimosis, and thus exposing the cord with its vessels, so that they can be manipulated separately, and the veins distinguished from both the artery and the *vas deferens*. After a fold of the scrotum has been removed, and the vessels of the cord exposed so that the *vas deferens* can be isolated, pass a needle around with a wire ligature beneath the cord, excluding the *vas deferens* and including all the other contents of the cord. The needle is then disarmed,

removed, and the two ends of the wire passed through a small tube about two inches in length, and wound over a cylinder fixed at the other end of the tube, so as to grasp the vessels as the *écraseur* does, and compress them sufficiently to arrest their circulation, and induce their complete obliteration.

After a lapse of thirty-six or forty-eight hours, the *écraseur* is removed and the wound closed by the ordinary interrupted suture or needles, the former being preferable. The operation is comparatively devoid of all danger, as any excessive inflammatory action may be controlled at once, by cutting the wire and withdrawing the *écraseur*.

Orchitis.—(See also SCROTUM AND TESTICLES, DISEASES OF.) Acute inflammation of the body of the testicles.

Ætiology.—The disease is usually the result of injury, as a blow on the testicle, or from the extension of the inflammation from the epididymis and more rarely from gonorrhea.

Varieties.—Simple orchitis, sub-acute orchitis, simple chronic orchitis.

Signs and symptoms.—In its onset and subsequent course simple orchitis resembles epididymis, but the constitutional disturbance is greater, the local pain more intense. On examination, the testicle will be found to be enlarged, globular, and extremely sensitive and tender; the scrotum red and swollen.

Diagnosis.—Acute orchitis has only to be distinguished from epididymis (*q. v.*)

Prognosis.—Orchitis usually gets well without difficulty, though it may rarely end in suppuration or chronic enlargement of the testicle.

Treatment.—See SCROTUM AND TESTICLES, DISEASES OF.

Simple Chronic Orchitis.—This disease is sometimes called simple sarcocele to distinguish it from strumous or syphilitic orchitis. It is an induration of the testicular connective tissue, generally the result of acute inflammation.

Signs and symptoms.—The most noticeable symptom is an enlargement remaining after an acute attack of orchitis, accompanied with pain, which gradually grows less. The testicle feels smooth, enlarged, hard, and is devoid of testicular sensation.

Diagnosis.—This is made from the history of the previous acute inflammation, the enlargement of the testicle, and its

smoothness which will distinguish it from syphilitic or malignant disease of the testicle.

Prognosis.—If treated in time, a healthy normal condition may be obtained; but if the testicular sensation has disappeared on even deep-seated and decided pressure, then will sterility be the result; and all attempts at promoting absorption are then too late to save the secreting tissue.

Treatment.—Strapping presents the chief and almost the only hope of cure. To strap a testicle proceed as follows: Clip the hairs of scrotum and wash the part clean. When it is carefully dried, stand the patient up against a wall, with his head and heels touching the wall, and his feet well separated. The surgeon, sitting in front of the patient, grasps the scrotum above the enlarged testicle between the finger and thumb. With plain diachylon plaster, or with emplastrum hydrargyri or lead plaster, pass an encirclement firmly around one side of the scrotum above the offending testicle. This strap may be made to encircle the scrotum twice or thrice, and made so tight that the testicle is compressed against the lower part of the scrotum. With this as a fixed point, strips of plaster, two-thirds of an inch wide, are made to pass alternately from behind forward and around the testicle until the whole is covered. On the third day the plaster will require renewal.

Syphilitic disease of the testicle.—If it be true that the tertiary stage of syphilis is characterized by a hyperplasia of the connective tissue of organs, then is syphilitic disease of the testicle a disease of the tertiary stage. The expression of the disease is in one or the other of two methods, diffuse thickening of the connective tissue, or localized induration leading to gumma of the organ. If diffuse, the organ is symmetrically enlarged at first, to become nodular afterward, either from unequal contraction or the presence of gummata.

Signs and symptoms.—The body of the testicle itself is the seat of the disease, and often both organs are affected, either together or consecutively. At first the testicle is felt to be smooth and globular, but it soon becomes nodular. The stony hardness of the enlargement, the absence of pain, the obscurity of the testicular sensation on pressure, the gradual de-

velopment, the chronicity of the affection, and the preservation of the generally ovoidal outline of the tumor are all characteristic of the disease. The presence of fluid in the tunica vaginalis obscures the disease, and it may rarely accumulate in such quantity that the primary cause is overlooked. Occasionally loose indurated bodies are met with in the fluid effused.

Diagnosis.—The history of syphilis, the stony hardness of the testicle, the nodulation of the surface, the absence of pain, and the speedy obscurity of the testicular sensation are all so distinct that but little practical clinical difficulty is experienced in attaining a sure diagnosis. Only when hydrocele is present will there be any difficulty.

Prognosis.—If submitted to treatment before the disease has lasted a month, a good prognosis may be given. If, however, the disease is of some months' standing, it may be doubtful whether or not a complete cure will be effected. The disease may lead to obliteration of all the secreting parts of the glands, suppuration, or the breaking down of a gumma which has become adherent to the skin; subsequently hernia testis or atrophy of the testicle may ensue.

Treatment.—The local treatment is to be as that recommended for simple orchitis; strapping, or strapping with either Scott's dressing or simple mercury plaster, will be the most effective; soap plaster will, however, often act as well.

When hydrocele is pronounced it may be wise to tap the fluid, so that strapping may have a more decidedly direct effect on the testicular substance.

The constitutional treatment is that for syphilis generally.

Tubercular disease of the testicle.—Under this name are included tubercular epididymis, tubercular orchitis, acute miliary infiltration of the testicle, and the more slowly developing tubercular disease dependent upon strumous deposit.

The history of a patient presenting himself with a tubercular disease in the epididymis—for it is there the disease most frequently begins—is, that by chance, or from some accidental uncomfortable sensation, he placed his hand upon the testicle and there discovered a small lump, which up to that time had given rise to no inconvenience; that since then the lump had got gradually larger,

and of late some shooting, darting pains now and again startled him; but that, until the skin began to look inflamed, he did not think it worth bothering about. On inquiring into the family history it may be found that his brothers have had enlarged cervical glands, or tubercular disease of the testicles or lungs; that some of them died young of intestinal disorders; that his sisters are affected, one with spinal curvature, another with disease of tarsal bones, and so on. The patient may be tall, active, and muscular, fond of athletics and proficient at them.

Signs and symptoms.—The first appearance of the disease has been already mentioned as an indolent lump in the epididymis, but before it comes under the surgeon's notice it is usually more advanced, and it may be only when suppuration threatens that the patient presents himself. The lump usually softens, becomes incorporated with the skin, fluctuation and inflammation occur, and the surgeon is usually called upon to open the abscess, when a small quantity of curdy pus may be evacuated. With poulticing, or hot boracic lint dressings, the inflammation and suppuration may subside and the part heal. Some time, say six months afterward, the same condition of things is gone through again, the surgeon being called upon to evacuate another abscess. During the healing process, if not before, the patient may complain that there is a dragging sensation in the groin, which proves, on examination, to be a thickened vas deferens; on the other hand, examination of the testicle itself may elicit the fact that its smoothness is lost, and that it has become nodulated and uneven. Toward either one or other, or both of these directions, viz., toward the vas deferens or testicle, the disease travels.

When the disease extends toward the vas deferens, the fact is recognized by a thickening of its walls and an induration of its substance. After a time the affection of the vas deferens may have extended so far that its tortuous ending, and the vesicula seminalis associated with its ending may be felt to be indurated and enlarged by rectal digital examination. Purulent deposit may next appear in the urine, to be speedily followed by tubercular disease of the kidney or by lung mischief.

When the disease extends toward the testicle, that gland becomes uneven, en-

larged, manifesting but little pain, and retaining the testicular sensation on digital pressure. One or both organs may be attacked consecutively or together. Hydrocele is but a very rare concomitant. By and by an indurated spot on the testicle becomes adherent to the skin, and then softening and suppuration result, necessitating, it may be, opening by the knife. A curdy pus exudes, and the discharge may cease; a sinus following, with occasional inflammatory effusion and obstruction occurring therein. Lastly, the testicle may atrophy and wither away, or the gland substance may extrude through the skin opening, and a fungus testis, hernia testis, or benign fungus of the testis results.

Hernia testis is most frequently a result of tubercular disease, but it may come from the breaking down of syphilitic gummata, from suppuration following orchitis or chronic orchitis, and from wounds of the scrotum. The protruding mass may consist of the whole or part of the testicular substance, which protrudes as a mushroom-shaped mass, pedunculated, and overlapping the edges of the skin aperture. In its center is usually a suppurating sinus; around the skin aperture the edge may be free or attached. The protruded tissue is usually of a grayish pink granulation tissue, or it may be covered by ordinary granulations with pus dripping from its surface.

Pathology.—It is consistent with the general behavior of strumous and tubercular disease that the lymphatics of any part first show signs of change. Hence it is, therefore, to the lymphatics surrounding the vessels that one directs one's attention to the genesis of the local development of the disease. An accumulation of low-formed cellular matter distends the neighboring tissues, presses upon the vessels, and, advancing by irritation and inflammation toward the surface, soon involves the skin. The neighboring lymphatics become affected, catarrh of the vas deferens results, and scattered patches of cheesy deposits develop in the testicle, by and by to run together to form a cheesy mass. A section of the testis, examined microscopically, will show the tubuli to be filled with a catarrhal epithelium, and the tissue of the testis infiltrated with giant cells. Now and again the testicle is found infiltrated with miliary tubercles.

The *diagnosis* of tubercular testis is not difficult; the age of the patient, usually young adult life; the gradually developing growth, its indolent character, the absence of hydrocele, the fact of the epididymis being first attacked, the softening and breaking down of the indurations, the thickening of the vas deferens, and the strumous or tubercular history, when taken together are sufficient to establish the diagnosis.

The *prognosis* of tubercular disease of the testis is bad in the extreme. There is a great tendency to set up tubercular disease in either the lungs or the kidney. Unless very favorable conditions can be obtained, the prognosis is almost as bad as possible.

Treatment.—The treatment of this disease will depend upon the stage to which it has progressed. If in the early stage, abscesses must be opened when necessary, and the usual local remedies must be applied, as in other similar inflammatory states. The constitutional treatment will be that for strumous diathesis generally. Should hernia testis occur, it requires special surgical treatment. An attempt may be made to bring the edges together by strapping, and to reduce the swelling by pressure and the application of the red oxide of mercury ointment. Should the ointment not succeed, the red oxide of mercury, in powder dusted upon the part, may effect absorption.

Failing these plans of cure, the edges of the opening in the skin may be pared, the tumor reduced, and the edges stitched together. Should an exuberance of granulations cover the true testicular tissue, they may be first shaved off and the edges brought together as before.

The question of castration in hernia testis has excited a great deal of discussion for many years, and the question is not now settled. The majority of practitioners condemn its removal, while, on the other hand, many testicles have been removed with apparently good results. The difference in results may depend more on the nature of the disease than the wisdom or skill of the surgeon. When the testicle is infiltrated with miliary tubercles it is almost certain an untoward result will follow castration; when, however, the testicular protrusion is the result of simply local strumous disease, castration need not necessarily be

followed by a development of tubercle in other organs. The constitutional treatment is that laid down for strumous disease generally; but the only real hope of any good result is to get the patient sent to a dry, warm climate with all possible speed.

Fibro-cystic enchondroma of the testicle.—The synonyms for this disease, fibrous, fibro-cystic, cystic, fibro-cystic enchondroma, adenoid growth, fibro-plastic growth, all indicate that opinions differ as regards the nature of the disease.

The *ætiology* is unknown, further than that it is a disease which belongs to older men, and that it is, according to Curling, an affection of the ducts of the testicle.

Signs and symptoms.—The history is that of gradual enlargement, which had attained a good size before the patient noticed it; that there was no pain in the testicle to usher in the disease, no distinct history of a blow or squeeze which could have started it. Testicular sensation speedily disappears, hydrocele is absent, and the testicle may be felt to be firm, elastic, smooth, and communicating a springy, resilient touch. The disease is always single, unattended by local or constitutional complications, either of an inflammatory or infective nature; and, when a grooved needle or trocar is thrust into it a sero-sanguineous fluid, more or less of a mucoid or sticky nature, may be withdrawn.

Diagnosis.—Absence of pain, translucency, true fluctuation, etc., are all negative signs and symptoms of a diagnostic nature. The age of the patient, the history of the development of the disease, the smoothness of the surface of the tumor, and many other negative and positive conditions detailed above, leave little doubt as to the nature of the disease.

Prognosis.—If the prognosis of castration for simple disease of the testicle is good, then is the prognosis of cystic disease of the testicle good, for castration is the only treatment.

Treatment.—See CASTRATION.

Malignant disease of the testicle.—Both sarcoma and carcinoma are met with in the testicle, the former in much the greater proportion of cases.

Sarcoma of the testicle is usually of the small round-celled variety; but, when the disease is very decidedly cystic, the

sarcomatous tissue is more usually of the large, spindle-celled variety.

Intermingled with the connective tissue of the gland are enchondromatous deposits, either naked-eye or microscopic, and not unfrequently a myxomatous condition is present.

Carcinoma of the testicle is of the encephaloid variety, and, but for its occurring in older people, and its being less frequently cystic, it is impossible to distinguish it from sarcoma.

The history of a case of carcinoma is that of a tumor appearing at, or about, middle life and growing rapidly.

The signs and symptoms.—The surgeon usually finds the testicle in encephaloid disease to be large, globular, smooth, firm, tense, and non-translucent.

As the case is watched, it will be found to become irregular, lumpy, softened at parts, the testicular sensation disappearing. Should the disease be allowed to run riot, the skin become involved, the glands on the groin, and especially the iliac glands, enlarge; the tumor then protrudes at the scrotum as a fungous mass (the fungus hematoides), and the patient succumbs to exhaustion.

The *diagnosis* between encephaloma and sarcoma is well-nigh impossible, except that the former belongs to elderly men, the latter to children or young adults. The history of the case will distinguish it from syphilitic or tubercular disease. The rapidity of growth is the only reliable diagnostic feature between it and simple fibro-cystic disease.

Castration is the only treatment for malignant disease of the testis.

Castration.—Removal of the testicle is required:

1. For malignant disease, whether sarcoma or encephaloma.
2. For cystic tumors, whether fibro-cystic or fibro-cystic enchondroma.
3. When after acute tubercular disease the testicle becomes reduced to a fibrous mass or to a nodule, which keeps up irritation and suppuration.
4. When hernia testis, from whatever cause, is intractable to other means of cure.

The proper time for its performance will depend on the nature of the case; thus, in malignant disease as early as possible; in tubercular disease as late as possible (or very early); in cystic disease as soon as the disease is diagnosed; and

in hernia testis when all other means of cure fail.

Operation.—Place the patient on a table in a good light; administer an anæsthetic; shave the pubes, if it has not been done; bring the patient's buttocks to the edge of the table, with the lower limbs separated and secured to the legs of the table; place a basin or sawdust trough on the floor to catch the blood. The surgeon now takes his stand between the separated thighs, and his first assistant on the right or left of the patient according to whichever testicle is to be operated on. If the tumor is very large, an Esmarch's cord, passed round the root of the scrotum, tightly crossed and carried round the body and secured, will serve to arrest hemorrhage. Should such not be required, the surgeon grasps the tumor at once in the left hand, making tense the skin in front; then, entering the knife just below the external abdominal ring, he cuts downward, to opposite the lower end of the tumor, either by a straight incision, or, if the skin be involved, by an elliptical incision, embracing the diseased portion. By a few cuts the cord is laid bare, seized between the finger and thumb, and isolated. Then it is to be dealt with by one or other of the following methods:

When the disease is that of malignancy, the cord is to be pulled well down, and a whipcord ligature passed round the tissue of the cord *en masse*.

When the disease is tubercular, it is best to separate the vas deferens from the other tissues of the cord, pull it well down, and tie it; the blood vessels are to be tied subsequently.

A clamp may be used to prevent retraction of the cord, until the vessels have been all secured.

Whichever method is followed, the testicle is then to be removed from its connections, the cord cut through a quarter of an inch below the clamp or ligature. All bleeding is to be stopped, both from the vessels of the cord (spermatic artery, vas deferens, and cremasteric), and those of the scrotum (the superficial and deep external pudic, and perineal arteries). A drainage-tube is to be inserted, and the margins of the wound should be brought together by horse hair or silver wire.

Atrophy of the testicle.—Varicocele, of all diseases, is most liable to develop a

partial atrophy of the testicle. A complete atrophy of the testicular tissue occurs in chronic orchitis, when the fibrous induration and thickening lead to obliteration of the tubuli seminiferi. Lesions of the spinal cord, injuries to the head, deficiency in the blood supply from obstruction to the spermatic artery owing to the pressure of aneurismal or other tumors, lead to gradual atrophy of the gland. Early, excessive, and unnatural venereal excitement has been followed by atrophy.

Hypertrophy of the testicle is occasionally found, when, owing to atrophy of a retained testis, the other in the scrotum becomes enlarged.

Functional Diseases of the Testicle.—**Sterility** means inability to procreate. In the male it is associated with:

Non-descent of the testicle, or some other malposition of the same. When one testicle is down, and well developed, that man, provided no other reason for sterility exists, is to be considered to be capable of begetting children. A malposition of the testicle means that that organ is functionless, as regards the production of spermatozoa.

The ducts of the testicle may be obstructed from chronic orchitis, tubercular orchitis, the result of epididymitis. The latter is, when present on both sides, a common cause of sterility.

Stricture of the urethra, by causing the semen to regurgitate into the bladder. It is a condition which admits of cure.

What is called "aspermatisms" includes all mental and physical conditions whereby coition is rendered incomplete.

The *treatment* for any one of these conditions will resolve itself into removing the cause, if possible, such as curing the urethral stricture, dispelling the inflammatory thickening left after epididymitis, and so forth.

Impotence.—The want of sexual desire may be temporary or permanent. Temporary, when it arises from over-study, excessive sexual indulgence, or from exhausting physical exertion, as in over-training and the like. Permanent, when desire is congenitally absent, or when it prematurely disappears. Idiots and imbeciles are also regarded as incurably impotent.

The *treatment* of temporary impotence is the restoration of a healthy tone to the

body generally, and to the sexual organs in particular.

JAMES CANTLIE.

Symptomatic Indications.—*Spongia*, in the acute form of hydrocele, is the best remedy. *Pulsatilla* is also useful; and *calcareo carb.*, in children. *Rhododendron*, internally and locally, has cured.

In varicocele the most generally useful remedy is *hamamelis*; *pulsatilla* and *nux vomica* are also useful. When the varicocele results from injury, *aconite* and *arnica* frequently prove beneficial.

Aurum and *conium* are useful in wasting and atrophy of the testes; *graphitis* and *staphisagria*, in chronic induration; *nux vomica*, in hernia scrotalis.

In carcinoma of the testicles, the most valuable remedy is *arsenicum*, which palliates the symptoms and relieves the suffering; after *arsenicum*, *conium* is most frequently useful.

TETANUS.—This terrible disease is met with at all ages, and in the most healthy persons. Males from fifteen to forty-five are the most frequent sufferers, because they are most exposed to wounds, but females are by no means exempt, especially after burns. In America it is but little known except as a complication of wounds, and of these a contused and lacerated one (followed by decomposition and suppuration) is most likely to produce it, especially under certain atmospheric conditions, which, at present, we can only ascribe to sudden changes of temperature and degree of moisture. All authors are agreed as to the occasional influence of chill in its causation.

No wound is free from the risk. Even the introduction of a hypodermic needle, a slight graze of the skin, and the extraction of a tooth have been followed by severe tetanus. It is important to remember that a foreign body imbedded in the tissues (sometimes in a nerve) is liable to set it up.

Symptoms.—Acute traumatic tetanus may be fatal within twenty-four hours from the onset of tetanic symptoms. Even more rapidly fatal cases, in which death has ensued after a few hours, are recorded among negroes in the tropics, who appear to be peculiarly liable to tetanus.

As a rule, no rise of temperature occurs at the onset of tetanus, and indeed this may be absent throughout. On the other hand, it sometimes attains a phe-

nominal height shortly before, or just after death, even 112° . Increase of pain in the injured part, the restlessness and anxiety of the patient, and especially the trismus and difficulty of swallowing, first arouse suspicion as to the disease.

The spasms are generally symmetrical, the chief exceptions being cases in which the muscles of the injured limb are especially involved, and the rare cases of *pleurosthotonos*, in which the body is strongly bent to one side. The head and neck are usually bent backward, and the back arched (*opisthotonos*); rarely it is bent forward (*emprosthotonos*). The mouth is sometimes drawn outward and the eyebrows elevated, so as to produce a sort of grin (*risus sardonicus*). Besides the tetanic rigidity which is so characteristic, and which can be observed in the muscles of the jaws, the neck, and the abdominal wall, violent clonic outbreaks occur from time to time, sometimes excited by dressing the wound, a draught of air, etc. During a severe one the patient is threatened with death from asphyxia, and after it the exhaustion and profuse perspiration are very marked. Spasm of the deeper muscles, such as the diaphragm and psoas (rupture of both the latter has been several times found after death), may be present at the same time.

The following features may be associated:

1. Perspiration, profuse; fluids taken with difficulty; urine high-colored and scanty; sudamina on the skin.
2. Violent and continuous spasms of the voluntary muscles; obstinate constipation, and sometimes retention of urine.
3. Fever slight or absent; pulse slow and perhaps soft. A quick pulse (if observed in intervals of comparative quiet) is a sign of approaching syncope or exhaustion, and it has been asserted that if it exceed 120 per minute the case will end fatally. Rapid breathing is of less grave import, and is nearly always met with. The intellect usually remains clear to the last, sleeplessness (unless defeated by the use of chloral, etc.) is constant, but toward the end a deceptive calm from exhaustion is occasionally present; delirium is sometimes met with, but may then be due to the drugs used (*e. g.*, atropine). Death often occurs during asphyxia from laryngeal spasm, less frequently from exhaustion, and in a few cases from hyperpyrexia.

Irregular contraction of the diaphragm may produce a spasmodic cough; a "girdle pain" is supposed to be of particularly bad prognosis, as indicating pulmonary obstruction.

The so-called *idiopathic* form of tetanus appears to be largely due to exposure to chill, and is less fatal than the traumatic one.

Prognosis.—The great mortality of tetanus after wounds may be judged from the fact that of 363 cases in the American Civil War, 336 died. Prof. Gross states that during fifty years' experience he has only known three cases recover. A considerable interval—ten days to three weeks—between the wound and the first symptoms is of good augury, but severe and fatal cases are seen with a "latent period" of several weeks. Rapid development and severity of the symptoms are, of course, grave features in the case, and if the patient survives more than a week, his chance becomes better every day. The majority of deaths occurs within the first five days. In those cases which recover, the symptoms last on an average about a month, the intervals between the spasms becoming longer and longer, and the spasms less severe.

Diagnosis.—*Trismus*, when not a part of tetanus, is nearly always excited by local irritation, such as the extraction of a tooth or the cutting of a wisdom tooth; it does not spread to other muscles than those of the jaws; the spasm is tonic only, and may subside in a few hours, or gradually pass off in a few days.

In *spinal meningitis* there is fever from the first, and there are no marked convulsive attacks. The latter remark applies also to rheumatism of the cervical muscles.

In *hydrophobia* the spasm wholly intermits, and a fresh one is set up by the sight of water, there being no aversion to this in tetanus, merely a difficulty in swallowing, and that not in all cases. Melancholia, hallucinations, outbreaks of screaming or barking, and free discharge of saliva, are peculiar to hydrophobia.

Strychnia poisoning usually affects the whole muscular system rapidly (the masseters among the last). Its onset may be announced by retinal hyperæsthesia, or disturbed color vision; between the convulsions there may be no tonic contraction. Marked foaming at the mouth

may be present, as in hydrophobia, and the teeth are gnashed together rather than tightly clenched; hence the tongue is more likely to be bitten. Death supervenes, as a rule, within an hour or two. The resemblance of the two in other respects is very close, and strongly points to the real nature of tetanus.

Hysteria may closely simulate tetanus, but the phenomena due to spasm of the diaphragm are absent. The symptoms are much milder, and may cease when the patient believes he or she is out of observation. Dysphagia and sleeplessness are absent as a rule.

Tetany appears to be allied to hysterical contraction; it affects the hands and feet by preference, occurs almost entirely in children and women. It could hardly be mistaken for tetanus.

Pathology.—Various parts of the brain and spinal cord have been found congested and softened; on the other hand, these structures often appear normal. Mr. Pepper in one case described peculiar rounded patches of degenerated nerve tissue, but this change is neither peculiar to, nor frequent in, tetanus.

The nerves near the wound may be inflamed or normal; the lungs are usually engorged or inflamed; the endocardium stained, etc. Various muscles, such as the recti and psoas, are occasionally ruptured.

Two chief views are held as to the real nature of tetanus, and upon the importance attached to each must depend to some extent the treatment.

1. That the spasms are reflex, and due to irritation or inflammation of peripheral nerves. In its favor are the cases of tetanus set up by foreign bodies imbedded in nerves; against it is the extreme rarity with which it follows operations or accidents in which nerves are torn, ligatured, contused, etc. Were this theory correct, amputation and nerve stretching or excision, as measures of treatment, would surely be followed by better results than is unfortunately the case.

2. That some poison (allied to strychnine and the ptomaines) is generated in the wound, and acts by selection on the motor nervous centers. Among the facts pointing to this conclusion are: The resemblance of tetanus to strychnine poisoning and to hydrophobia; a contused wound, in which decomposition

must occur, is commonly the starting-point; a poison has been extracted from human urine which tetanizes animals. Inoculation with the blood from tetanic cases has hitherto failed, but it will be remembered that M. Pasteur, in producing hydrophobia, employs pieces of the brain and spinal cord.

Treatment.—On the first appearance of symptoms the patient should be kept in a private ward, the air of which is warm and dry, and all excitants of spasm, such as frequently dressing the wound, should be avoided. If the wound is very unhealthy, and on a comparatively unimportant part, immediate amputation is perhaps worth trial; otherwise, a warm antiseptic dressing should be applied. Nerve stretching or excision seems only worth doing if the local pain is severe, and if the transmitting nerve can be identified.

The bowels should be freely cleared by enema or purgative, and nutrient enemata may subsequently become necessary; though the use of sedatives or an anæsthetic with a gag has fortunately removed much of the old difficulty in giving nourishment, which should be concentrated and taken at considerable intervals.

The following are the chief sedatives used: chloral, bromide of potassium, calabar bean [better its alkaloid eserine], curare, belladonna, and opium or morphia. Whichever is selected, the surgeon should push it freely until some relief from spasm is obtained; and it may be necessary to use very large doses.

Chloral is perhaps the most useful at the onset, and subsequently toward evening so as to procure sleep, fifteen to twenty grains being a safe dose for an adult. Its great danger is heart paralysis, from which the use of bromide of potassium is comparatively free. The latter may be given up to four or six drams daily. Tobacco smoking helps to allay the spasm in some cases.

Eserine has been used in daily amounts of one-fourth or one-third of a grain; curare, one to three grains. Opium was formerly given in heroic doses, but it entirely fails to allay the spasm.

As far as our present knowledge goes, perhaps the best treatment is the very free use of the bromide, chloral being cautiously employed as a hypnotic. Every effort should be made to sustain

the patient's strength, and quinine is useful.

Since it has been shown that cocaine restrains reflex action it has been advised in the treatment of this disease.

JONATHAN HUTCHINSON.

Symptomatic Indications.—The most generally useful remedy is *nux vomica*, particularly in the idiopathic form, *aconite* is also useful in the idiopathic form, especially when excited by cold or wet. *Gelsemium* has proved beneficial. *Hyoscyamus* has relieved when there were alternate convulsions of upper and lower extremities; drawing of neck to one side; contortions and curvings of the body. *Arnica* in traumatic tetanus, jerks and shocks, has given excellent results. *Cuprum* in tetanus with opisthotonos; face pale; foam at mouth; loss of consciousness.

TETANY.—A tonic spasm of the extremities occurring chiefly in rickety infants and lasting a variable time.

Symptoms.—The attack commences more or less suddenly with numbness and tingling in the fingers, followed by stiffness and drawing of the hands into the typical position, with the thumb adducted to the palm but not flexed, and all the fingers adducted to the middle line of the hand, so that this is a little arched. The fingers are only slightly flexed at the metacarpo-phalangeal joints, but the wrists, elbows, and knees are usually somewhat flexed. The fingers may be separated when the attack is passing off. The feet are also arched and the toes adducted, the dorsum of the foot being tense and swollen; the hands and feet are usually very painful and tender; the back of the hand is swollen and tense, but does not pit. If the stiffness be overcome by force, the hand immediately resumes its position when the force is removed. In rare cases the muscles of the face about the jaw may also be in a state of contraction.

The spasm may last only a few minutes, though its duration is usually from a few hours to some days or even weeks; it does not appear during sleep, and is unaltered during chloroform anæsthesia. The attack passes off gradually, and as it does so there is a feeling of numbness and tingling; relapses occasionally occur. Facial irritability and laryngismus (*q. v.*) are constant accompaniments of tetany in

children. Fever is not always present. The peripheral nerves may show an increased irritability to both the induced and constant currents. Convulsions, when present, are probably due to some independent cause; they do not appear to have any connection with, or any influence over, the tetany, which may persist through them unaltered. Recovery is the rule, but the patient may die from suffocation during an attack of laryngismus.

Prognosis.—Except in the most severe cases there is a tendency to spontaneous recovery in the course of a few days.

Pathology.—No central changes have yet been discovered; the symptoms would point to reflex irritation of the spinal cord as the determining cause; the persistence of the spasm during sleep, chloroform anæsthesia and convulsions shows that the brain has no share in the causation.

Ætiology.—The disease is seldom met with except in rickety infants during the first three years of life, but occasionally occurs in older children and even in young adults of both sexes, and has been specially described by Trousseau as occurring in young nursing women. In the case of older children and adults it is always difficult to determine what share hysteria may have had in its production. The exciting cause in these cases is often a definite chill. In children, usually, some source of reflex irritation can be found, intestinal derangement being present in a considerable proportion of the cases. Teething, apart from rickets, does not seem to be a cause. Often other children in the family have suffered from it, and frequently one or other parent is neurotic or has neurotic antecedents.

Treatment.—Wrapping cold water bandages round the affected limbs always relieves the spasm, pain, and tenderness, and should never be omitted. The bandages should be renewed every three hours until the spasm is completely relaxed and the limbs can be manipulated without any pain. In all cases careful attention to the diet and to the hygienic surroundings is of the first importance in the treatment; any source of reflex irritation such as diarrhea, worms, or eczema, should be sought for and obviated. Where nothing of the kind can be discovered, nervine sedatives may be tried, Calabar bean ($\frac{1}{8}$ grain, thrice daily, for a child aged two years) being prob-

ably the best. Bromide of potassium, chloral, and morphine have also been given with success in some cases. In adults the possibility of hysteria should be borne in mind in directing the treatment. In children the administration of cod-liver oil and steel wine is always useful.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Nux vomica, hyoscyamus, cuprum.*

TEMPERATURE. — The average normal temperature in the axilla of a healthy adult is 98.6°F .; in children, 99° . The diurnal variation is about 1.5° , highest in the evening. This temperature is nearly the same in all climates, and maintains its standard in summer and winter. "A normal temperature does not necessarily indicate health; but all whose temperature either exceeds or falls short of the normal range are unhealthy." A persistent variation of 1° without apparent cause, is a sign of serious disease.

A clinical thermometer should be self-registering, accurately graded, plainly marked and certified as to its correctness. A lense front case (H. J. Green, Brooklyn) which magnifies the index adds much to the convenience of reading when taking the temperature. The bulb of the thermometer should be placed in the axilla and, the arm being pressed down, allowed to remain from seven to ten minutes.

The temperature in healthy conditions varies slightly in individual cases; it is increased at the prime of life, and temporarily raised and depressed by the influence of dirt, stimulants, exercise, etc. Its diurnal changes are most marked after meals, when there is a slight rise. The minimum daily temperature is found about 2 A. M., the maximum at 4 to 6 P. M. A rise above 99.5° , or fall below 97.3° , if persistent, indicates disease. The range of temperature in severe diseases is 30° ; the minimum 91.4° , the maximum 121.4° , though it seldom rises above 107° , even in severe and fatal cases, or falls below 95° . "Alterations of temperature may be confined to special regions, while the rest of the body remains almost normal; they seldom exceed 1.8° to 2°F . A rapid increase in the heat of the body, and decrease of the heat of the extremities, is associated with cold shivers, rigors, etc."

"A persistent temperature of 102° , or more, is usually accompanied with heat, lassitude, thirst, headache, frequency of pulse; if persisting, with diminution of body-weight, pyrexia, fever, fever heat."

"Any considerable diminution of warmth in the extremities, with very high, or very low central temperature, is expressed by a small pulse, sunken features, weakness, nausea, cold sweating, collapse."

A temperature of 107° indicates malignancy, and when found for two consecutive days in typhus, scarlatina, measles, pneumonia, pyæmia, meningitis, or rheumatism, indicates rapidly approaching death. In relapsing, remittent, and intermittent fevers, or in the initial chill of an abortion, the temperature may reach 107° without presaging danger. In many diseases, in the last hours, the temperature may rise to 109° to 112° , as in tetanus, sunstroke, typhus, etc.; and may rise 3° or 4° after death, as has been found in typhoid fever, rising from 107° to 110.5° ; when the temperature falls to 95° collapse is imminent.

A high average temperature, above 104° , is found in scarlet, remittent, typhus, and typhoid fever, pneumonia, etc. A moderately high temperature, 102° to 104° , in pleurisy, peritonitis, rheumatism, dysentery, etc. A temperature of 100° to 102° , in chronic affections, incipient inflammations. "When, in effervescence, the heat increases rapidly, it will in defervescence, decline proportionally fast, and *vice versa*. Beware of a grave affection when the temperature is of a continuous type. A distinct interval between morning and evening temperature is a favorable sign. A slow and gradual increase indicates typhoid fever; in rheumatism and analogous fevers the increase is more rapid, and still more so in acute inflammatory disease, pneumonia, angina, pleurisy, typhus, scarlatina, rubeola, etc. It is usually very rapid in intermittent fever, febricula, and ephemeral fever. A rapid effervescence and slow defervescence indicates some complication of disease; the reverse order indicates great danger."

In phthisis, the temperature is higher in the evening than in the morning, although usually continuously higher than normal, the morning temperature being about 102° , and the evening temperature rising to 104° . In chronic cases the temperature is intermittent, the minima falling to

normal or a little below, the maxima rising to 101.3° to 102° .

In typhoid fever the temperature increases a degree each day, with daily variation, rising from 1.5° to 2.5° from morning to evening, and falling from evening to next morning from $.9^{\circ}$ to 1.3° , so that by the third or fourth evening a temperature of 104° or a little more is reached. If the evening temperature does not exceed 103.5° the disease is probably of a mild type, but a rise of 105° presages a severe form and a dangerous condition. A sudden fall of the temperature during the third week to 95° indicates intestinal hemorrhage; a continued temperature of 101° to 102° in the fourth and fifth weeks denotes non-cicatrizatio of the intestinal ulcers.

In pneumonia the temperature rises at once to 104° to 105° in the evening, falling one or two degrees in the morning.

In measles the usual temperature is about 103° , increasing with the eruption to 104° , and in severe cases to 105° . A high temperature, lasting beyond the tenth day, indicates complications.

In scarlatina the rapid rise of temperature is characteristic, as no other disease presents such a rapid increase, a temperature of 104° to 105° being sometimes reached in a few hours. The high temperature is continuous until the eruption begins to fade, when it remits, unless there are complications.

In variola the temperature rises on the first day to 103° to 104° , and on the second or third day to 105° , and in severe cases to 107° . With the appearance of the eruption the temperature falls nearly to normal, rising again with the maturation of the pustules to 102° to 104° .

In croup the temperature rarely rises above 101.5° , except with complication with other diseases, when it may rise to 104° to 105° .

In diphtheria, in uncomplicated cases, the temperature rises in the first two or three days to 103° to 104° , with morning remissions. With the appearance of the exudation it begins to decline, falling rapidly. In mild, favorable cases falling from the fourth to the sixth day, in more severe cases from the twelfth to the fourteenth. A sudden rise of temperature, during the progress of the disease, indicates the extension of the disease to the larynx or other complication. In asthenic cases, the surface temperature falls while the

internal remains high. During convalescence the temperature is low and readily depressed.

THIRD NERVE, DISEASES OF.—

This nerve, the motor nerve of the eyeball, arises from its nucleus of large cells in the floor of the aqueduct of Sylvius on either side of the middle line, in the neighborhood of the corpora quadrigemina. The nerve runs forward through the crus, and emerges at the interpeduncular space, courses along the outer wall of the cavernous sinus, and enters the orbit through the sphenoidal fissure, dividing into two branches; the superior supplies the superior rectus and the levator palpebræ superioris, while the inferior supplies the internal rectus, the inferior rectus, and the inferior oblique muscles. Besides these the nerve also supplies the ciliary muscle and the constrictor muscles of the iris. According to Hensen and Voelcker, these different functions are arranged in the nucleus of the nerve in the following order from before back. Most anteriorly is the center for accommodation, then for the reflex action of the iris, next for the muscles, the internal rectus, the superior rectus, levator palpebræ and inferior rectus, while below them is the fourth nucleus, for the superior oblique. Muscular paralysis and spasm are the affections which result from lesions of the third nerve.

Paralysis.—This will differ in its distribution accordingly as the nucleus or the nerve trunk is involved; when the former is affected, the symptoms will vary according to whether the whole nucleus is paralyzed, or different parts of it. When the *whole nucleus* is affected, the lesion is frequently associated with disease of the nuclei of the other ocular nerves, and ophthalmoplegia externa and interna of Hutchinson is the result, all movements of both eyes being lost together with the reaction of the pupils to light, and the power of accommodation (*see* OPHTHALMOPLÉGIA). The loss of the pupil reflex (Argyll-Robertson pupil) is a well-known symptom of locomotor ataxia, and occurs without any other part of the nucleus being affected. The *trunk of the nerve* is affected by hemorrhage or softening in the crus cerebri, by meningitis or growths, or aneurism in the interpeduncular space; by rheumatic disease of the nerve in the wall of the cavernous

sinus; by syphilitic disease of the membranes there, or aneurism of the internal carotid artery. The nerve may also be affected in diphtheritic paralysis, and in tabes dorsalis. In the orbit the nerve or its individual branches may be compressed by growths. When the whole trunk is affected, the eye cannot be turned in any direction except outward, and outward and downward; there is external strabismus, with diplopia, ptosis, and loss of accommodation. The pupil is of medium size, but does not contract to light or on accommodation. When the different *branches of the nerve* in the orbit are involved, the individual muscles supplied are paralyzed. Thus, when the right *superior rectus* is paralyzed, the eye cannot be turned upward, and in trying to do so the eyeball is rotated on its antero-posterior axis out and down by the inferior oblique; secondary deviation—*i. e.*, the overaction which the sound eye executes when the paralyzed eye tries to fix an object above it and which the sound eye is prevented from seeing, is by the left superior rectus; there is diplopia for objects seen in the upper half of the field of vision, the images being side by side and one above the other; they are crossed—*i. e.*, when the right eye is covered up, the left image, which is also the higher of the two, disappears; the further the object is removed from the horizontal line, the greater the separation of the images.

In paralysis of the right *inferior rectus*, the symptoms are similar, though the direction is reversed; movement is defective downward, the eyeball being rotated on its antero-posterior axis out and up by the superior oblique; secondary deviation is by the left inferior rectus; there is diplopia for the lower half of the field of vision, the images are side by side and are below the other, they are crossed, the left and lower image disappearing when the right eye is covered up; the separation increases downward from the horizontal line.

When the right *internal rectus* is paralyzed, there is a divergent squint, and the eye cannot be turned inward; secondary deviation is by the left external rectus. Diplopia occurs in looking at objects to the left of the middle line, the images are side by side, and become further separated as the object is moved to the left; they are crossed—*i. e.*, the left image

disappears when the right eye is closed.

With paralysis of the right *inferior oblique*, there is defective movement upward, for the muscle works with the superior rectus; secondary deviation takes place by the left inferior oblique and superior rectus. Diplopia is for objects in the upper field, and is simple,—*i. e.*, the false image is to the right, the images are side by side, the false one being the higher, and the distance between them is increased by looking to the left, while on looking to the right the false image becomes oblique, converging toward the horizontal line.

Spasm occurs in some of the muscles supplied by the third nerve, and especially the internal rectus and levator palpebræ; the former condition is met with in hysteria, meningitis, and hypermetropia. Clonic spasm of the muscles occurs in nystagmus, especially in the form affecting miners.

Diagnosis of paralysis, when the whole trunk is involved, is not difficult, but when single muscles are affected, and strabismus is not a marked symptom, the position and behavior of the double image will assist the diagnosis.

Prognosis.—When the paralysis is due to organic growths or an affection of the nucleus, as an ophthalmoplegia externa, the prognosis is unfavorable, but favorable when caused by rheumatic or recent syphilitic disease, or after diphtheria. In tabes dorsalis, in the early stages, the prognosis is favorable, but in the latter the paralysis is usually permanent.

Treatment.—If the paralysis is due to organic disease, the treatment is that suitable for the disease. When due to cold, hot fomentations may be applied and be followed by a blister on the temple just outside the orbit, and tonics may be given. Iodide of potassium in increasing doses should be administered, if syphilis be the cause of the lesion. After diphtheria, the paralysis usually recovers with tonic treatment. The constant current may be employed (very weak), the negative pole being applied to the closed eye, and the positive pole being placed at the back of the neck. In cases of spasm the best results are obtained by counter-irritation to the temple.

C. E. BEEVOR.

THOMSEN'S DISEASE (Myotonia Congenita).—An hereditary disease occurring in several members of the same family. Upon the attempt to use any of the voluntary muscles, the patient finds that contraction is slow; and relaxation is still slower, because the muscles remain tonically contracted for some seconds. Much the same result is noticed upon the application of any form of stimulus to the muscles. There are certain characteristic electrical reactions. Under the microscope the muscular fibers are found to be hypertrophied.

Symptoms.—The chief of these is a peculiar stiffness which accompanies voluntary movements. Involuntary movements are never affected. The peculiarity of movement consists in the fact that the contraction of the muscle the patient wills to move is slower than normal, that it persists, and then relaxes gradually and very slowly; consequently the muscle remains contracted for some seconds, and this contraction is so strong that the antagonistic muscles cannot overcome it. If a series of similar voluntary movements be made one after another, the patient begins to execute the second movement before the first contraction has completely relapsed, and his difficulty, as regards stiffness, gradually becomes less and less in each movement. For example, if he be standing still and set out to walk he puts forward one leg rather slowly, it then remains stiff for a few seconds; the next time it is moved the stiffness is less, and soon he walks quite comfortably even for miles; but, if he trips against a stone this brings into play a new movement, and the muscles performing it become stiff, and he may fall down. The acts of respiration, micturition, defecation, and parturition have never been observed to be implicated, but with these exceptions the stiffness may be noticed in any movements executed by voluntary muscles. The muscles of the extremities are most commonly implicated; some of the rarest to be affected are the muscles of deglutition, those of speech, those of the eye, and the interossei. The muscles are well formed, sometimes they are a little increased in bulk; there is slight diminution in power. Erb gives the following points as characterizing the "Myotonic Reaction" (MyR). The contraction of the muscles, upon mechanical stimulation of the motor nerves,

is normal. Mechanical stimulation of the muscles, as by repeatedly hitting them with a percussion hammer, easily produces contractions lasting from five to thirty seconds. The motor nerves are quantitatively normal to the faradic current, but strong closing currents induce long lasting contractions. The motor nerves are quantitatively normal to the galvanic current, but strong closing currents produce long lasting contractions. The effect of the faradic current applied to the muscles is the same as when it is applied to the nerves. The galvanic current applied to the muscle shows that opening contractions are very difficult to obtain, that the closing contractions are of very long duration; that anodal closing contractions (ACC) are as easy or more easy to obtain than kathodal closing contractions (KCC), and that upon stable application, well formed, wave-like contractions may be seen to pass from the kathode to the anode. Almost all observers have obtained all these features of MyR, except that very few have found the wave-like contractions, and there is some doubts as to the response of the muscles to mechanical stimuli to the nerves. Pain upon contraction of the muscles is excessively rare. The latent period is probably normal, although there are some differences of opinion on this point. Myographic tracings bring out the features of the movement very well. The difficulty of movement is usually, but not always, increased by mental excitement or cold. It is often said to be diminished by alcohol, digestion, and warmth. The reflexes are normal; there are no sensory symptoms. The muscular fibers excised during life are wider (from two to four times) than normal, the transverse striation is indistinct, the border of the fiber is irregularly curved, the muscle nuclei are increased in number, and sometimes there is a slight excess of interstitial tissue.

Course of the Disease.—It is usually first observed during childhood; most often at about the age of eight or nine the child notices that it cannot take part in games. The difficulty of movement, as a rule, becomes worse at puberty. It is doubtful whether recovery ever takes place; usually the trouble is slowly progressive. It usually incapacitates from almost all occupations.

Diagnosis.—This is not difficult if the

salient points are remembered, but all sorts of obscure cases of muscular spasm are incorrectly described as Thomsen's disease.

Prognosis.—This is bad. No certain case of recovery has been recorded. Thomsen found he was better the more active his life. One woman is said to have improved when she married.

Pathology.—The only pathological basis for the disease is in the muscular fibers. That these are its seat is supported by the following facts: (1) The histological changes in them; (2) Thomsen-like contractions can be produced upon direct stimulation of the muscles of the frog, even when the end plates have been paralyzed by curare, if the animal has been brought under the influence of sodium phosphate; (3) some animals possess in each muscle two sorts of fibers: white, which contract quickly, and red, which contract slowly; (4) the muscles of newborn animals also contract very slowly. Bernhardt has suggested that the disease is an hereditary defect of muscular development. Some have supposed that the nervous system is also at fault, but of this there is no evidence.

Ætiology.—Rarely it has been ascribed to fright, but it is uncertain whether this ever has any causative relation, probably not. It is strongly hereditary, occurs in many members of the same family, and is directly transmitted by fathers and mothers to both sons and daughters.

Treatment.—None has been of any avail. Tonics, electricity, electric baths, and massage have all been tried.

W. HALE WHITE.

THREADWORMS (*Oxyuris Vermicularis*).—The threadworm is a minute filiform nematode, of which the female is the longer, though less than half an inch in length; the female is full of ova, the eggs being oval in shape. It is supposed that the eggs are swallowed with fruit or vegetables, and that the embryos are liberated in the stomach. Re-infection afterward takes place without any external source of infection, the child (for the affection is much more common during childhood than subsequently) scratches the anus, and so gets some of the ova under his nails, when they find their way into his mouth at

meal times. According to Cobbold, the cæcum is the habitat of the threadworm.

Symptoms.—Unless the worms are actually seen either about the anus, in the bed, or in the motions, it should not be taken for granted that a child is suffering from threadworms. They are apt to produce heat and irritation about the anus, as also about the vagina and prepuce, whither possibly they are transferred by the hands of the child rather than by spontaneous migration. Children suffering from worms are often restless and irritable; they pick at their noses, have twitchings of the face and limbs, and sometimes even convulsive movements. Leucorrhœa may be set up in little girls, and threadworms have been regarded as one of the causes of masturbation. There may also be diarrhea and slimy motions, with a tendency to prolapsus ani.

Treatment.—Popular superstition attaches much importance to so-called worm powders, and a dose of three grains of powdered rhubarb with half that quantity of carbonate of soda may be given to an infant under one year to bring away the worms; such a powder often does expel large quantities of threadworms. Its administration should be followed up by a small enema (not more than three ounces) of salt and water, or a similar quantity of infusion of quassia may be used, and, except in inveterate cases, the repetition of the enema on two or three successive evenings is usually sufficient to rid the patient of his trouble. In the more chronic cases cod-liver oil and steel wine may be given internally with benefit, while calomel and jalap may be substituted for the rhubarb and soda, and small doses of perchloride of iron may be added to the enemata. In adults the same treatment should be adopted, but the cases are often more rebellious. Saline mineral waters, such as Friedrichshall and Hunyadi Janos, are of service in these cases. The strictest cleanliness should be adopted, and the child's hands should be muffled and tied up at night so as to avoid the possibility of reinfection taking place as above described.

THROMBOSIS.—The process of coagulation of the blood within the heart and vessels during life.

The resulting product of coagulation is termed a *thrombus*. The essential cause of coagulation is the formation of *fibrin*, which is derived from the action of a *ferment* upon fibrinogen contained in the plasma. Formerly it was believed that fibrinoplastin was also necessary.

The disintegration of the white corpuscles continually produces this ferment, but not in sufficient amount to cause coagulation in health. It is more abundant in venous blood than arterial. Recent observations have shown that this ferment is derived not only from leucocytes, but also from the blood plates, or from microcytes, and the formation of thrombi has been especially ascribed to their agency. If a foreign body such as a thread be introduced into the circulating blood, it will be covered, after a short time, with leucocytes and microcytes, which serve as a starting-point for coagulation.

The blood, in order to remain in a fluid state, must be in contact with the healthy endothelium, which forms the wall of the capillaries and the internal lining of the remainder of the cardio-vascular system. Should this be damaged, coagulation will occur at the point of injury. The vessel, denuded of epithelium, acts like a foreign body; the leucocytes and microcytes adhere to it; the result is the formation first of ferment, and then of fibrin. Retardation of the circulation is not, of itself, a direct cause of thrombosis, but it is a very important factor in its production; firstly, by favoring the accumulation of leucocytes, and, secondly, by causing impaired nutrition of the vessel wall.

Thrombosis may arise from two causes, which generally coexist:

I. Injury and Destruction of the Cardio-Vascular Endothelium.—(1)

The process of obliteration of a vessel by ligature, torsion, and cautery, is an example of simple injury without any abnormal condition of the blood.

(2) Inflammatory conditions of the cardio-vascular system, such as *endarteritis*, *endocarditis*, and *phlebitis*, whether originating primarily in the intima, or extending from inflamed circumjacent tissues, are the commonest causes of thrombosis. (3) Foreign bodies and new growths may cause thrombosis of the veins by piercing the walls of the vessels.

(4) Imperfect nutrition of the vessel

walls, due to slowing of the circulation and poverty of the blood, is another important factor in such cases; leucocytes are frequently in excess in the blood. The affection occurs with especial frequency in the veins of the lower extremities, also in the auricular appendices, the apices of the ventricles, and between the trabeculæ of the heart.

II. Abnormal Conditions of the Blood.—In septic fevers, typhus, septicæmia, erysipelas, and pyæmia, the amount of fibrin ferment is greatly increased, owing to the breaking up of leucocytes, possibly by the agency of micro-organisms. This condition of the blood is usually associated with a failing heart and loss of vascular tone. The circulation is thus retarded, and the endothelium is liable to be damaged.

There is a tendency to thrombosis in the later months of pregnancy and after profuse hemorrhage; also in certain diseases, as typhoid fever, diabetes, Bright's disease, gout, phthisis, and cancer. After parturition, thrombosis of the iliac veins is liable to occur, causing phlegmasia dolens (*q. v.*).

Varieties of Thrombi.—Red thrombi are uniform red clots, soft in the early stages. They form in the blood by coagulation when the circulation through a vessel has ceased—*e. g.*, after ligature or embolism.

White or Mixed Thrombi are found in the circulating blood; the foreign body or damaged vessel serves as a surface of attraction for the sticky leucocyte and microcyte. These adhere and form ferment, which causes a deposition of fibrin from the blood. The deposit is frequently stratified, and the strata may present different colors, owing to the varying numbers of red corpuscles in the coagulum, this being dependent upon the degree of slowing of the circulation. Thrombi may be further divided into *obliterating*, or those which completely fill the vessel, and *parietal*, or those which adhere to some portion of the wall. The former are generally red, the latter colorless.

When a thrombus extends, whether in an artery or vein, it is always toward the heart; hence thrombosis of the iliac veins may extend to the inferior vena cava and give rise to symptoms of obstruction of that vessel.

Cardiac Thrombi.—The distinction of

ante-mortem from *post-mortem* clots in the heart is of importance. The former are found especially in the auricular appendices and at the apices of the ventricles; they have a smooth or ribbed surface, buff or variegated color, and usually vary in size from a pea to a large filbert; they often occur in groups which are continuous with one another. They may be of uniform consistence on section, but more frequently their center is broken down, from degenerative changes, into a thick reddish-yellow pus-like fluid, consisting of cholesterine, fat granules, and degenerated blood corpuscles. They cannot be removed, being firmly adherent.

Post-mortem clots are often like black-currant jelly, the portions prolonged into the arteries being usually fibrinous, while those of the veins and pulmonary arteries are soft and black. They are readily removed, and in no case adherent. Often, during the death agony, clots are forming in the heart for some hours. These consist almost entirely of fibrin; they are opaque, buff-colored; it may be even slightly laminated, but they are only entangled and never really adherent; they are moister and tougher than *ante-mortem* clots, and never show the yellow hue of degeneration.

The changes which may occur in thrombi are *decolorization* from changes in the hemoglobin and absorption of the pigment; *softening*; *organization*, or conversion into fibrous tissue; *canalization*, or channeling of the thrombus, and *calcification*, giving rise to a phlebolith.

The softening may be *simple*, the degenerative changes taking place in the center; or *puriform*, as in cases of *infective thrombosis*. The latter occurs when germs gain admission to the thrombus, or when the process which excites thrombosis is a septic one. As an example, infective thrombosis of the lateral sinus occurring in purulent otitis media may be mentioned.

In connection with the obstruction of vessels by blood clots it is well to bear in mind, first, that thrombosis is the cause of obstruction when it exists in the pulmonary, hepatic, and systemic veins; secondly, that arteries and the portal vein may be obstructed either by thrombosis or embolism; and, thirdly, that when obstruction occurs in the pulmonary arteries, associated with pre-existing venous thrombosis, it is due to embolism.

The *results* of thrombosis are (1) those due to mechanical obstruction of the circulation, and (2) the dislodgment of simple or infective particles into the circulation with the production of embolism.

The results of venous thrombosis depend in great measure upon the possibility of collateral circulation being established; the conditions are the same as those produced by the obstruction of veins from whatever cause—namely, swelling and œdema of the part, with compensatory enlargement of anastomotic vessels. If the obstruction lasts for some time, the tissues become indurated as the result of mechanical congestion. See EMBOLISM.

THROMBOSIS, PUERPERAL VENOUS.—See PHLEGMASIA DOLENS.
THORACIC ANEURISM.—See ANEURISM.

THROAT, ULCERATED.—Ulcers are very common in connection with the various structures of the throat, being either acute or chronic. They may be enumerated as: 1. Catarrhal, which are slight and superficial, being very frequently observed, especially at the back of the pharynx, and often associated with chronic catarrh. 2. Follicular. These ulcers are generally small, and circular or oval, corresponding to the follicles, but by their union they may become irregular and of some size. 3. Syphilitic, either secondary or tertiary. 4. Scarlatinal. 5. Diphtheritic. 6. Ulcers following eruptions, such as herpes. 7. Gangrenous or sloughing sore throat, cynanche, or angina maligna. This form of ulceration is generally associated with syphilis or scarlatina, but may be independent of these affections. Thus, it may follow severe catarrhal inflammation, if the patient is in a very low state of health from any cause; and occasionally it occurs as a complication of typhus, enteric fever, or other exanthemata. It spreads more or less extensively, but not as a rule deeply; the mucous membrane is dusky, while there is much œdema around. 8. Ulcers on the tonsils simulating syphilitic ulcers, but probably originating in blocking up and subsequent inflammation of their follicles. 9. Cancerous ulceration, which is extremely rare.

Symptoms.—Ulceration of the throat may be unattended with any symptoms,

even when of considerable extent. Usually, however, local symptoms are present to a greater or less degree. There may be merely uneasiness or pain and difficulty in swallowing, but when certain parts are destroyed, most unpleasant and dangerous symptoms are liable to arise. Food, especially of a liquid kind, may tend to pass into the posterior nares or down the larynx instead of into the esophagus. The voice is often completely altered, being thick, guttural, and indistinct; or the patient may scarcely be able to articulate at all. Offensive matters are hawked or coughed up; and the breath is in many cases very foul, sometimes peculiarly so. It is important to notice that dyspnoea is not uncommonly present, being attended with very noisy breathing; and that there may be a liability to sudden death from suffocation, in consequence of the ulceration involving the upper opening of the larynx. In some cases there is also a danger of hemorrhage.

Ulceration of the throat is often attended with a low condition of the general health, and there may be much emaciation and debility, owing to inability to swallow food. In gangrenous ulceration there is a danger of septicæmic symptoms setting in. Of course, when the ulceration is a part of some special disease, such as scarlatina, the general symptoms will be modified accordingly.

The ultimate local consequences of ulceration are also liable to be very unpleasant, or may even prove dangerous in the way of permanent destruction of tissues, adhesions, and contractions after cicatrization. I have seen a case in which the throat was one large chasm, with thickened bands extending along its walls, every trace of its various parts having disappeared. Of course, under these circumstances, swallowing becomes very difficult, and the voice is permanently altered.

Diagnosis.—It must be borne in mind that the throat may be ulcerated without any complaint of local symptoms being made by the patient. The smell of the breath has in not a few instances led me to the discovery of unsuspected ulceration in this part, and, when this is fetid, the throat should always be carefully examined. In conducting the examination it is necessary to raise the uvula, in order to see the upper part of the back of the

pharynx, as ulcers are not uncommon here, and may otherwise be overlooked. It is important to determine the nature of any ulceration of the throat, and especially whether it is of a syphilitic character.

Prognosis.—Ulceration of the throat may prove immediately dangerous, in consequence of interfering with deglutition, and thus affecting nutrition; spreading to the larynx; giving rise to hemorrhage; or inducing septicæmia. Some forms are difficult to cure. The destructive effects of ulceration may lead to serious permanent mischief.

Treatment.—1. *Local.*—For most ulcerations of the throat nothing answers better than the frequent use of chlorate of potash as a gargle (3 ij-iiij to Oj); or in the form of lozenges or spray. Follicular ulcers, as well as other chronic forms, often require to be freely touched with nitrate of silver or its solution. When the surface is sloughy, antiseptic gargles must be abundantly employed, such as one containing Condry's fluid, carbolic acid, creosote, or chlorine, and they may be used alternately with the chlorate of potash gargle. In gangrenous forms of ulceration exhibiting a tendency to spread, it is advisable to start by brushing the surface over carefully with strong nitric acid, or hydrochloric acid, then proceeding with the other application. Inhalations containing carbolic acid, creosote, or other antiseptics are also very valuable.

2. *General.*—It is very important, before commencing treatment, to determine the nature of any throat ulceration, and especially whether it is due to syphilis. If such is the case, iodide of potassium with decoction of cinchona bark or quinine generally produces the best results. Sometimes a course of mercury is required, but it must be conducted with care. It will often be found, even in syphilitic cases where there is much sloughing, that dilute nitric acid, with decoction of bark, brings about rapid improvement, and this mixture is very useful in other forms of gangrenous ulceration. Tincture of steel, in doses of m.xx-xl every four or six hours, is also exceedingly valuable, especially if there is much debility, and it may be combined with quinine. The internal administration of chlorate of potash is recommended as a specific remedy in throat ulcerations. It has appeared to me to answer just as well if freely em-

ployed locally, but it may be given as a drink. Dr. Sansom advocates the use of the sulpho-carbolates.

Not uncommonly one of the most important matters requiring attention is the feeding of the patient. In many cases, owing to great difficulty or pain being experienced in swallowing, very little or no nourishment is taken, and hence the system becomes greatly lowered, so that healthy action cannot take place, and the ulceration will not heal. Under these circumstances the patient must be compelled to take small quantities of beef-tea and milk at frequent intervals, and in this way a considerable amount of nutriment may be administered. If this is persevered in for a short time the patient generally becomes able to swallow easily, and there is a marked effect for good produced on the ulceration. At the same time a good quantity of port wine should be given in similar small doses. If deglutition is really impossible, nutrient enemata must be employed.

When there is much dyspnoea accompanying throat ulceration the patient must be carefully watched, as remarkably sudden death may occur from suffocation, and laryngotomy or tracheotomy may be called for at a moment's notice. Indeed, in cases attended with great danger it is decided advisable to open the larynx as a precautionary measure, so that there may be no fear of sudden death, while, at the same time, the ulcerated structures are left in a state of rest, and therefore in a more favorable condition for undergoing the healing process.

FREDERICK T. ROBERTS.

Symptomatic Indications.—*Mercurius* is the principal remedy, particularly in inflammations of low grade; pains worse at night; expectoration of much tough, fetid saliva; putrid sore throat. *Aconite*, when disease attended with marked febrile symptoms, is useful. *Belladonna* has marked power when membrane is highly inflamed without much swelling; ulcers on inflamed base, very painful. *Kali bichrom.*, hoarse, croupy cough, with expectoration of stringy mucus, deep-eating ulcers in the fauces. *Arsenicum*, severe cases; much prostration; putrid or gangrenous condition.

THRUSH.—A form of stomatitis due to the presence of a vegetable parasite termed the *Oidium Albicans*.

Symptoms.—The disease commences with the formation of circular spots about the size of a pin's head, slightly elevated, and of a white color, on the tongue, gums, buccal mucous membrane, or pharynx. It does not extend into the larynx, nor has the white membrane, which is characteristic of the disease, been found beyond the esophagus. If the course of the disease be unchecked, the spots gradually coalesce, until in some cases, the mucous membrane of the mouth is covered with patches of a whitish color. The membrane is at first slightly adherent, so that a little oozing of blood follows attempts to remove it. Thrush is usually ushered in with some febrile disturbance and gastro-intestinal irritation, such as sickness, diarrhea, and abdominal pain and tenderness. In cases running a fatal course the patient becomes drowsy, there is profuse diarrhea with foul-smelling stools, and the nates and anus become red and excoriated.

Diagnosis.—The only condition with which thrush is at all likely to be confounded is simple aphthous ulceration; its differentiation from the latter will be found under APHTHÆ.

Prognosis.—In children who are under favorable conditions, and who can be kept clean, the disease generally yields readily to treatment; but in adults, on the other hand, it usually indicates the commencement of the end, though cases of recovery do occur even when patches of membrane of a considerable size have formed.

Pathology.—As already stated, the essence of the disease consists in the presence of a vegetable parasite, the *oïdium albicans*, and it is now generally admitted that this is identical with the *oïdium lactis*, the ferment fungus on the presence of which depends the acid fermentation of milk. When the white membrane of thrush is examined microscopically, it is found to be composed of spores and filaments with a granular basis.

Ætiology.—Thrush is for the most part a disease of infancy, occurring almost exclusively in children brought up by hand, but it may be met with in old people and in persons exhausted by some wasting disease, such as cancer or phthisis.

Treatment.—The important indication is the observance of the most scrupulous cleanliness in everything used for the child, especial attention being paid to the

state of the bottle. The mouth should be carefully swabbed out two or three times daily with a weak solution of carbolic acid, permanganate of potassium, or sulphurous acid. In the interval a spray composed of 20 grains of borax and 20 minims of glycerin in an ounce of water may be used. If, in children brought up by hand, the disease does not yield to the treatment just recommended, a wet nurse should be engaged, and recovery may then be expected even in cases apparently hopeless. In a very severe case occurring in an adult the administration of a lozenge containing $\frac{1}{6}$ grain of cocaine and 5 grains of chlorate of potassium, every three or four hours, speedily effected a marked improvement in the local condition, and enabled the patient to take food without pain.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Arsenicum* is useful in adults and children; great burning; exhaustion; emaciation; *chamomilla* in children; peevishness; restlessness; colic; green stools. *Mercurius* is useful in confluent thrush, changing into cankers; pytalism; bad smell from the mouth; feverishness; green, slimy stools; *baptisia*, last stage of consumption.

TINEA VERSICOLOR (Pityriasis Versicolor).—A disease of the skin due to the presence of a vegetable parasite—*microsporon furfur*—and characterized by the existence of fawn-colored or brown, slightly scaly patches, usually confined to the trunk.

Tinea versicolor is common, but its discovery is frequently accidental, as it seldom causes subjective symptoms of sufficient intensity to prompt application for relief, but a severe form is said to exist in the East. It is essentially a disease of middle life, being rare below fifteen and above forty-five years of age. It runs a chronic course, and is subject to considerable exacerbations and remissions, according to the amount and condition of the sweat secretion. The affection is, therefore, generally worst in warm weather and its relative frequency in phthisical subjects who perspire freely is thus explained.

Eruption.—The favorite seats of the disease are the front of the chest, the abdomen and the interscapular region. The lesions consist, at first, of small, cir-

cular, discrete spots which soon coalesce to cover extensive, irregular areas, and may finally cover, almost uninterruptedly, the whole trunk. Generally, however, the distribution is more patchy, and round the main tract of disease there are outlying islets, roughly circular in outline. Extension to the upper arms and thighs is common, and the disease may spread occasionally as far as the wrists and ankles, but its occurrence on exposed parts (*e. g.*, face and hands) is extremely rare. The fungus has, however, been found in a case of apparently simple seborrhea of the scalp. The color of the patches is yellowish, fawn, or some deeper tint of brown, according to the "complexion" of the patient—*i. e.*, the amount of pigment normally present in the skin. Their surface is finely scaly, their edge sharply defined, although only slightly elevated. Scraping with the nail or with a knife removes the scale and discoloration. Occasionally, especially after violent exertion and in summer, the patches inflame, become eczematous and itchy, some difficulty in diagnosis being thereby produced. The fungus, which lies in the most superficial horny layers of the epidermis, can be easily demonstrated by microscopic examination of scrapings after their treatment with ether and liquor potassæ or acetic acid. It consists of closely interlacing, fine mycelial threads or tubes, and of triangular or pyramidal heaps of small, brightly refracting, circular, nucleated spores, which often lie at points of intersection of the mycelial threads. Although undoubtedly contagious, T. versicolor is so to a very limited degree only.

Diagnosis.—The affection can only be mistaken for lichen circinatus (eczema seborrhœicum corporis), pityriasis rosea, erythrasma, pigmentary syphiloderma, or other disorders of pigmentation, but in doubtful cases the microscope will at once clear up the diagnosis.

Treatment.—Repeated and vigorous washings with hot water, soft soap, and a fleshbrush, or a piece of flannel, are necessary to remove greasiness and scales previous to the application of the parasiticide lotion or ointment. Ointments of sulphur or chrysophanic acid are efficacious but disagreeable remedies. A lotion of hyposulphite of soda (3 j ad 3 j) is that most usually employed, and probably the previous dabbing on of vinegar,

which causes the decomposition of the hyposulphite and the production of sulphurous acid in an active state, is an improvement. It is generally advisable to continue treatment after apparent cure has resulted, as little islets of disease, where the parasite is perhaps unusually deep in the epidermis, are apt to pass unperceived. It is also a wise precaution to destroy all clothing worn next the skin; silk is a preferable material to flannel for the underclothing of persons liable to the disease.

Erythrasma.—A rare disease of the skin to which certain authors are inclined to assign no place as a morbid entity, but to consider it as a phase of tinea versicolor or tinea cruris (eczema marginatum), or even as an intermediate condition between the two.

Erythrasma always attacks the axillæ or inguinal regions, nates, and immediately neighboring regions. It forms reddish or brownish, sharply defined, slightly raised, desquamating patches, which cause no itching or inconvenience, and may thus pass for years unperceived. In the one indubitable case seen by the writer, in a man, it occupied the entire gluteal region. The micro-organism—*microsporon minutissimum*—consists of densely packed, very fine, interlacing threads, none of which branch or segment. Observers differ with regard to the presence of spores; the majority, however, have not observed them.

The condition is readily curable by the same means as tinea versicolor.

J. J. PRINGLE.

Symptomatic Indications.—*Sepia* is useful for brown-red herpetic spots on the skin; *lachesis*, for small reddish spots on the face, neck, and chest, become scurfy, then disappear; *viola tricolor*, dry scabs; *cocculus*, red spots on skin without heat or itching.

TINNITUS.—A singing, ringing, or other kind of noise in the head; a frequent accompaniment of deafness. It may be present in almost every form of disease of the middle or internal ear, in obstruction to the eustachian tube and in accumulation of wax in the external auditory meatus. It is also met with in nervous and other forms of deafness where the ear is quite normal, and in such cases it is usually incurable. When disease of the ear is present,

the treatment must be directed to its removal.

TOBACCO, POISONING BY.—

Whether taken in the form of infusion or smoked or chewed, the *symptoms* of poisoning by tobacco are much the same, and consist of vertigo, nausea, vomiting, and colic. These are accompanied by a clammy state of skin, or the latter may be bathed in perspiration; diarrhea, pallor, faintness, and trembling are also usually present, and the pulse becomes very small and weak, and the patient much collapsed. There may be tetanic cramps. The pupils become dilated and insensible, and, in fatal cases, stupor and convulsions precede death.

Post-mortem Appearance.—The odor of tobacco, if present, may be easily recognized, otherwise there is nothing characteristic.

Treatment.—Consists in aiding the rejection of the poison, by vomiting, etc., and in combating the collapse by the use of stimulants and strychnine, either by the mouth or by hypodermic injection (gr. $\frac{1}{25}$).

Chronic Effects.—The most important is atrophy of the optic disk, producing the so-called tobacco amaurosis; but the excessive use of strong tobaccos may lead to other disorders. Epileptic fits have sometimes been clearly traced to this cause, and many cases of dyspepsia and palpitation are largely due to it. In amaurosis total abstinence from tobacco generally suffices to effect a cure, but sometimes a partial atrophy of the optic nerve remains (see OPTIC NERVE, DISEASES OF; section, Tobacco Amblyopia).

TONGUE, DISEASES OF.—The following morbid conditions of the tongue are briefly described in this article:

Fur.

Wandering Rash.

Tubercular Ulcer.

1. Fur on the Tongue.—The condition of the tongue, as an index of the general health, particularly of the state of the digestive organs, although somewhat displaced from its former pre-eminence as a signal of disease, still shares the chief place jointly with the pulse and the temperature.

The white or yellowish-white coating of fur, so commonly present on the dorsum, has been shown to consist chiefly of

masses of minute living organisms—viz., micrococci and the bacillus subtilis; epithelial scales and the *débris* of food are also present, but their minor importance is proved by the fact that where the fur is thickest they are found in the smallest quantity. The fungus is attached to the filiform papillæ, the fungiform and circumvallate papillæ and the intervening spaces being seldom covered. The appearance known as “strawberry tongue” is produced by the turgid state of the vessels of the fungiform papillæ, causing them to stand out as red points, in marked contrast with the thick coating of fur on the filiform papillæ.

When the processes of the filiform papillæ over any area are temporarily destroyed, fur ceases to form there, and if the loss be permanent, as in the condition known as leucoma (*q. v.*), the surface remains afterward free from fur.

The presence of fur, even a layer of considerable thickness, is quite consistent with health; in fact, in most individuals, the dorsum of the tongue in front of the circumvallate papillæ is furred on rising in the morning. The tongue is generally covered with fur in patients who take little or no solid food, as the movement of the tongue during mastication plays an important part in the cleansing of its surface. Any condition of debility, by lessening movement, tends to produce the same effect. In febrile disorders accompanied by prostration, in addition to the above factors, the mouth is often kept open, and this, with the increased temperature, tends to produce dryness of the surface of the mucous membrane.

To recapitulate, the essential factor in the production of fur is (1) a growth of micro-organisms on the surface of the filiform papillæ; aided by (2) diminished movement of the tongue, (3) the absence of solid food from the diet, (4) any condition of debility, (5) the febrile state, and (6) an open mouth, whereby evaporation is favored.

Unilateral Furring.—The tongue is occasionally found to be furred on one side and clean on the other. This condition is probably in every case due to some cause tending to restrict the movements of the affected side, which consequently fails to get properly cleansed, and not to a loss of nervous influence. Among such conditions are the presence

of an ulcer or a sharp jagged edge of a decayed tooth, and loss of power of movement, as in hemiplegia.

2. Acute Inflammation (*Glossitis*).—See MOUTH, DISEASES OF.

3. Leucoma (*Ichthyosis, Leukoplakes, Chronic Superficial Glossitis*). See MOUTH, DISEASES OF.

4. Wandering Rash (*Geographical Tongue*).—This is a rare affection, usually met with in children below the age of six years, and characterized by the presence on the dorsum of the tongue, generally near the tip, of smooth red patches, at first of small size, but which gradually enlarge, and form rings with yellowish, raised, sharply defined borders, but smooth and red within. Adjacent rings may intersect, and small rings may form within larger ones. Itching and salivation are the only subjective symptoms which have been noticed, and these in a very few cases only, none being present as a rule.

The affection may remain uncured for years, but fluctuates much, eventually undergoing spontaneous cure. Its nature is obscure; the only microscopical examination made appears to show that it is “a subacute inflammation of the derma of the mucous membrane,” probably due to some nervous influence.

No *treatment* appears to be of much avail, but tonics, such as iron and cod-liver oil, may be of some service in improving the general health.

5. Syphilis.—See MOUTH, DISEASES OF.

6. Tubercular Ulcers.—The statement that ulcers of tubercular origin are sometimes primary on the tongue appears to be made on the ground that in some cases no physical signs could be detected on examination of the lungs—a most fallacious test. There is, however, no reason why primary tuberculosis of the tongue should not occasionally occur, although it is undoubtedly in most cases secondary to similar disease of the lungs or larynx.

The affection was first described in 1858 by Sir James Paget, and fresh attention has of late been drawn to the occurrence in phthisis of these ulcers on the tongue and in the mouth.

The ulcers present a pale, yellowish-gray, granular surface, often covered with mucus; the edges are either beveled or sharp cut, but are rarely undermined.

Induration of the surrounding tissue is slight or absent, but, as a rule, there is some swelling. The ulcer is at first superficial, but subsequently increases in depth, and may lay bare the muscle. The tubercle bacillus has been found in the discharge from such ulcers, and post-mortem in sections through the base. The ulcers are in the greater number of cases due to the passage over the tongue of the discharges from pulmonary cavities or laryngeal ulcers.

The *prognosis* is, as a rule, very unfavorable, but healing occasionally occurs.

Treatment.—The ulcers which appear to be primary and are still of small size may be excised, but in the majority of cases no operation is advisable, and, if there be severe pain, the surface of the ulcer may be gently brushed over with a solution of cocaine (ten per cent.). If this be done shortly before a meal, the patient is often able to take food without pain. All sources of irritation should be removed, and a powder composed of iodoform in fine powder (gr. j), morphine (gr. $\frac{1}{8}$ – $\frac{1}{2}$), and borax (grs. ii) may be blown upon the surface of the ulcer.

J. K. FOWLER.

TONICS are substances which improve the tone of a part or of the whole of the body. They brace up, so to speak, the relaxed tissues. They are divided into nervine, vascular, cardiac, blood, and gastric tonics according to the organ upon which they are supposed chiefly to act, but the distinctions must not be adhered to too rigidly, as it is evident that anything which improves the quality of the blood will through it have an immediate effect on every organ and tissue throughout the body. Cod-liver oil and iron salts are the chief blood tonics, the mineral acids and alkalies the chief gastric tonics, nux vomica, strychnine, and arsenic the chief nervine tonics. None of these, however, act on one part of the system only, but in varying degrees on all parts.

TONSILLITIS (Quinsy).—Inflammation of the tonsils.

The disease may involve the whole substance of the gland (*parenchymatous tonsillitis* or *quinsy*), or be chiefly confined to the lacunæ on the surface of the tonsil (*follicular tonsillitis*).

Symptoms.—Clinically, the two forms are so interwoven that it will be convenient to describe them together. The attack usually comes on with febrile disturbance, malaise, and aching in the limbs. Stiffness in the neck and pain in the throat soon supervene; the pain shoots up into the ears, and is increased on opening the mouth or attempting to swallow. There is a constant desire to swallow, but the difficulty in doing this is so great that the secretions dribble out of the mouth, and, if fluids are taken, they frequently return by the nose. The tongue is coated and the breath is offensive. The voice is thick and nasal, there is often deafness, the patient snores when asleep, and the breathing is sometimes noisy even when he is awake. In quinsy the above symptoms attain their maximum just before the pus is evacuated, and the patient may suffer excruciating pain. On examining the throat in a case of parenchymatous tonsillitis, the tonsil (usually, only one is affected) and adjacent parts will be found greatly swollen, of a deep purple-red color, and often coated with viscid mucus. In the follicular variety, which is usually bilateral, the tonsils will be found enlarged and the surface dotted over with yellowish creamy spots, due to retention of secretion in the lacunæ.

The following complications have been met with, though fortunately only rarely, in connection with an attack of tonsillitis, viz., otitis media, cardiac disease (either endo- or peri-cardial), acute rheumatism, and bronchitis. Occasionally, a trace of albumen is present in the urine, but only in cases where there is considerable elevation of temperature.

Diagnosis.—This is easily made as regards quinsy; but there is sometimes a difficulty in distinguishing between follicular tonsillitis and diphtheria; in fact, there are transition forms in which differentiation is impossible. In diphtheria the patches are of an ashy-gray color, cover a larger area, and are not dotted about as in follicular tonsillitis, and leave a bleeding surface on attempt at removal. Moreover, the onset of diphtheria is more insidious, the temperature as a rule is not so high, and albuminuria is generally present.

Prognosis.—Recovery is the termination which may be confidently looked for in quinsy; death has, however, occurred

in a few cases from the bursting of the abscess, and the entrance of the pus into the larynx causing suffocation.

Pathology.—In parenchymatous tonsillitis there is an inflammation of the substance of the gland, which may go on to suppuration. In the follicular form the inflammation is more superficial, and chiefly affects the little lacunæ or crypts due to the involution of the mucous membrane. The creamy exudation seen in the lacunæ consists of fibrinous lymph, epithelial cells, and *débris*.

Ætiology.—Tonsillitis is essentially a disease of adolescence and early adult life, being rare before fifteen or after thirty. Great stress has recently been laid on the connection between rheumatism and tonsillitis, and there can be no doubt that the same causes are operative in the production of these diseases, exposure to cold and damp being the most common exciting cause of both, while heredity also plays a part in both. Follicular tonsillitis should always suggest the possibility of septic poisoning, and there is distinct evidence in favor of the contagiousness of sore throats, even where there is no suspicion of diphtheria.

Treatment.—The treatment is the same as for acute pharyngitis (*q. v.*). In some cases the application of a twenty per cent. solution of cocaine has appeared to prevent suppuration, and, even in those cases in which an abscess formed, the application added much to the comfort of the patients by diminishing pain and enabling them to swallow. Should there be signs of suppuration, the bursting of the abscess is to be encouraged by poultices externally and the inhalation of steam, but the patient should not be left in pain when it is clear that suppuration has occurred, as immediate relief may generally be effected by puncturing the tonsil, using for this purpose a bistoury protected by strapping except for an inch at the end, and taking care to cut upward and inward. The previous application of cocaine will diminish the pain of the incision and facilitate the operation. Bleeding is to be encouraged by washing the mouth out with hot water.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Aconite* is valuable in the early stage, when attended with fever and arterial tension; prevents suppuration. *Belladonna*, facial mucous membrane involved; bright

redness of inflamed part; much heat and pain; general congestive condition; *mercurius cor.*, ulcerated throat; fetid breath; pytalism. *Bartya carb.*, given early, averts suppuration; especially adapted to strumous cases. *Calcium sulphide*, when suppuration appears inevitable. *Apis mel.*, when there is much œdema; burning, stinging pains; dryness of mouth and throat. *Arsenicum* in severe cases; great prostration; tonsils putrid or gangrenous.

TONSILS, HYPERTROPHY OF.

—Chronic enlargement of the tonsils.

Symptoms.—The child—for it is in children that the symptoms are most marked—breathes with the mouth open, and has consequently a vacant expression, which is increased if, as is often the case, deafness be also present. The deafness is usually due to catarrhal thickening of the mucous membrane of the eustachian tube. The breathing is labored, and when asleep the child snores. The face is long and the nose narrow and contracted. The mouth is generally open and the lower lip everted; there is, as a rule, some fullness of the neck about the angle of the jaw. The patient has an unhealthy aspect and is often listless, and has a thick and nasal voice. Owing to the difficulty in breathing the chest is pigeon-breasted; this is especially apt to be the case if, as often happens, the child be rickety. The cervical glands are almost invariably enlarged.

Diagnosis.—One glance at the throat will suffice for this purpose.

Prognosis.—In advising the removal of the tonsils it is well not to give too certain a prognosis as to the effect of the operation, on account of the possibility of the coexistence of adenoid vegetations in the naso-pharynx; if this be the case the removal of the tonsils will not suffice to cure the patient of his symptoms, as the naso-pharynx will require to be cleared ere the patient can breathe freely. With this proviso, there is hardly any operation which yields more certain and satisfactory results than the removal of greatly enlarged tonsils, and all ideas as to possible injury of the voice, or interference with the sexual function may be dismissed as groundless. Moreover, in recommending the removal of tonsils, it should be clearly pointed out to parents the risk children suffering from enlarged

tonsils run in the event of their being attacked by scarlet fever or diphtheria.

Pathology.—There is a true hypertrophy of all the tissues of the tonsils, but the proportion varies in different cases.

Ætiology.—Nothing can be definitely said on this point except that there is a strong hereditary tendency to this condition; by some writers enlargement of the tonsils is attributed to struma; not unfrequently it seems to follow upon repeated slight attacks of tonsillitis.

Treatment.—If the tonsils are sufficiently enlarged to interfere with the breathing, especially if the chest is becoming affected, they should be removed (*see* MOUTH, DISEASES OF). It is advisable not to remove them when they are inflamed. The only remedy, short of excision, which promises any success is the use of the galvano-cautery, the tonsil being made to contract through the cicatrization brought about by puncturing it with a fine galvano-caustic point. In less marked cases, painting the tonsils nightly for some months with an application composed of equal parts of tincture of iodine, tincture of catechu and glycerine, together with the internal administration of cod-liver oil, syrup of the iodide of iron, and residence at the seaside may succeed in preventing further enlargement and may even cause some diminution in the size of the tonsils.

F. DE HAVILLAND HALL.

Symptomatic Indications.—*Baryta carb.* is very valuable, especially when the result of tonsillitis, or scarlatina; *baryta iod.*, when the result of repeated attacks of inflammation, glands swollen, indurated; *calcareo phos.* or *calcareo iod.* in simple hypertrophy of strumous origin; *Kali iod.*, in syphilitic cases.

TORTICOLLIS (Wry-neck and Spasmodic Wry-neck). See SURGERY, ORTHOPEDIC.

TOUCH, DISORDERS OF (including **MUSCULAR SENSE**).—Under this heading are included all the varieties of sensibility other than the special senses—viz., tactile sensibility to pain, sensibility to pain, sensibility to temperature, and muscular sensibility.

Tactile Sensibility.—This may be either altered in character (paræsthesia) or lost (anæsthesia). The tactile sensibility is rarely, if ever, excessive (hyper-

æsthesia), but, if the sensory nerves be in a condition of irritability, a slight touch may give rise to pain, and to this condition the term “hyperæsthesia” is commonly applied in preference to the term “hyperalgesia.” When the time which elapses before a stimulus, applied over a certain area, is perceived is longer than on the corresponding part, sensibility is said to be delayed. Tactile sensibility may be tested by touching the part lightly with a pin, the patient’s eyes being closed, or by use of the “æsthesiometer,” an instrument for ascertaining at how short a distance apart two points can be differentiated. As a rule, the simple method first mentioned gives satisfactory results.

Sensibility to Pain.—This form of sensibility may be affected together with or independently of the last named variety. When lost, the condition is properly termed “analgesia,” but the term “anæsthesia” is more often employed. As already stated, the same remark applies to the terms used to denote an increased sensibility to pain. Sensibility to pain, like tactile sensibility, may be delayed. The condition of sensibility with regard to pain may be tested by pricking or pinching the part, or a faradic current may be used.

Sensibility to Temperature.—The appreciation of differences of temperature may be affected with the varieties of sensibility already mentioned or independently, and it is also believed that the sensations of heat and cold are conveyed by different nerves. The impairment of this sense may vary from a difficulty in recognizing slight differences in temperature up to a point where such stimuli pass quite unperceived.

The usual method of testing sensibility to temperature is by the use of sponges from hot and cold water or heated and cold metal spoons.

These various forms of sensibility may be either impaired, lost, over-active, or disordered owing to lesions situated in (a) the peripheral nerve, including its terminal organ, (b) the spinal cord, or (c) the brain.

(a) *Peripheral Lesions.*—The fact that after complete division of a nerve there is, in some rare cases, no loss of tactile sensibility is generally explained by assuming that in such individuals an unusually free nervous anastomosis exists.

In case of injury or disease the peripheral nerves remain capable of conducting sensory impressions long after motor impulses have ceased to pass; a very few healthy fibers being apparently sufficient to convey sensory stimuli. Loss of tactile sensibility is a marked symptom in all forms of peripheral neuritis (*q. v.*) and also in the anæsthetic variety of leprosy (*q. v.*) and under various circumstances from pressure upon nerves. Irritative lesions of nerves may produce hyperæsthesia and pain in the area of distribution of the affected nerve.

(*b*) *Spinal Lesions.*—For the effect of partial and total transverse lesions of the spinal cord, see SPINAL CORD, ANATOMY AND PHYSIOLOGY OF.

Loss of sensibility in spinal lesions is usually bilateral, but is always situated on the side of the body opposite to the lesion of the cord.

The posterior median and the anterior portion of the lateral white columns, or antero-lateral ascending tract, are probably the chief conducting strands for sensory impressions, and it is believed that the former are mainly concerned in the transmission of tactile impressions and the latter of sensations of pain.

The path by which impressions of temperature are conveyed through the cord is unknown, but it is probably situated in the lateral columns with that conducting sensibility to pain.

Increased sensitiveness is more often found in association with lesions of the spinal meninges than of the cord itself, while sensation may be abolished by lesions involving the posterior roots.

There are a great number of diseases in which, owing to lesions of the spinal cord, these various senses are affected, the most important being compression of the cord, as from tumors or hemorrhage, or in any other way; and in the various forms of myelitis and spinal sclerosis, especially locomotor ataxia.

(*c*) *Cerebral Lesions.*—In cerebral lesions, owing to the decussation of the sensory fibers in the cord, the side of the body affected is opposite to that of the lesion. As a rule, in cerebral lesions the loss of sensibility, although affecting a larger area, often exactly one-half of the body, is less complete than in spinal and peripheral lesions. Sensory impressions are probably conveyed through the upper part, or tegmentum, of the pons and

crura, thence through the posterior third of the hinder limb of the internal capsule and the corona radiata, to the cortex in the central and parietal regions.

Hemianæsthesia may be produced by a lesion situated anywhere in the sensory path. In the case of a tumor situated in the pons, the loss of sensibility may affect both sides of the body. Hemianæsthesia rarely occurs from disease of the cortex, but there is often some impairment of sensibility in such cases. As a rule, the loss of tactile sensibility is most marked in the extremities of the affected limbs.

In typical cases of hemianæsthesia the loss of sensibility affects the head, trunk, extremities, and mucous membranes on the side opposite to the cerebral lesion, sensibility to pain and touch being lost either separately or in association. In such cases the special senses are often affected also (*see* BRAIN, FUNCTIONS OF).

A condition somewhat similar to the above is met with in neurotic subjects—hysterical hemianæsthesia; in this the muscular sense is also lost, and, as a rule, ovarian pain is present (*see* HYSTERIA).

Irritant cerebral lesions may give rise to various paræsthesiæ.

Muscular Sense.—This may be defined as the knowledge of the degree of muscular contraction, *i. e.*, of how much force a given muscle is exerting. It also includes the ordinary sensibility of the muscles to pain and pressure, but it is commonly used in connection with the first mentioned and more striking form of sensibility. The power of estimating differences in weight and the knowledge of the position of a limb are intimately bound up with the sense of degree of muscular contraction, and are lost when that sense is in abeyance.

This sense may be tested in various ways. The patient's eyes being closed, his arm is placed in a certain position, which he is asked to describe or imitate; two glasses, one full of water, the other empty, may be allowed to rest upon the end of corresponding fingers of the two hands, or balls of equal size but of different weight may be placed in the hands, or bags containing different weights may be hung on to the fingers, and the patient be asked to state which is the heavier.

The fibers conveying the muscular sense do not decussate in the cord; consequently, the muscular sense is lost on

the same side as the lesion. The path of these fibers is possibly in the posterior median columns, and it is also considered possible that the posterior vesicular tract, and the direct cerebellar tract, may convey sensory impressions from the muscles of the lower part of the trunk.

As stated, the muscular sense may be lost in hysterical hemianæsthesia, while anæsthesia of the muscles may be present in locomotor ataxia and in hysteria. If the loss be sudden, the affection is probably spinal in origin. The treatment depends entirely upon the nature of the underlying cause.

J. K. FOWLER.

TRACHEA, FOREIGN BODIES IN.—A foreign body may enter the trachea and cause sudden death from obstruction, if sufficiently large to occlude the air tube; if of smaller size, it may cause dyspnœa and symptoms of irritation.

Treatment.—Tracheotomy should be performed at once, and not unfrequently the foreign body is speedily expelled either through the glottis or through the opening; if this does not happen, inversion may be tried or forceps may be cautiously used.

F. DE HAVILLAND HALL.

TRACHEA, INFLAMMATION OF.—Inflammation of the trachea may be either acute or chronic.

Acute Tracheitis.—Acute catarrhal inflammation of the trachea is almost always the result of extension from the larynx or bronchi; it may, however, be the primary affection. In such a case the voice will not be affected, tenderness may be felt along the course of the trachea, with pain on coughing, and the patient may experience pain on swallowing, as the bolus of food passes down the esophagus. By the aid of the laryngoscope the congested condition of the mucous membrane may be recognized in a certain proportion of the cases; but a tolerant patient and an excellent light are required to make a satisfactory tracheoscopic examination.

Prognosis.—If the inflammation be limited to the trachea no danger need be apprehended.

The *ætiology* and *treatment* of acute tracheitis are practically the same as for acute laryngitis.

Chronic Tracheitis may be the sequel

of an acute attack; it generally occurs as a result of chronic laryngitis or chronic bronchitis. The *treatment* is the same as for the bronchitic affection.

F. DE HAVILLAND HALL.

TRACHEA, STENOSIS OF.—Narrowing of the trachea.

Symptoms.—Dyspnœa, but unaccompanied by the up-and-down movements of the larynx which are observed when the obstruction is seated at the glottis. The breathing is attended by stridor, and the respiratory sounds are masked by the tracheal sound. The voice is usually weak, though clear. Semon has recorded a remarkable case of stenosis of the trachea, of syphilitic origin, in which there was inspiratory dyspnœa, free expiration, and normal voice; a combination suggestive of bilateral paralysis of the abductors, but distinguished from it by the absence of the respiratory excursions of the larynx.

Diagnosis.—Laryngoscopic examination will usually suffice to distinguish tracheal from laryngeal obstruction, but unless the cause of the mischief can be seen in the trachea, it is often extremely difficult to say whether the obstruction is situated within or without the trachea.

Prognosis.—In all cases this is grave; the stenosis, being so frequently of a cicatricial character, has a tendency to increase; and, if seated low down, mechanical treatment may be difficult or even impossible.

Pathology.—The stenosis may be brought about by pressure from without; disease of the tracheal wall; or the implication of the trachea in disease of neighboring parts. Enlargement of the thyroid, aneurism, and mediastinal tumors are the chief causes of the first group. In the second class cicatricial contraction, due to syphilis, plays the most important part; in fact, the great majority of cases of stenosis are of this nature. Granulation tumors due to the irritation of the canula after tracheotomy, new growths—*e. g.*, cancer, occasionally lead to stenosis. In the third class cancer of the esophagus may, in its onward growth, implicate the trachea and cause a diminution in its lumen.

Treatment.—Unless syphilis can be absolutely excluded, the patient should be placed on an antisyphilitic treatment immediately upon the supervention of

symptoms of tracheal stenosis—*i. e.*, half a dram of blue ointment must be rubbed in daily, and ten to twenty grains of the iodide of potassium given every six hours. In chronic cases attempts may be made to dilate the trachea, either through the larynx or after the operation of tracheotomy.

F. DE HAVILLAND HALL.

TRACHEOTOMY. — See LARYNX, EXCISION OF.

TRACHEA, TUMORS OF.—Non-Malignant.—New growths are not nearly so frequently met with in the trachea as in the larynx; in fact they are of rare occurrence.

Symptoms.—Dyspnœa is the chief symptom, the degree depending on the size of the tumor. As in other instances of tracheal obstruction, dyspnœa is unaccompanied by respiratory excursions of the larynx. In some cases the tumors may be seen by tracheoscopy.

Treatment.—In a few instances the tumors have been removed *per vias naturales*; if this cannot be effected, the trachea must be opened in a vertical direction so as to gain access to the tumor.

Malignant.—Primary carcinoma of the trachea is exceedingly rare.

Dyspnœa is the chief symptom, but a diagnosis can only be made if the growth can be seen by the aid of the laryngoscope.

Tracheotomy will prolong life unless the growth extend too low down to admit of its being performed.

F. DE HAVILLAND HALL.

TRACHELORRAPHY (Emmet's Operation).—An operation devised by Dr. T. A. Emmet of New York, for the repair of the lacerations of the cervix which occur in most women who have had children. It is quite certain that the enormous majority of cervical lacerations interfere in no way with convalescence after labor or with subsequent health, comfort, and fertility, and that, if the operation of trachelorrhaphy be done in every case in which laceration coexists with illness, in the vast majority of cases it will fail to improve health.

G. E. HERMAN.

TRANCE.—Trance, in its ordinary sense, is a term of somewhat vague limits,

but had best, perhaps, in strict medical language, be confined to a prolonged and rare condition of abnormal sleep which is produced by no known external agency, is generally entirely passive, in which the vital functions are reduced to an abnormally low minimum, and from which the entranced patients cannot be aroused by such ordinary excitants as would be more than sufficient to wake them from normal sleep. They can assimilate food artificially given, and may remain in this trance condition for as long as twenty-three weeks, or even for a year. Braid made a careful collection of Indian cases in which the fakirs induced in themselves a trance condition of extreme lethargy, in which they were able to remain ten days or more without either food or drink. This tends to show a certain power of the will in the matter, and a greater adaptability of the Oriental mind and body to the conditions.

The *onset* of such a condition is usually sudden, and the awakening from it also rapid, though not to such an extent as to startle the person who has been in trance.

The *symptoms* are almost entirely negative. There is an absence, complete or incomplete, of sensation, and in a less degree of motion and of deep and superficial muscular reflexes. The breathing becomes nearly imperceptible; it may even be impossible to see any cloud on a clear mirror held before the mouth; the respiratory movements may be imperceptible, or at least as infrequent as three in two minutes; the pulse and action of the heart may be impalpable, though the condition of the retina will show that very slow circulation is still being kept up. The temperature is low, but has not been observed below 97° F. There is sometimes pallor, but very rarely that cadaveric appearance which once led Vesalius to mistake trance for death. Any such question of diagnosis can be settled by the electrical reactions of the muscles.

The condition in its *physical signs* is, as a rule, very like that of a hibernating animal. But the physical signs are variable; in fact, there are few cases in which they are all present at the same time. There may be, for instance, nearly normal pulse and respiration, and normal sensation or even hyperæsthesia.

The condition in itself is not one of

any danger under careful supervision and treatment by food and warmth, but it may be almost indistinguishable, except by its history, from one of so-called spontaneous somnambulism arising in a hysterical subject, which generally implies an obstinate type of hysteria.

With the *psychical conditions and relationships* of trance we are at present very imperfectly acquainted. As a rule, the mental state is passive, and no memory of it persists; but there are insensible grades between this and ecstasy, in which there is mental concentration on perceptions, sometimes supernormal, with outward expression of this, and more or less subsequent recollection. On the other hand, though the mental state in trance is generally quite unaffected by its surroundings, there are intermediate states between this and self-induced hypnotism, or auto-hypnotism, in which, with almost the same physical signs, there may be a very remarkable *rapproch* with other people, and notable receptivity to slight external stimuli.

A. T. MYERS.

TRANSFUSION (and INFUSION),

—By these terms are meant the operations by which blood or some saline solution is injected into the blood vessels of a living animal by artificial means. In medicine transfusion has been performed in various kinds of cases, such as where there has been great loss of blood after operation or parturition; where there has been excessive drain of the fluid constituents of the blood, as in cholera; in diabetes; where there has been profound alteration in the blood itself from various causes, such as occurs in leukæmia, anæmia, pyæmia, or the acute specific fevers.

Of recent years the opinion has been gaining ground that the value of "blood," as such, to the person into whose vessels it is injected, is less than was originally supposed, and that much, if not all, the benefit claimed for it can equally be claimed for some simple saline solution. This latter acts by increasing the quantity of fluid in the vascular system, and by enabling the circulation to be maintained when, for some cause or other, it had practically come to a standstill.

It has been ascertained by experiment that, even after syncope has occurred, sufficient corpuscular elements are left in

the vascular system to carry on the function of the blood if only some harmless fluid be poured into the circulation. Various substitutes for human blood have been suggested, such as milk, or the defibrinated blood of some mammal whose corpuscles are smaller than man, such as the sheep. Not only have these no superiority to simple saline solution, but they are, in some cases, positively harmful.

Two methods only will here be considered. First, the injection of blood, either mediately or intermediately; and secondly, the injection of normal salt solution (0.75 per cent. solution of chloride of sodium in distilled water at 98° F.).

Many ingenious forms of apparatus have been invented, but none of them have any superiority in skilled hands over the simplest apparatus which is in the possession of every surgeon. The best known forms of apparatus are those of Aveling and Roussell. The former is practically a bulb syringe with stop-cocks instead of valves at either end. The latter is an attempt to provide a mechanical substitute for surgical skill, and does not seem to be in any way necessary for the safe and easy performance of the operation.

The experiments of Dr. W. Hunter show that in the great majority of cases the infusion of normal saline solution is attended with equally satisfactory results, and accompanied by far less danger than the injection of blood, whether defibrinated or not. The nutritive value of blood, when injected into the circulation, is very small; any advantage from its use seeming to depend more upon its physical than its physiological character; and, considering the difficulty of keeping in order any particular form of apparatus for the mediate or intermediate transfusion of blood, the injection of saline solution should receive the preference in cases of emergency, such as hemorrhage after confinement, diabetic coma, or choleraic collapse.

In order to perform the operation, it is only necessary to open some moderate-sized vein, to insert a small cannula, and attach to it a few inches of india rubber tubing, filled with the saline solution. To the end of this tube a small glass funnel is attached, so that the requisite amount of fluid can be allowed to pour into the vessel by the force of gravitation. The

quantity injected must, of necessity, vary very much according to the size of the patient, the extent of the loss of blood, and the effect produced by the injection. Probably not more than a pint would in any case be required.

Professor Schäfer has published a series of experiments on the direct transfusion of blood from vein to vein or artery to artery.

In order to perform the former of these operations it is only necessary to insert one cannula into the vein in the arm of the donor and another into the vein in the arm of the recipient, connecting the two by a small tube of india rubber which has been filled with bicarbonate of soda solution to prevent the coagulation of the blood.

In direct transfusion from artery to artery, it is suggested that the dorsal artery of the foot in the donor should be opened, and that during the operation he should stand, by which means the highest pressure of blood is made available. If the dorsal artery of the foot in the recipient cannot be found, owing to its not being filled with blood, it is desirable that the left radial should be opened, the cannula in any case being made to point toward the heart. It is in some cases easier to practice the intermediate operation, that is to say, to receive the blood of the donor in a glass vessel, to mix it with solution of phosphate of soda to prevent coagulation, and then to inject it into some vein of the recipient.

Dr. J. Duncan recommends that a solution of five per cent. of phosphate of soda should be added in the proportion of one part to every two of blood.

In performing this operation the most scrupulous precaution must be taken to render the apparatus aseptic. If this be done, it is almost as simple as the injection of the saline solution.

The blood from the donor, to the amount of from 8-15 ozs., should be received in a small glass beaker containing the required amount of phosphate of soda solution, which must be kept at the normal temperature of the body by being immersed in hot water. A small cannula of glass, with two inches of india rubber tubing attached, after being filled with phosphate of soda solution, should be inserted into the selected vein of the recipient. The blood may then easily be injected with a simple glass syringe, whose

nozzle fits into the india rubber tube. Care should be taken to avoid the entrance of any bubbles of air, though this source of danger has been very much exaggerated. The whole apparatus may be kept warm with flannel wrung out in some hot antiseptic solution. It is necessary to perform the injection very slowly. As much as sixteen ozs. have been injected in this manner with very satisfactory results. If excess of phosphate of soda be used, violent pain, chiefly in the back, may be induced; and if the operation be performed too rapidly over-action of the heart may make it necessary to desist, but if the details are attended to there is little fear of either of these complications. In all cases it is desirable, before attempting to insert the cannula, that the vessel should be carefully dissected out, as it is often not easy to find, owing to its being empty or only partially filled with blood.

Dr. Roussell has published fifty cases of transfusion, twenty-seven of which were successful, and, entirely on practical grounds, he urges the use of some such apparatus as his, and the use of human blood passed directly from giver to the recipient.

Against the use of any such form of apparatus it may be urged that the operation of transfusion is only likely to be necessary in cases of extreme emergency, and that any apparatus, however simple, is liable to get out of order unless constantly attended to; that no form of apparatus will supply want of skill on the part of the operator, and that on clinical, experimental, and physiological grounds it is unnecessary to incur the risks and complications of using blood when so simple a fluid as a normal salt solution will supply all that is necessary to carry on the circulation of those cases which are not already hopeless.

The transfusion of blood, in cases of anæmia and other blood disorders, has not justified the hopes which were at first formed as to its value.

T. D. ACLAND.

TRANSPPOSITION OF VISCERA.

--Man, in common with mammals, is distinguished from other vertebrates by the fact that the aorta arches over the root of the left lung, and passes downward on the left side of the vertebral column. Certain anatomical conditions in man are closely associated with this position of

the aorta—viz., the apex of the heart is directed obliquely to the left side of the thorax, the right lung is three-lobed, the thoracic duct terminates at the junction of the left subclavian and internal jugular vein. Turning to the abdomen we find the liver occupying the right hypochondrium, its right lobe greatly exceeding in size the left; the *cul-de-sac* of the stomach lies in the left hypochondrium, and is closely related to the spleen. The transverse duodenum is directed from right to left across the body of the second lumbar vertebra, and the pancreas has its head on the right side of the abdomen and its tail in relation with the spleen. The cæcum occupies the right iliac fossa, and the vena azygos major lies on the right side of the column and terminates in the vena cava superior, after arching over the root of the right lung.

It occasionally happens that the aorta arches over the root of the right lung and runs along the right side of the spine. This variation is often accompanied by a transposition of the viscera—that is to say, those organs, normally found on the right side of the thorax and abdomen respectively, take up a position on the left side, and *vice versa*. This alteration is of a most complete character, and is not merely an alteration in position, but an actual transposition, and, in order to appreciate it, the organs implicated may be separately considered.

Aorta.—The direction of this vessel is not merely the reverse of that which is normal, but the order of the vessels arising from it is reversed also; thus, the left subclavian and common carotid arise from an innominate trunk, while the right common carotid and subclavian arteries spring directly from the arch. Among the numerous anomalies to which the trunks arising from the arch are liable, perhaps the most interesting is when the right subclavian, instead of arising from the innominate as usual, is the last vessel given off. Under such conditions it passes behind the trachea and esophagus to gain its usual position on the first rib. So common is this that many anatomists adopt the following rule: when the right subclavian frees itself from the innominate, it usually arises as the last vessel from the arch, and passes behind the esophagus.

When this arrangement obtains, the right inferior laryngeal nerve has often a

direct instead of a recurrent course, and the thoracic duct has a dextral termination. In one carefully described case of right aortic arch the left subclavian artery, instead of coming from a left innominate, was the last vessel to arise from the arch, and then followed the course usual to this mode of origin—that is, it passed behind the esophagus. The relation of the inferior laryngeal nerve and thoracic duct is, unfortunately, not stated. An aber-

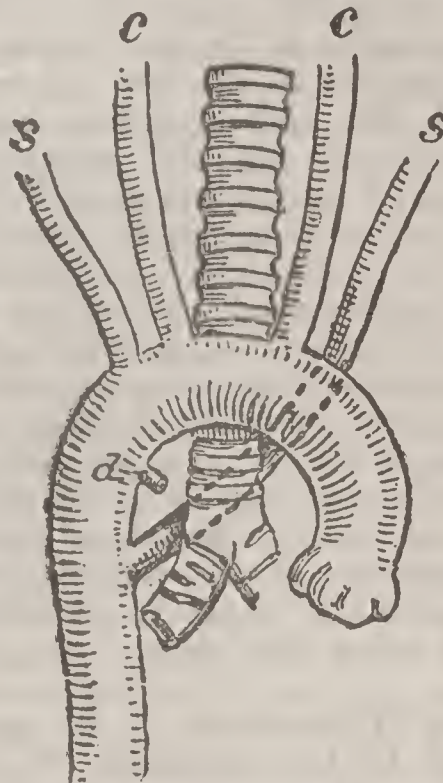


FIG. 1.—A right aortic arch, with aberrant subclavian artery.

rant subclavian artery of this character, associated with a right aortic arch, is represented in Fig. 1.

A right aortic arch, with transposition of viscera, must not be confounded with "transposition of the aorta." This term is used when the aorta arises from the *right ventricle* of a *normally placed heart*.

Heart.—The transposition of this organ consists, not merely in the deflection of its apex to the right instead of the left, but in an actual reversal of its cavities, the right ventricle becoming systemic and the left pulmonic. The superior and inferior venæ cavæ open into the left auricle, and the major azygos vein arches over the root of the left lung to gain the superior vena cava. This displacement of the heart is frequently accompanied by imperfect development of the ventricular septum, often so extreme as to be incompatible with life.

Lungs.—Even in cases of incomplete transposition, the left lung is furnished

with three lobes and the right two; it is remarkable that a three-lobed left lung unassociated with transposition, complete or incomplete, has yet to be recorded.

Liver.—This organ is completely reversed; it not merely lies in the left instead of the right hypochondrium, but its left lobe is the larger, and is the part which accommodates the gall-bladder.

Stomach.—This is not altered in position so frequently as the preceding viscera. In typical cases the great *cul-de-sac* or fundus is directed to the right and the pylorus to the left. In individuals with the liver occupying the left hypochondrium and the stomach not transposed, it must naturally follow that this viscus cannot occupy its natural position, but is pushed lower in the abdominal cavity than usual. When the stomach is transposed the direction of the duodenum is reversed also, and the head of the pancreas, instead of lying on the right side of the spine, is directed to the left. Under such conditions the jejunum commences on the right side of the spine. The disposition of the various parts of the duodenum is liable to considerable variation when the viscera are transposed.

Spleen.—The position of the spleen is influenced by the stomach; when the latter organ is transposed the spleen, connected as usual with its great *cul-de-sac*, occupies the right hypochondrium. When the liver is in the left hypochondrium and the cardiac end of the stomach maintains a sinistral, though displaced position, the spleen maintains the natural relation to this viscus. When the stomach and spleen are completely transposed the latter is liable to be malformed. Even under ordinary conditions the spleen is extremely liable to be accompanied by one or more satellite spleens or spleniculi; but when it occupies the right hypochondrium it is usual to find numerous satellite spleens, and in some cases the spleen has been represented by a number of spleniculi instead of a single organ. In one case (Hickman's) nine spleniculi were counted. Thurman, in reporting a case in which all the viscera except the stomach and spleen were transposed, writes: "Behind the stomach was a round spleen, the size of a small apple, and accompanying it were five supernumerary spleens, the size of walnuts and filberts, which grew, as it were, from the

branches of the splenic artery something like a bunch of grapes."

The Cæcum and Colon.—In many of the cases in which the thoracic viscera of the liver, stomach, and spleen were transposed, the cæcum occupied the left instead of the right iliac fossa; the ascending, transverse, and descending colon took the reverse of the usual course, and the rectum was on the right side of the pelvis. In others the cæcum was situated as usual in the right iliac fossa; under these conditions the ascending and descending portions of the colon were parallel to each other on the right side of the abdomen. In a few cases the cæcum was in the left iliac fossa, and the colon passed obliquely across the abdomen to the right hypochondrium and then descended to the pelvis. So vagarious is the colon when the viscera are transposed, that no positive statement can be made in regard to it, and even in cases where the stomach, duodenum, spleen, and pancreas are completely reversed, the cæcum and colon may retain a normal position. Transposition of the cæcum and colon, independently of the remaining viscera, is by no means an unusual event. The intra-abdominal portion of the vitello-intestinal duct is unusually persistent in cases of visceral transposition.

Veins.—Many anomalies of veins, especially in regard to their terminations, have been recorded in connection with the transposition of viscera. These cannot all be considered; it is clear that if the aorta runs along the right side of the spine and the inferior cava on the left, certain alterations in the venous system are unavoidable. The chief of these are the following: the right renal vein is longer than the left, and receives the corresponding spermatic or ovarian vein, as the case may be. It has been noticed in two cases that the right testis was lower than the left. The right iliac vein is longer than the left, and the portal vein is directed to the left instead of the right side. In the thorax the right innominate vein is the longer; the dextral thoracic duct has already been mentioned. In a few carefully dissected cases the major azygos vein was situated on the left side of the spine.

The bronchial veins are liable, under these conditions, to vary in their mode of termination. The most remarkable variation is recorded by Hickman, in which

the pulmonary veins from the right lung entered the left auricle, and those from the left lung entered the right auricle. No symptoms, which could in any way be attributed to this anomaly, were observable during life.

Individuals with transposed viscera, unassociated with developmental defects of the heart, seem to be little influenced thereby. In several cases defects of the ventricular septum, and anomalous terminations of the bronchial and systemic veins with concomitant cyanosis, have been reported, but as these defects occur independently of transposition, they cannot in justice be attributed to it. The history of the cases does not show that the position of the viscera had any evil effect; in some of the cases death was due to lung trouble, and in several the heart was described as diseased and there was general dropsy.

It has often been stated that individuals with reversed viscera are left-handed, but an examination of the reports of many cases observed during life, and in a few in which this matter was inquired into after death, does not lend the least support to such a conclusion.

The cause of transposition of viscera is as unknown as the reason why the liver normally occupies the right hypochondrium and the spleen the left. Speculations as to the cause have been advanced, but with little confirmatory evidence. Von Baer attempted to explain it in the following way: In the early stages of the avian embryo, and certainly in a few mammals, the ventral aspect of the embryo lies on the yolk, but soon the left side is turned toward the yolk; occasionally, embryos are found with the right side in the direction of the yolk. Von Baer believed this alteration in the position of the embryo determined the deviation in question. To say the least this suggestion is very ingenious; but when taken in consideration with such facts as the disappearance of the right omphalomesenteric vein and the left superior cava in man, the right oviduct in all, and the right carotid in a few species of birds, and other kindred facts, the view ceases to carry that conviction which it does when considered in relation to man alone.

Allen Thomson and others have pointed out that in double embryos produced by dichotomy of a single germ, the viscera of one or other embryo should be

transposed; one should be, as it were, the reflection of the other, *velut in speculo*. The writer of this article has tested this matter, and in many instances such is indeed the case, but in the majority of specimens the heart, liver, and other organs are so displaced or agglomerated, that it is impossible to decide not merely to which half of the body, but often to which fetus, they belong. This is particularly the case with the heart. The writer, too, believes that when twins occur of the same sex, with a common amnion and single placenta, they are the product of a single ovum. This, of course, suggests that an individual with transposed viscera should be one of twins. Unfortunately no facts are forthcoming whereby this view may be tested, but it is one that would repay investigation. It must be carefully borne in mind that it does not follow that because only one child was recognized at birth, therefore only one was present. Many cases of twin-births have been recorded in which the second child was flattened out, and formed merely a small lump in the membrane, or presented itself in the form of an *acardiacus*, and the writer has known such masses to be cast aside even by obstetric physicians as "mere adventitious lumps." Perhaps, now that many workers look upon teratology as something more than a science of curious deformities, in which the varieties are distinguished by sesquipedalian names, a solution to the question of visceral transposition may soon be forthcoming.

J. BLAND SUTTON.

TREMOR.—A form of chronic spasm consisting of rhythmical movements of one or more groups of muscles. It may be coarse or fine according to the muscles affected.

Tremor constitutes an important symptom of many diseases, most of which are treated under their appropriate headings (*see* DISSEMINATED SCLEROSIS).

The tremor constantly met with in alcoholism and delirium tremens is described in the article on ALCOHOL; in paralysis agitans (*q.v.*) tremor is almost invariably present, but cases are on record in which the symptom was absent; and in poisoning by lead, mercury, and arsenic, tremor is an important symptom, and it is generally also observed in chronic poisoning by chloral and opium. It is

often met with in hysterical subjects, where it occurs in association with both paralysis and contracture.

Senile tremor, as its name implies, attacks the aged. The arms and head are the parts chiefly affected. When tremor occurs without association with nervous disease in persons who have not passed middle life it is generally termed "simple" tremor. A coarse tremor, occurring only on movement, is often met with in exophthalmic goiter. Tremor is often present in conditions of debility—for example, during convalescence from acute disease—and passes off as strength is regained.

Diagnosis.—In disseminated sclerosis the tremor is irregular, and the movements are sudden and jerky, and are much increased by any voluntary effort of the patient to restrain them; they occur only on movement, and cease during rest. In paralysis agitans the tremor is regular and rhythmical, and occurs during both rest and movement, except in an early stage of the disease, when it may cease during rest.

Senile tremor occurs at first only on movement, and ceases, or almost so, during rest, but when severe it may be present during both rest and movement; it is more influenced by the latter than is the tremor of paralysis agitans, and in this form the head is more often affected than in paralysis agitans. Alcoholic tremor occurs only during movement, and affects chiefly the arm, face, and tongue.

Treatment.—This will depend upon the nature of the causal condition. In simple and senile tremor but little is to be expected from treatment; a trial may be given to nervine tonics and sedatives.

TREMOR, CONVULSIVE.—See CONVULSIVE TREMOR.

TREPHINING.—Indications for the operation are given under HEAD, INJURIES OF. The operation is occasionally done for cases of epilepsy, in which the surgeon thinks he recognizes signs of localized mischief. And it is likely enough that the labors of Ferrier, Fritz, Hitzig, Duret, and others, together with the development of antiseptic surgery, may lead to further co-operation between the physician and the surgeon in the treatment of cerebral diseases.

Operation.—Scalpel, dissecting for-

ceps, trephine, elevator, piece of quill, sponges, antiseptic dressings, spray, etc. Unless bone is already exposed by a scalp wound, reflect soft tissues sufficiently by Y-shaped incision. Adjust trephine so that the pin shall project very slightly beyond the teeth. If there be a fracture, place the pin on a firm edge of the bone. In working trephine, take care to press evenly on all sides, lest dura mater be reached on one side before other side of trephine is half through. As dura mater is approached, saw very gently, and frequently probe with the piece of quill. As soon as this detects dura mater on one side, tilt trephine toward other side. When loose enough, remove disk of bone with elevator. Dangers: (1) of wounding dura mater; to be avoided by precautions mentioned above; (2) of wounding the sinus of large arterial branch; to be avoided partly by same precautions, but chiefly by bearing in mind anatomical landmarks.

C. B. KEETLEY.

TRICHIASIS.—See EYELIDS, DISEASES OF.

TRICHINOSIS.—A disease produced by digestion of meat containing a minute helminth, the trichina spiralis. The male worm, when found free, measures $\frac{1}{18}$ inch in length. The female is larger, measuring nearly $\frac{1}{8}$ inch in length.

In the muscles the worm is found coiled up in a lemon-shaped capsule, at either end of which is a small collection of fat globules. The long axis of the capsule lies parallel with the muscular fibers. The worm may be found in the fæces.

After the trichinous meat (pork or sausages) has been eaten, the course of events is as follows: In two days the larvæ becomes mature, in about six days the embryos are born, and in the course of the next week they proceed to migrate to all parts of the body, establishing themselves finally in the voluntary muscles, where they become inclosed in a thin, but subsequently laminated, lemon-shaped capsule. When this stage has been reached, the trichinæ are absolutely quiescent, and no symptoms may betray their presence. Ultimately the inclosing sac becomes calcareous. Prior to encapsulation, nausea, vertigo, and fever are the earliest symptoms noticeable.

These are followed by diarrhea, prostration, and a stiff and painful condition of the extremities. At the end of a week the fever increases, [the face becomes œdematous, and the voluntary muscles throughout the body swollen and painful. There may be aphonia and pain on moving the eyes, while perspiration, insomnia, and delirium are among the graver symptoms of this period. The helplessness of the patient is extreme. In a month improvement may set in, a gradual amelioration of all the symptoms being observed, and desquamation usually takes place. The patient, however, may die from exhaustion with high fever before the end of the month, or from pneumonia or other complication.

Treatment.—As regards treatment, not much can be done except to try and relieve the pain and allay the fever by general measures. If seen within a day or so of taking the trichinous food, it might be well to empty the alimentary canal with a calomel purge. The trichinæ are destroyed by cooking, therefore only those who eat uncooked meat can become the victims of this disease.

TRIFACIAL NERVE, DISEASES OF (Fifth Nerve ; Trigeminus).—This nerve arises from the side of the pons Varolii by two roots, motor and sensory. The former, the smaller, comes from a nucleus lying rather deeply below the lateral angle of the fourth ventricle, and above the facial nucleus; the sensory nucleus is larger and lies to the outer side of the motor, and it also receives fibers from the so-called ascending root of the trigeminus.

The fifth is the largest of the cranial nerves and consists of three parts, or divisions as they are termed, the ophthalmic, the superior maxillary, and the inferior maxillary; of these the two former are connected with the Gasserian ganglion, and are purely sensory.

The Ophthalmic supplies the integument of the nose, upper eyelid, and forehead, and the upper part of the hairy scalp, the mucous membrane of the nose and eyelids, the ball of the eye, and the lachrymal gland.

The Superior Maxillary gives sensation to the skin above the zygoma, the lower eyelid, the side of nose, the upper teeth, and the mucous membrane of the

roof of mouth, nose, and upper part of pharynx.

The Inferior Maxillary.—The third division contains all the motor fibers which do not pass through the Gasserian ganglion, and gives motor fibers to all the muscles of mastication as well as to the mylo-hyoid and digastric muscles; while the sensory part, passing through the ganglion, supplies the skin of the lower lip and lower part of the face, the lower teeth, the mouth, tongue, the side of the head and the ear, and the salivary gland.

The Gustatory Nerve, from this division, supplies the function of taste to the anterior two-thirds of the tongue.

The nerve is liable to be affected by local diseases within the pons Varolii, as softening, hemorrhage, or tumor; outside the pons by meningitis, growths, or carious bone; and the individual branches are apt to be involved in growths in the orbital or speno-maxillary fissures. In locomotor ataxia, the fifth nerve is liable to be paralyzed along with other cranial nerves. Paralysis is the most important affection, and may involve either the whole nerve or one or more of its divisions; other affections are neuralgia of the sensory part and trismus of the muscles supplied by the motor fibers.

Paralysis.—When the whole nerve is paralyzed, the symptoms may be described under the head of (1) *Sensory*, (2) *Motor*.

(1) *Sensory.*—There is loss of sensibility to tactile and painful impressions in the parts supplied, the anæsthesia being often preceded by tingling or pain. The anæsthesia will include the corresponding half of the face and adjacent side of the head, as well as the conjunctiva, and mucous membrane of the half of the nose, lips, tongue, hard palate, anterior pillar of the fauces, and the soft palate of the same side. As a consequence of this the conjunctiva can be touched, the nostril may be irritated by ammonia, and the fauces of one side can be tickled without any reflex actions being evoked. The patient bites on the other side, as he cannot feel the food, and as a result fur collects on the affected side of the tongue. Smell is lost, owing to the dryness of the nasal mucous membrane. Taste may be completely lost from disease of the root of the trigeminus, but disease of the gustatory nerve, after it has been joined by

the chorda tympani, causes loss of taste in the anterior two-thirds of the tongue; no effect is, however, produced when the lesion in the gustatory is above this junction.

Besides the above symptoms there are certain trophic changes of importance. The secretions, including those of the lachrymal and salivary glands, are diminished; herpes zoster of the face and inflammation of the cornea are considered to be especially due to irritation and disease of the Gasserian ganglion; in the latter case the cornea becomes cloudy, opaque, ulcerates, and the whole eye may become disorganized and destroyed.

(2) *Motor*.—The chief motor symptom is an inability to use the muscles of mastication of the affected side; the patient cannot bite hard, and the temporal and masseter muscles can be felt to contract feebly or not at all. Owing to paralysis of the external pterygoid, the lower jaw cannot be carried over to the opposite side in grinding the food, and in opening the mouth the lower jaw drops over toward the paralyzed side, being drawn there by the healthy external pterygoid of the other side.

Diagnosis.—This is not difficult when the symptoms are well marked; in the early stages the pain produced by irritation of the nerve may simulate simple neuralgia, but in the former case the pain is more persistent and passes on to anæsthesia and motor paralysis of the parts supplied by the nerve, which is a certain proof of organic disease. Loss of sensation of the face and mucous membranes is met with in hemi-anæsthesia of organic or functional origin, but in these cases the anæsthesia extends beyond the anatomical distribution of the trigeminus, to the head, nerves, limbs—or the whole of one side may be affected—and this is also associated with hemiplegia and affection of all the special senses of the same side. The seat of the disease will be shown by the anatomical relations of the part affected.

Treatment.—When due to cold, hot fomentations should be applied to the side of the face and the head, and if any inflammation be present a blister may be applied behind the ear. If the pain is very severe, local sedatives, as cocaine or menthol, may be required, or morphine

hypodermically. In cases where syphilis can be made out or suspected, iodide of potassium in full doses should be given. Faradization of the face with the wire brush has been recommended to promote the return of sensation.

C. E. BEEVOR.

TRISMUS NEONATORUM.—A form of tetanus only met with in infants.

Symptoms.—The onset is gradual, but the course is rapid. At first the child is peevish and cannot take the breast properly, its mouth is found to be fixed, and subsequently the whole body becomes more or less rigid; general convulsions, lasting perhaps half a minute, come on in paroxysms, at intervals of one or two minutes. During the attacks the child becomes livid, the hands and feet are clenched, and the spine is arched backward (opisthotonos). The condition of the mouth is most important and characteristic; at first it is a little open and the angles are drawn down, then the jaws become closed, and the angles more drawn down, so that the child can neither suck nor swallow. In the intervals between the paroxysms the rigidity does not wholly pass off. A mere touch, or even the attempt to swallow, is sufficient to induce a paroxysm. There is generally some fever, and there may be hyperpyrexia.

Prognosis.—Death results from asphyxia, usually within thirty-six hours of the onset, during a convulsion, or from coma. If the child survive the sixth day there is some chance of its recovery.

Morbid Anatomy.—Intense congestion of the vessels of the spinal cord and its membranes, with hemorrhages external to the theca, are almost constant lesions, but it is not proved that they are the cause of the symptoms; they may be the effect. Congestion of the brain and its membranes has been found.

Pathology and Ætiology.—The disease almost invariably ensues in the first five days of life, rarely after the end of the first week; it is a very fatal affection, and the earlier it appears the more rapid is its course.

The theory that it is dependent upon some condition of the umbilical cord is far from proven; inflammation of the cord or thrombosis of some of its veins is by no means constant, but it may be

noted that in traumatic tetanus there is frequently no inflammation of the wound. It has been attributed to pressure on the medulla and nerves by a faulty position of the occipital bone, but it appears much more probable that it is in some way dependent upon defective hygienic surroundings, for some years ago it was exceedingly common in a Dublin lying-in hospital, and became rare directly the sanitary arrangements of the building were made satisfactory.

Treatment.—Hygienic measures should be adopted as preventive whenever the disease is found to be of frequent occurrence. Placing the child on its side and manipulating the occipital bone into a different position has sometimes, it is said, resulted in the disappearance of the symptoms. During the attack, hot or cold baths, or ice to the spine should be tried; chloroform might be administered, and bromide of potassium or Calabar bean given internally; but treatment has not hitherto seemed of much avail.

Symptomatic Indications.—*Arnica* is valuable when disease is result of injury; *calcareo carb.*, when umbilicus inflamed.

TROPHIC NERVES.—That nutrition can go on independently of a nervous system is clear from what occurs in plants and the lower animals. Nevertheless, the theory is held that in the higher animals it is a function of the nervous system so to co-ordinate the metabolic processes in the different tissues of the body that their nutrition shall be healthy. Injury to certain parts of the nervous system is believed to disturb this co-ordination in such a way that the nutrition of the parts is visibly altered, and such alterations constitute trophic lesions. The nerves which are supposed to preside over nutrition are called trophic nerves.

It is impossible in most cases to prove the existence of trophic nerves with absolute certainty; nevertheless, in many instances their existence is extremely probable. The only certain examples of trophic influences which have been localized are, first, that which the posterior spinal ganglia have over the nutrition of sensory nerve fibers; for, if the nerve root be cut either side of the ganglion, such of the nerve as is still in connection with the ganglion remains healthy, but the part that is severed from the ganglion

degenerates. Secondly, some, at least, of the sympathetic ganglia have a similar influence upon the nerve fibers attached to them.

As instances of trophic influence which cannot be precisely localized, the following may be mentioned:

If the anterior spinal nerve root be cut, the part which remains attached to the spinal cord is unaffected, but the distal part degenerates; the degeneration of its fibers extends down into the mixed nerve, just as, when the posterior root is divided on the distal side of its ganglion, the degeneration of its fibers extends down into the mixed nerve. When, in the rabbit, the trigeminus is cut in the skull, the cornea becomes cloudy, and ulcers form inside the nose and mouth. It is highly probable that this is owing to the fact that this nerve exerts a trophic influence upon these parts. The salivary glands are almost certainly under the control of trophic nerves.

We will now pass to a consideration of those pathological conditions which have been attributed to trophic disturbance.

1. Trophic Lesions of Nerves.—Whenever a nerve fiber is separated from one of the nerve cells, or the only nerve cell, to which it is attached, it degenerates. Thus, we have seen that the fibers of the posterior root degenerate when separated from the posterior ganglion, and that the fibers of the anterior root degenerate when separated from the cord, because the cells in the anterior cornea exert a trophic influence on them. The fibers of the crossed and direct pyramidal tract degenerate when separated from the cells of the motor area of the cortex. Under certain circumstances other tracts of fibers in the cord degenerate, but it is not known what cells exert a trophic influence upon them. As a rule fibers degenerate in the direction in which they conduct, but exceptions are the degeneration away from the posterior root ganglion of the sensory fibers in a mixed nerve and the degeneration away from the gyrus fornicatus of the fibers connected with it. This process of degeneration is called Wallerian, after A. Waller, who first described it.

The time at which it begins varies in different species, but soon after the destruction of the trophic cells, or the

separation of the nerve fibers from them, the nuclei of the fibers become larger, and the amount of protoplasm around them is increased. This protoplasm so increases that at places it extends right across the nerve fibers, and consequently splits up the myelin, first into large, then into smaller particles, and at the same time, or rather later, destroys the axis cylinder. The fatty myelin forms drops in the protoplasm; these undergo some change in chemical composition, and ultimately are absorbed. While these changes have been going on, the enlarged nuclei have subdivided. After the absorption of the myelin, the nerve fiber shrinks; the process goes on simultaneously along the whole fiber. Regeneration takes place if the trophic center is not completely destroyed, by the new growth of axis cylinders from the healthy portion of the nerve; these grow down among the degenerated fibers; some apparently die, but others become clothed with a sheath of myelin and are in some few months functionally active. The changes undergone by the nerve fibers of the central nervous system are the same as take place in the peripheral nerves.

2. Trophic Lesions of Muscles.—Either irritative or destroying lesions of the ganglion cells of the anterior cornua of the spinal cord and their homologues in the medulla and pons, or of the efferent fibers which unite these cells with the periphery may give rise to active trophic lesions of muscles. Thus, they are met with, for example, in acute anterior polio-myelitis and in peripheral neuritis. Whether the same cells have both a motor and a trophic function is not known, but it is clear that, if not, the motor and trophic cells must be close to each other. At first the only change to be seen in the muscles is that the individual fibers have become narrower; for the most part the striation remains as usual, but sometimes the transverse striation is indistinct; while the longitudinal is very evident. At this stage the process is recoverable, but, if it proceed, the fibers become filled with fine granular matter, in which fat globules ultimately appear, only to be absorbed. Next there is a great multiplication of the muscle nuclei and also of those of the connective tissue between the muscle fibers. These nuclei ultimately develop into fibrous

tissue; by this time recovery is quite impossible, and what was the muscle becomes a mass of fibrous tissue with a few remnants of granular muscle fibers. The bulk of the muscle is considerably decreased. The whole process occupies several weeks. These trophic changes in muscle are always accompanied by a reaction of degeneration, which is never met with unless such changes are going on in the muscle. It is most important to remember that these trophic alterations in the muscle can only occur under the conditions stated, and that therefore they are found in simple atrophy of muscle, never as, for example, in the atrophy that comes from disuse, or in primary muscular atrophy, or in pseudo-hypertrophic paralysis. Nor do they ever occur when the lesion is above the motor cells in the cord, medulla, or pons.

Nothing is known of the trophic changes of the plain muscle fibers.

3. Trophic Lesions of the Skin.—It is not known which part of the central nervous system controls the nutrition of the skin. There are so many varieties of cutaneous trophic changes that they must be described separately.

(a) *Vasomotor Disturbances.*—These occur chiefly in diseases of the peripheral nerves; for example, flushing over the painful spot is common in neuralgia, vasomotor dilatation is seen when an aneurism or tumor paralyzes the cervical sympathetic (*see* SYMPATHETIC SYSTEM), and increased redness has been met with in association with disease of other nerves. Vasomotor alterations are occasionally observed in lesions of the central nervous system, but then they are generally preliminary to some more important trophic lesion, such as an acute bed-sore. Sometimes the vasomotor disturbance is accompanied by œdema, which may be general over the whole area of distribution of the nerve, or may be patchy, giving rise to urticaria; and often in nervous diseases, even when there is no obvious vasomotor alteration, a mild irritant produces severe and widespread redness, which readily passes on to vesication and even gangrene, hence blisters should be cautiously applied.

(b) *Vesicular and Bullous Eruptions.*—These also are mostly associated with disease of the peripheral nerves. Herpes occurring over the intercostal

and other nerves is a familiar instance (*see* HERPES), and has been proved to be due to a neuritis situated at the exit of the nerves from the spinal canal. In the face, herpes of the fifth nerve is often accompanied by so much œdema that careless observers, failing to notice its unilateral character, have mistaken it for erysipelas. It may be accompanied by a rise of temperature, and is a very painful affection; the pain often persists after the herpes has disappeared. Herpes is met with in peripheral neuritis, and also in tabes dorsalis, when it may be due to the accompanying peripheral neuritis. Occasionally the vesicles become pustular, and then the lesion simulates eczema. The occurrence of bullæ large enough to remind one of pemphigus, which is not a nervous disease, is rare, except where they are the precursors of acute bed-sores. It is doubtful whether lesions of the central nervous system ever lead to herpes, for in most of the recorded cases the post-mortem examination has been incomplete.

(c) *Glossy Skin*.—This condition is seen in neuritis or traumatic lesions of peripheral nerves. The fingers are most frequently affected, sometimes also the palm, rarely the dorsum of the hand. In the foot the toes suffer, occasionally the dorsum, very rarely the sole. In a well-marked case the fingers are usually tapering, smooth, hairless, devoid of wrinkles, glossy, pink or ruddy, or blotched as with permanent chilblains. They are commonly also very painful, especially on motion; the pain often extends up the arm. The condition is, in some respects, not unlike scleroderma; in fact, one variety of scleroderma—viz., morphœa—is an atrophy of the skin distributed along the course of a nerve, usually the supra-orbital branch of the fifth.

(d) *Scaly Conditions of the Skin*.—In rare cases after injury to a nerve or neuritis, the skin supplied by it becomes scaly and dry.

(e) *Pigmentary Changes in the Skin*.—A few instances are on record in which, after emotional disturbance, or after injuries to nerve trunks, patches of abnormal pigmentation have appeared upon the skin.

4. Trophic Lesions extending deeper than the Skin.—(a) *Bed-sores*.—The acute variety is especially met with in

acute diseases of the spinal cord, such as traumatic lesions and acute myelitis, but not in diseases affecting the anterior cornua only, such as infantile paralysis. Lesions of the cauda equina, and severe cerebral hemorrhage or extensive softening, will occasionally cause acute bed-sores. In the case of cerebral lesions the bed-sore is on the opposite side to the lesion. These bed-sores may form in any part, but the favorite positions are, in order of frequency, the sacrum and coccyx, the trochanters, the ischial tuberosities, the heels, the knees, the vertebral spines, the scapulæ, and the elbows. The first sign of the bed-sore is an erythematous patch, on which in a few hours vesicles develop. These soon burst and a sore results, which quickly spreads deeply and widely, the sides and base of the ulcer become gangrenous, and ultimately the muscles are destroyed, and the bone is exposed. The whole process is very rapid; it may stop at any point, and recovery may take place. When the sore is over the spinal column the necrosis of the bone leads to the exposure of the spinal canal; pus thus gets into this, and purulent meningitis is set up. Occasionally, also, bed-sores lead to death from pyæmia.

Sometimes, when the nervous disease leading to the bed-sore is chronic, such as chronic myelitis, the sore is much longer in developing, a large slough forms on the skin, and ulceration around this leads to its being cast off.

Both acute and chronic bed-sores usually form on parts subjected to pressure; but mere pressure will not explain their production, for they may occur in cases in which by careful nursing the pressure has been rendered almost inappreciable, and they occur much more readily in nervous diseases than in any other maladies. It is not known precisely what part of the nervous system must be damaged to produce such bed-sores.

(b) *Perforating Ulcer*.—In this disease the nerves going to the ulcerated part have always been found to be inflamed. The patients nearly always suffer from tabes dorsalis, of which perforating ulcer is an early sign. It is generally accompanied by lightning pains, and has a large area of anæsthesia round it. Its most usual site is the sole of the foot, especially over the metatarso-phalangeal joints of the great and little toes.

Rarely it is seen in the hand. First a corn appears, and in the center of this an ulcer forms and extends deeply, ultimately reaching the bone, which at that spot soon dies. The ulcer looks more like a sinus than an ulcer. There is no discharge. The skin around it is thickened and heaped up. They may occur on both feet, in which case they are usually symmetrical, and there may be more than one. They are often accompanied by trophic lesions of the joints and bones.

(c) *Leprosy*.—The changes in the skin and deeper structures met with in this disease are due to a neuritis. They are described in the article on *LEPROSY*.

5. Trophic Lesions of the Nails and Hair.—In rare cases of *tabes dorsalis* the nails are particularly prone to fall off, but they grow again, and then fall off again, and this process may be repeated several times in the course of a year or two.

In certain cases of neuritis and myelitis the nails become dry, brittle, and hard.

Under severe emotional disturbance the hair may turn gray, and alterations in color have been observed in association with neuralgia. In neuritis the hair has been stated to become very dry and brittle in exceptional cases.

6. Trophic Alterations in the Secretion of Sweat.—Emotion may greatly increase the secretion of sweat. A unilateral secretion of sweat, on the affected side of the body, is met with both in hemicrania and rarely in hemiplegia. Tumors, etc., pressing on the cervical sympathetic nerve sometimes cause an increase, sometimes a diminution, of sweat on the same side of the face (*see SYMPATHETIC NERVE, DISEASES OF*).

7. Trophic Affections of Teeth.—It appears probable that the teeth are more likely to fall out in patients affected with *tabes dorsalis* than in other persons, but the cause of this is not known.

8. Trophic Affections of Joints.—In quite exceptional cases, after injuries to nerves, after diseases of the spinal cord, and after cerebral lesions, the larger joints (on the opposite side of the body in the case of cerebral lesions) have been observed to become red and swollen, so that they look like joints affected with acute rheumatism.

The condition of joint which is known as Charcot's joint disease, and is thought by some to be a trophic lesion, is described

in the article on locomotor ataxy, with which disease it is always associated.

9. Trophic Lesions of Bones.—The bones of patients affected with *tabes dorsalis* are very liable to fracture spontaneously. Sometimes nearly every bone in the body may be broken. The fractures heal with the formation of much callus. The femur is the bone most often broken, and those of the leg are more often affected than those of the arm. The inorganic constituents of the bones of patients with *tabes dorsalis* are occasionally only twenty-four per cent. instead of sixty-six per cent. as in health.

In anterior polio-myelitis the growth of the bones is retarded.

The bones of insane persons, especially general paralytics, are often so soft that they yield readily to pressure, and thus produce various deformities. At other times they are so brittle that they may crumble under the fingers, and, of course, are then very liable to fracture.

10. Trophic Affections of the Salivary Glands.—In neuralgia of the fifth nerve the secretion of saliva is often reflexly increased. It may be affected in lesions of the cervical sympathetic (*see SYMPATHETIC NERVE, DISEASES OF*).

In facial paralysis there may be a diminution of the secretion of saliva on the paralyzed side.

11. Trophic Affections of the Lachrymal Glands.—The lachrymal secretion may be reflexly increased in trigeminal neuralgia (*q. v.*).

W. HALE WHITE.

TUBERCULOSIS (including Scrofula).—Tuberculosis is a pathological process due to the presence and growth in the tissues of a pathogenic bacillus, and characterized in its most typical manifestations by the production of minute rounded or lenticular bodies, which tend to increase in size and then to become caseous in the center.

History.—Tuberculosis was at first chiefly studied in the lungs, and more than seventy years ago Laennec perceived that the "existence of tubercles in the lungs is the cause and constitutes the true anatomical character of consumption." The next real advance in the conception of the pathological process was the hypothesis propounded by Buhl in 1857, that miliary tuberculosis was due to the absorption into the blood of caseous

matter from non-encapsuled yellow tubercle. In 1865 Villemin showed that tuberculosis could easily be induced in certain animals, especially in rabbits and guinea-pigs, by the inoculation of tuberculous matter from the human subject. Other pathologists confirmed this statement, but were led to believe that tuberculosis could also be induced by inoculation with non-tuberculous material or by the maintenance of chronic local irritations (as by foreign bodies or setons). Further observation has shown that these conclusions were incorrect, the occurrence of tuberculosis, under the circumstances mentioned, being due to the readiness with which animals of the species experimented on contract tuberculosis if kept in company with other animals suffering from that disease. It fitted, however, with a theory subsequently very widely held that tuberculosis was a non-specific inflammatory process, the peculiar characters of its local and general distribution being due to the fact that the essential element in the process was an irritative overgrowth of lymphoid tissue in the affected organs. The nucleated cells of the so-called lymphoid type were believed to be due to proliferation; the multinuclear cells—the so-called giant cells—which were said to be present in larger or smaller numbers in all tubercles, were believed to be produced by coalescence of a number of such cells, or by protoplasmic budding from the walls of blood vessels, such buds being the elementary stage of new blood vessels which never reached full development. The central caseation of tubercles was attributed to the fact that blood vessels were not formed. On the other hand it was shown that, in the lungs especially, the cells in acute miliary tubercles might be of the epithelioid type, and one writer even went so far as to assert that acute miliary tuberculosis of the lungs ought to be renamed acute disseminated catarrhal pneumonia. To Cohnheim belongs the credit of recalling attention to the all-important fact that tuberculosis was a specific inoculable malady; he first satisfied himself that the earlier experiments, made by himself and others, which were supposed to have proved that tuberculosis could be produced by the inoculation of other than tuberculous material were not to be relied upon; in the second place he showed that in rabbits and guinea-pigs

tuberculosis had a tolerably definite period of incubation. Working with Salomonsen he found that if a perfectly fresh piece of tubercle were introduced into the anterior chamber of the rabbit's eye a slight reaction only occurred, and after a few days the fragment could be seen through the transparent cornea; the fragment gradually diminished in size, and might entirely disappear, but about fourteen days or three weeks after the inoculation a crop of small gray granulations appeared on the iris, these granulations increased in size, caseated, and finally a general tuberculosis ensued. Further, a consideration of all the histological facts had led so good a pathologist as Ziegler to the opinion that a tubercle probably owed its rounded form and definite size to the fact that it was produced by the circumscribed action of an irritant of but slight intensity upon the spot which afterward became the center of the tubercle. In 1882 Koch announced the discovery of the tubercle bacillus, and thus supplied the last link in the chain of evidence that tuberculosis is a specific infective disease.

The Tubercle Bacillus.—The bacillus of tubercle is a small, fine, short rod, varying in length from a quarter to half the diameter of a blood corpuscle, its breadth is about one-fifth of its length; each bacillus is, as a rule, slightly bent or curved. It forms spores, which produce slight swellings, so that a bacillus containing several such spores has a beaded appearance. For a description of the method of examining the sputa for the bacillus the reader is referred to the article EXPECTORATION.

Koch first of all cultivated the bacillus outside the body on the surface of blood-serum, solidified by repeated heating to 65° C. He started cultivations from the following human morbid products: (1) Miliary tuberculosis; (2) pulmonary phthisis: *a.* open cavities, *b.* closed cavities, *c.* caseous pneumonia; (3) scrofulous glands; (4) tubercular testicle; (5) fungous arthritis; (6) lupus. He also started them from the tuberculosis of cattle, and from tuberculosis induced in guinea-pigs by inoculation with human tuberculous material.

The surface of the blood-serum was inoculated by spreading out on it a small particle of the tubercular material; the tube was then kept at a uniform tempera-

ture of 37° C. (98.6° F.) : after an interval of ten to fifteen days the growing colonies appeared as white spots, resembling tiny dry scales adhering to the surface of the serum. When many such colonies form they coalesce into a thin, grayish-white, lusterless covering. From this material fresh cultivations can be started and continued in series, and the bacilli are found to retain their power of producing tuberculosis in rodents inoculated with these subcultures. The bacilli will also grow on meat infusion solidified by agar-agar, and in shallow layers of meat infusion, but not on vegetable material. Further, the bacillus does not grow at temperatures below 28° to 29° C. (82.4° F.) or above 42° C. (107.6° F.). Koch points out that the lower limits of temperature at which the bacillus is just able to grow are not reached by summer heat, and that its growth is so slow that, before the life cycle could be completed, its colonies would be choked by other kinds of bacteria which are present everywhere and develop much more rapidly. Tubercle bacilli must, therefore, be regarded "not as occasional, but as true parasites—*i. e.*, as finding the conditions necessary to their existence only in the animal or human organisms."

Distribution of the Bacillus in Lesions.

—The number of bacilli found in tuberculous lesions varies considerably. They occur in largest numbers at points where the tuberculous process is just beginning or where it is spreading rapidly; they are found within or in the immediate neighborhood of the accumulated cells which are taking on the epithelioid diameter. As the process advances the bacilli increase in number, forming dense masses; meanwhile the cell nuclei begin to disintegrate, and the cells and nuclei are finally resolved into a granular material. This dead matter forms the central caseous mass, and in it but few bacilli remain, though it probably contains spores, derived from the pre-existing bacilli, by whose agency the destruction of the cells has been brought about. The relation of the bacilli to the giant cells is intimate; in chronic tuberculous processes, such as scrofula and fungous arthritis, but few bacilli are to be discovered, and these are always or almost always in the giant cells, perhaps one or two in each, when, however, the process is more acute, the number of bacilli in each giant cell is

much more numerous. The bacilli, if numerous, may be grouped in one end of the cell, if still more numerous they are disposed radially, reach to the periphery, and finally cause the destruction of the cell. If a large number of bacilli are introduced directly into the blood stream, and the animal killed shortly afterward, numbers of white corpuscles in the blood are seen to contain one or more tubercle bacilli, and here and there in the lungs, liver, and spleen a few round cells may be found, each containing a tubercle bacillus. It is probable that disseminated tubercle thus originates, and it has been shown that minute tubercles of the arterioles may in the human being rupture into the cavity of the vessel. From a single infective center also tubercle may be carried along the lymphatics and eventually lead to caseation of the nearest glands.

Pulmonary Tuberculosis.—In the lungs the tuberculous process presents certain peculiarities in its development and mode of spreading, owing mainly to the fact that, sooner or later, the caseous area opens into a bronchus, discharges its softened contents, and thus becomes a cavity. The bacilli may continue to grow in the walls of this cavity, sometimes universally and with great rapidity, causing rapid softening, at other times at a few points only, while in specially favorable cases the bacilli may entirely disappear, and the cavity may be obliterated by a process of cicatrization. The tuberculous process may spread in the lungs through vascular or lymphatic channels, but the most frequent mode is through the air passages; the infective contents of a cavity are inhaled into other bronchi, and in terminal bronchi and air cells set up the tuberculous process coincidentally over extensive tracts. Frequently, areas of consolidation of lobular form may be found, and are doubtless thus produced. In this way, large portions of lung may be almost simultaneously affected, producing the condition to which the term caseous pneumonia has been applied. The walls of cavities resulting from the breaking down of such areas are everywhere pervaded by a dense growth of bacilli; this leads to destruction of tissue with so much rapidity that the walls of such cavities are soft, being formed of lung-tissue in which there has been no time for indurating cicatricial processes to occur.

Scrofula and Lupus.—The relation in which scrofula and lupus stand to the more acute forms of tuberculosis is most interesting. On the one hand, there can be no doubt that scrofulous glands and joints and lupus-tissue contain tubercle-bacilli, and are capable of inducing typical tuberculosis in rodents; and, on the other hand, it is obvious that, clinically, acute tuberculosis and lupus are as far as the poles asunder. It is not at present possible to speak definitely on this point. It seems clear, however, that the virulence of the bacillus tuberculosis varies, just as the virulence of the bacillus anthracis varies. Lingard has recently published a series of remarkable experiments showing that whereas in guinea-pigs, inoculated with tubercle, enlargement of the lymphatic glands in the neighborhood of the point of inoculation appears in six or seven days, and the animals succumb to the disease in about eighty days, the same animals, when inoculated with scrofulous material, show enlargement of the glands in two or three weeks, and survive for six or seven months, and, when inoculated with lupus, show enlargement of glands in four or five weeks, and do not die for eleven or twelve months. The experiments with scrofulous material further proved that as the infection was transmitted from one guinea-pig to another it grew in virulence, thus A, an animal inoculated with scrofulous material, died of tuberculosis in 206 days; B, inoculated from A, in 131 days; C, inoculated from B, in 79 days; and D, inoculated from C, in 60 days (averages). The resistance of the tissues to infection by the bacillus doubtless also varies in different individuals, and in the same individual at different times; it in fact appears probable that the above noted attenuation of virulence is brought about in and by the tissues, possibly of the affected individual.

Ætiology.—Tuberculosis is an almost ubiquitous disease, and appears to be quite independent of climate; it is especially a disease of towns and crowded localities, and is favored by want of ventilation and unwholesome trades. A single phthisical patient ejects daily enormous numbers of bacilli (according to Bollinger, as many as twenty millions). Phthisical sputum resists desiccation and retains its infective properties for

long periods, owing, doubtless, to the presence of spore-bearing bacilli in it. The healthy body is, it would seem, capable of destroying the numerous bacilli which find their way into the lungs and intestines from time to time, and it is probable that, even in persons with a hereditary or acquired predisposition, infection is not established until a considerable dose of tuberculous virus is accidentally inhaled or ingested. The deteriorating influence of town life, and the fact that the air of rooms and places of public assembly in towns must often swarm with tubercle bacilli, appear to offer an explanation of the increased frequency of phthisis and other forms of tubercular disease in town as compared with country populations. The injurious influence of dusty trades is to be attributed to the catarrhal process set up by the irritating particles. Tuberculosis can also be transmitted to guinea-pigs, pigs, and calves by the milk of cows suffering from tuberculous mammitis, if not also by that of cows with tubercle in other organs, but not in the mamma. This is a probable source of infection in infants and others who drink unboiled milk in large quantities. It is possible also that the flesh of oxen in an advanced stage of tuberculosis may communicate the disease to persons consuming it, for the central parts of roast joints and grilled portions of meat are probably never brought to a temperature sufficiently high to destroy the bacillus, if it be present, as there is some evidence to show.

With regard to phthisis pulmonalis, hereditary predisposition, habits of life, and occupation are probably the most important ætiological factors, but with regard to acute tuberculosis their importance is by no means so clearly established; on the contrary, in the present state of knowledge, clinical and experimental, the more probable opinion is that the most important factor is the introduction into the economy of an adequate dose of the bacillus tuberculosis in a virulent state, and that, in fact, acute tuberculosis is ætiologically as distinctly an infectious disorder as typhoid fever (*see also* PHTHISIS).

DAWSON WILLIAMS.

TUBERCULOSIS, ACUTE.—Tubercle bacilli occasionally gain entrance

into an artery, vein, or lymphatic vessel, and are then rapidly disseminated throughout the body, miliary tubercles appearing in various organs almost simultaneously. The pia mater and the lungs may be thus attacked at or about the same time, or the serous membranes may be affected quickly, one after the other, in either case constituting the condition known as acute tuberculosis.

Speaking generally, it may be stated that when tubercle is widely disseminated, if the cerebral meninges be affected, the symptoms of that lesion will probably overshadow those due to the condition of the lungs and abdomen, and in a very large proportion of cases of acute tuberculosis, especially in children, the meninges are affected. The focus from which the bacilli are disseminated is, in the majority of cases, a pulmonary lesion, but any tubercular nodule may be the starting-point of a general infection.

See MENINGES, CEREBRAL INFLAMMATION OF; PERITONITIS, TUBERCULAR, and PLEURISY, TUBERCULAR.

Acute Tuberculosis of the Lungs.—A rapid infiltration of tubercle throughout the lungs is a common event in the course of phthisis (*i. e.*, pulmonary tuberculosis), and is one of the most frequent modes of termination of that disease, of which it is really only one of the most acute varieties.

The *symptoms* closely resemble those of a specific fever, and the disease at its outset is not infrequently mistaken for typhoid fever. The early history of the case will depend upon the site of the primary tubercular lesion, but even when this is situated in the lungs there may have been no symptoms prior to the onset of the attack suggesting such a condition, or they may have been forgotten or overlooked. The patient becomes gradually ill, suffers much from dyspnoea, which tends to increase as the disease goes on. The pulse is rapid and the temperature generally high, although subject to much variation. It may be as high as 104° or may remain below 102°. There are daily fluctuations of an irregular type, the highest point being sometimes in the forenoon. In cases due to the breaking down of an old apical lesion, the attack may be ushered in by hemoptysis. The amount of cough and expectoration

will depend upon the degree of catarrh present; as a rule, the sputa are scanty.

There is almost always an excessive degree of sweating, but in rare cases the skin is dry. The countenance is generally dusky and sometimes cyanosed, and the expression of the features is always one of anxiety. There is marked emaciation, and, as the disease progresses, symptoms of cerebral disturbance probably begin to show themselves, and eventually the patient sinks into the "typhoid state," with sordes, a dry brown tongue, delirium and stupor gradually deepening into coma.

The *physical signs* which attend these very marked symptoms are often most equivocal. The expansion of the chest may be found to be a little defective at one apex, if an old lesion be present there, but the resonance on percussion is unimpaired by the recent lesions. The breath sounds are generally harsh, and are often accompanied by fine crackling râles. If bronchial catarrh be present, rhonchus and sibilus will be audible, and the expiratory sound will be prolonged. The vocal resonance is usually unaltered.

The *diagnosis* has often to rest upon the symptoms alone. The high temperature, rapid respiration, with no obvious physical signs to account for it, and the increasing cyanosis and sweating form the main points upon which it may be established. From typhoid fever the distinction is often very difficult, especially as enlargement of the spleen occurs in both diseases. From the examination of the sputa for bacilli, and of the eye for evidence of tubercle in the choroid, positive indications may often be obtained when all other signs are of doubtful significance.

Prognosis.—The disease rarely extends beyond three weeks, and may be even more rapidly fatal.

Pathological Appearances.—The lungs are infiltrated, sometimes throughout, with miliary granulations in an almost uniform stage of development. These are of a pearly white or grayish tint and of firm consistence, but may be softer and of a yellowish color, tending toward rapid caseation. When acute tuberculosis has supervened upon pre-existent tubercular lesions in either lung, the appearances proper to such changes will, of course, be present in addition. In the rapidly fatal cases the granulations are

unaccompanied by any obvious inflammatory change. The tubercles are formed for the most part in the spaces around the minute arterioles.

The tubercles are generally more numerous in the upper lobes, particularly if old phthisical lesions be present there. When not situated in the lung a careful search is often necessary to discover the source of primary infection. The bronchial glands should be closely examined; attention must be paid to any bone disease present: while in males the prostate gland and the vesiculæ seminales, and in females the fallopian tubes, are in rare cases the starting-point of a general tubercular infection, in which the lungs share.

Ætiology.—Acute tuberculosis of the lungs may occur at any age; it is decidedly more common in males than in females. In children the disease is commonly associated with tubercular meningitis, the lungs being often free from old lesions, while in adults there is often evidence of an arrested pulmonary tubercular lesion which has recently broken down.

Treatment can only be directed toward the maintenance of the patient's strength by appropriate food and stimulation, and to the relief of troublesome symptoms as they arise.

TUMORS.—Clinically, we understand that a tumor is a new growth, which produces a swelling or enlargement of the affected portion of the body; that it has no tendency to undergo resolution or spontaneous cure, and that it is little or not at all affected by medicine. Yet we are forced to admit that there are new growths (tuberculous, lupous, etc), which are not regarded as tumors; and that some tumors do not produce swelling or enlargement (*e. g.* some withering cancers of the breast, and certain epitheliomas). Among the tumors, too, it is customary to include cysts, whether they are due to the presence of new growth or not. It must, therefore, be admitted that the manner in which the term is used is, in some respects, very arbitrary.

All tumors originate in the natural tissues of the body, and are probably derived from the tissues in which they originate, for they are composed of elements which resemble those of the tissues, either in their perfect or imperfect

and embryonic state. The new growth may, in its course, thrust aside the surrounding natural tissues, or it may infiltrate them. In the former case it remains limited to the tissues in which it took its origin (a fatty tumor in the subcutaneous fat, for example), and is then termed *homologous*; in the latter case it may extend into tissues of many different varieties, and becomes *heterologous*. Homologous tumors are generally innocent; heterologous tumors are generally malignant. Secondary tumors are often heterologous from their commencement, as when an epithelial growth is formed in the interior of a lymphatic gland.

Tumors owe their *origin* to many different causes.

1. Inflammatory new formations are not usually regarded as tumors, yet there can be little doubt that inflammation is a frequent cause of the formation of a tumor.

2. Long-continued irritation, without actual inflammation, may cause the formation of a tumor; *e. g.*, the formation of a cancer of the lip from the irritation of a dry and harsh pipe stem. The frequent or continual contact of certain irritating substances may induce the growth of a tumor, as cancer in the scrotum of sweeps.

3. An injury may lead to the occurrence of a tumor. Two cases may be cited: A young lady leaning out of the window was struck in the back by the fall of a heavy sash, and very quickly after the accident a sarcoma, which was rapidly fatal, formed at the point where she was struck. An old lady was looking on at a tennis match, when she was struck sharply on the breast by the ball, and where the blow was felt there formed a large and quickly growing carcinoma.

4. There are also certain predisposing causes, particularly of malignant tumors. Of these, some are actually tumor formations: thus, a simply warty growth may become an epithelioma. Others are inflammatory; chronic inflammatory conditions of the surface of the tongue (leucoma) may lead to epithelioma.

5. In addition to these local predisposing conditions, there are several very important general conditions which may predispose to tumors. Age and sex are the most important of these. Fatty tumors are far less common in children

than in adults; true carcinoma very seldom occurs in persons under thirty years of age. The female sexual organs are very liable to malignant tumors; but in parts of equal importance in the two sexes, such as the esophagus, lip, and tongue, men are much more liable to malignant disease than women. Anxiety and sorrow are thought to predispose to the occurrence of malignant growths. Residence in valleys is said to be much more productive of cancer than residence on hills and mountains.

6. Lastly, tumors may be congenital, as *nævi* usually are. And perhaps they may be inherited, or the predisposition to them may be inherited.

Growth.—The rapidity of growth, the course which a tumor will pursue, and many of its physical characters, depend partly on the structure, partly on its seat of origin. Generally speaking, the less developed the structure, the more malignant is the tumor. But tumors of similar structure differ widely in their powers of mischief, according to the part of the body in which they originate.

Tumors, like the natural tissues, are liable to accident, disease, and death. Their structure and situation, as might be expected, exercise great influence on their liability in these respects. Very large tumors, situated on the surface of the body, whatever be their structure, are exposed to injury and are liable to ulcerate and slough. Large fatty and soft fibrous growths, when they are pendulous, are peculiarly prone to ulcerate. Epitheliomata, partly because they grow on or close beneath the surface of the skin and membranes, partly because the masses of epithelium of which they are composed are ill supplied with blood, almost invariably ulcerate at an early period of their existence. In them, the ulceration sometimes extends so quickly and so deeply that the new growth is destroyed nearly as rapidly as it forms, and the essential structure of the disease can only with difficulty be discovered with the microscope. Unfortunately, tumors are rarely so completely destroyed by sloughing and ulceration that they are cured.

Again, tumors may undergo great change in their physical characters owing to degeneration and organization. Thus, sarcomas may become organized into bone and fibrous tissue; fibrous tumors

may calcify; cartilaginous tumors may soften. These changes do not usually affect the nature of the growth, which still remains essentially sarcomatous, or fibrous, or cartilaginous, as the case may be.

It is important to bear in mind these diseases and metamorphoses of tumors, for they may lead to grave errors in diagnosis and prognosis. A carcinoma of the breast may become inflamed and suppurate; a round-celled sarcoma may present the consistence of cartilage or bone; the error of mistaking the former for a chronic abscess, the latter for a cartilaginous or bony growth, can only be avoided by close attention to the history of the case and the sum of the symptoms which are present.

Classification.—Tumors were at one time classified as *innocent* and *malignant*, and the terms are still, and probably always will be, used. An *innocent tumor* has usually a structure similar to that of the tissue in which it grows. It grows slowly, thrusts the surrounding tissues out of its way, is generally encapsuled when it lies in the midst of other tissues, does not recur if it has been completely removed, does not affect the neighboring lymphatic glands, does not occur in distant parts of the body. A *malignant tumor* is usually composed of tissues which differ more or less widely from those in the midst of which it grows. It grows quickly and infiltrates the surrounding tissues, no matter how much they differ from it in structure; it is often not encapsuled; it frequently affects the neighboring lymphatic glands and occurs in distant organs. Speaking generally, the sarcomas and carcinomas represent all the malignant tumors; but the endotheliomas, some of the myxomas and lymphomas, are also malignant. Although innocent tumors are, comparatively, diseases of small moment, and malignant tumors are almost invariably fatal, yet an innocent tumor may kill the individual by reason of its situation, and a malignant tumor may exist for twenty or thirty years without causing death. Thus, a simple bony tumor, pressing on the brain, may destroy the patient; a rodent ulcer (which is a definite carcinoma) may progress so slowly that it may be borne for more than a quarter of a century. Yet it is undoubtedly malignant, and exhibits its malignancy by in-

filtrating and destroying every tissue with which it comes in contact.

The diagnosis between an innocent tumor and a malignant tumor, of the highest importance to the patient, depends on many of the following circumstances: the history of the case, the age of the patient, the sex, the situation of the growth, the rapidity of its progress, its physical signs, and the presence or absence of other tumors. The history of very long duration, and of slow growth, is in favor of innocence. Youth is almost incompatible with the existence of a carcinoma, but children suffer not uncommonly from sarcoma. Men are much more liable to malignant disease of the lip, tongue, esophagus than women, and women are peculiarly liable to malignant disease of the generative organs. The circumstance that a woman more than forty years of age suffers from a rather quickly growing tumor of the breast or uterus, is presumptive of malignant disease. Malignant tumors are as a rule less movable, less clearly defined, less separable from the surrounding structures than innocent tumours. They are very prone to become adherent to the skin when growing in the breast and similar organs. And the affection of the neighboring lymphatic glands or the presence of tumors similar to the growth which first appeared, and following it after an interval of a few weeks or months, is a strong circumstance in favor of malignancy.

Treatment.—The only growths which appear to yield, even temporarily, to internal remedies, are some of the malignant or semi-malignant diseases of lymphatic glands (lymphadenoma), which sometimes disappear under the influence of increasing doses of liquor arsenicalis. The only effectual treatment is removal or destruction of the tumor. It may be laid down as a rule that this should be undertaken if the growth produces much inconvenience, deformity, disturbance of health, danger to life, or if it threatens to produce either or all of these conditions, if it is not dealt with. The best method of dealing with each particular growth will be mentioned in the account of each.

The following classification of tumors will be adopted:

A. CYSTS.

B. SOLID TUMORS.

1. Fatty: lipoma.

2. Fibrous: fibroma.
3. Cartilaginous: chondroma.
4. Osseous: osteoma.
5. Mucous: myxoma.
6. Lymphatic: lymphoma.
7. Muscular: myoma.
8. Nervous: neuroma.
9. Vascular: angioma and lymphangioma.
10. Embryonic: sarcoma:
 - " round-celled.
 - " spindle-celled.
 - " mixed-celled.
 - " giant-celled.
11. Endothelioma.
12. Warty: papilloma.
13. Glandular: adenoma.
14. Carcinoma:
 - " spheroidal-celled, or glandular-celled (hard and soft).
 - " squamous-celled (epithelioma).
 - " cylindrical-celled or columnar-celled.
 - " colloid.

Cysts.—A cyst may be defined as a closed sac with liquid or semisolid contents. Cysts may be divided into: 1. Those formed by the distension of previously existing tubes or sacs or cavities. 2. Those of new formation. 3. Those of uncertain origin.

An excellent example of the first variety is found in the ordinary sebaceous cyst, which may be due to the stoppage of the duct, and may occur on any part of the body in which sebaceous glands naturally exist. *Sebaceous cysts* frequently form on the scalp, about the face and neck, and neighboring parts. Their contents are semisolid, and consist of a pulaceous material of offensive odor. They project, often to a large size, beneath the skin, are smooth and rounded on the surface, soft and pulpy to the feel, and the skin over the larger of them is sometimes traversed by enlarged and varicose vessels. The summit of the cyst is adherent to the skin, and a tiny depression, marked by a black speck, can often be distinguished in the adherent skin where the occluded duct opened. The cyst, if it is injured or irritated, may inflame and suppurate. *The diagnosis* of a sebaceous cyst depends partly on its situation immediately beneath the skin, on its adherence to the skin, its rounded form and softness, on the vessels ramifying on its surface. Inflammation may mask the characters, and cause it to be mistaken for an abscess, but the error is unimportant. A cyst which is not inflamed may sometimes be cured by opening up the occluded duct with a fine probe, enlarging the opening with larger probes, and squeezing out the contents. The sac gradually shrivels. If the duct can-

not be discovered, or if the tumor be large, it should be dissected out. This may be done without opening the sac. But in most instances the better method is to transfix the tumor, turn out the contents, and seizing the interior of the sac at its deepest part with a pair of toothed forceps, to draw it out through the incision. Great care should be exercised in removing sebaceous tumors of the scalp and back, even if they are of small size. If the patient is not in good health, or is imprudent after the operation, there is danger of cellulitis. Cysts which are inflamed should not be removed during the course of the inflammation. If they suppurate, they should be opened like a simple abscess, for the suppuration often effects a cure of the disease.

Other examples of cysts of the first variety are mucous cysts of the lips and milk cysts of the breast.

Cysts of the second variety may be formed by the organization of the products of inflammation round a blood clot or foreign body. The cysts produced by parasites (hydatid cysts, etc.) are of the same variety.

The cysts of uncertain origin include many of the congenital cysts. Some of these are of course due to errors of development, but the exact method in which they are formed is not always apparent. Among these cysts must be classed the *dermoid cysts*, the most frequent seat of which is beneath the outer cornu of the eyebrow. There they are found in infants, appearing as a prominent, smooth, oval, soft tumor, well defined and movable, not adherent to the integument. They present many of the characters of an ordinary sebaceous cyst, without the black speck and adherence of the skin over them. If the little tumor be dissected out through an incision running parallel with the eyebrow, it will be found that the cyst wall, so thin that it is difficult to dissect it out unbroken, contains a material precisely similar in appearance to sebaceous matter, but having fine hairs embedded in it. Large cysts of the same nature, but containing many and more complex integumental structures, or even teeth, bone, and other fetal structures, occur under the tongue, deep down in the neck, in the ovary, testicle, and scrotum, and other parts of the body. There are no certain

signs by which they can be diagnosed in most of these situations, unless by their doughy consistence. Usually, indeed, the diagnosis is not made until after the tumor is opened or removed. Some of them suppurate, are opened under the impression that they are ordinary abscesses, and are then discovered to be dermoid cysts.

Lipoma (fatty tumor).—A tumor composed of fat, differing in no essential respect from the natural fat of the body. It forms a soft lobed tumor, circumscribed, flattened, so far adherent to the skin (when it is seated in the subcutaneous tissue) that the skin dimples when it is lifted off the tumor. It is seated most frequently on the trunk and shoulders, but may occur beneath the skin of any part of the body, even of the scalp or palm of the hand. It usually forms a single tumor, grows in adults, and progresses very slowly. But cases of persons with multiple fatty growths are not rare, and children and young people are not exempt from fatty tumors.

Although the great majority of lipomata present the characters which have been described, there are several *common variations*. For example, the growth may contain a much larger proportion of fibrous tissue than usual, and may thus be much firmer than the majority of fatty growths. It may lie deeply seated between the tissues, in the intermuscular planes, or may even grow from the surface of a bone. The superficial growth, instead of presenting a flattened mass, may stand out prominent as a pedicled tumor. It is then liable to ulcerate and slough.

A frequent variety is that in which there is not a distinct and separate tumor, but a mere outgrowth of the fat, usually of the subcutaneous tissue. Such outgrowths are frequent in the neck and about the trunk. In the former situation they produce very unsightly masses, giving the appearance of great double chins and swollen necks.

A fatty tumor may, in the course of years, attain a very enormous size; but examples of the huge masses which were not uncommon before the use of chloroform in surgery are now very rarely seen. The tumor is seldom painful or tender, but this cannot be said of all cases, for some of the most typical examples of what are termed "subcutaneous painful

tumors" are composed of fat. When subjected to irritation and pressure, the tumor may ulcerate or slough, and this is more liable to occur in pedicled tumors. Still more rarely pus or serum forms in the interior of the mass.

The *diagnosis* is usually very easy. The softness, almost amounting to fluctuation, the dimpling of the skin over those tumors that are subcutaneous, the situation of the tumor, its slow growth, and its manifest lobulation, serve to distinguish it from a cyst, a chronic abscess, or a bursa. The diffused continuous outgrowths are also easy to recognize, for they are uniformly soft and of slow growth. The deeper-seated tumors are more difficult to diagnose, yet even they are seldom mistaken for any but soft fibrous or mucous tumors, an error of small consequence, for the same treatment is proper for all these tumors.

It is seldom wise to attempt the *removal* of the diffused outgrowths, especially when they are seated about the chin and neck. It is very difficult to remove them entirely, and the disfigurement produced by the growths is not greater than that of the scars of the operations. They appear, too, to yield in some cases to the influence of liquor potassæ, given in doses of about ten minims, three times a day during long periods. Multiple fatty growths do not often require removal, but if one of them becomes painful, or grows quickly, it may be excised. For all single fatty growths which are growing, or are troublesome in any way, excision is the only treatment. A free incision is made over the middle of the tumor, and through this the mass, with its lobes, is drawn or dissected out. It is well not to leave any of the growth behind, for although such pieces rarely increase in size or form the starting point of a new tumor, they occasionally do so, and instances are on record in which a fatty tumor has, from such a cause, recurred several times.

Fibroma (fibrous tumor).—Pure fibrous tumors are not so common as those which are composed of fibrous tissue mingled with adipose, glandular, mucous, and other tissues. Those which occur in the breast and uterus, for example, are very seldom composed only of fibrous tissue. Even the fibrous tissue which they contain varies much in different tumors, and in different parts of the same tumor, and

may resemble any of the many forms in which fibrous tissue occurs naturally in the body. Owing to this and to the close or loose texture of the mass, fibrous tumors present to the naked eye many different types, appearing sometimes uniform, pale, white; sometimes made up of shining bundles running in all directions; sometimes concentrically arranged round one or many centers.

Fibrous tumors may occur in almost any part of the body in which fibrous tissue is found; but the *commonest seats* are the breast, the uterus, the testes, the periosteum of many bones, the jaws, the sheaths of nerves and tendons, the subcutaneous tissue, the scrotum, the labium, and the intermuscular spaces. Those which grow in the scrotum and from the vulva are more often continuous outgrowths than separate tumors.

The typical *shape* of fibrous tumors is the oval or rounded shape, but they are liable to be modified by the resistance of the tissues which surround them, and most of them are nodular or bossed. Some of them growing from the skin or subcutaneous tissue are pendulous. Fibrous tumors may attain a large size, and this is more often the case with the softer varieties, which are very loose-textured and contain a great deal of liquid in their meshes. Such growths were formerly termed fibro-cellular, but are now included in the class of fibrous tumors, of which they form the soft variety. The best examples of fibro-cellular growths may be found growing from the labia, the skin (as pendulous tumors), and in the interior of the nose as polypi.

The large majority of fibromata are very firm, some of them actually hard. They are tolerably equal in consistence, unless they contain cysts or have softened by degeneration of parts of their substance. They grow slowly, in some instances so slowly that the bulk of the tumor at the end of ten years is not greater than that of a walnut. They are generally painless, and not particularly tender; but this rule is liable to a remarkable exception, inasmuch as some of the "painful subcutaneous tumors" are formed almost wholly of fibrous tissue.

Although usually *single*, fibromata may attack the same patient in large numbers, particularly in the nerves, the skin, and uterus. They are more common in

adults than in children, but may occur at any age. They are liable to soften by mucous degeneration, and to calcify; but such changes are rare. The prominent, and particularly the pendulous, tumors may ulcerate and slough.

The *diagnosis* of a fibrous tumor is not always easy. The features to which attention should be directed are the regular shape; the uniform consistence; the nodular or bossed surface; the slow growth, and the freedom of the surrounding textures. Those in the breast and subcutaneous tissue are usually very freely movable, and are not adherent to the skin and other structures. In these situations they cannot always be distinguished from hard sarcomata, especially in the earlier stages, for the sarcomata are often encapsuled, and some of them are so far organized as to consist almost wholly of fibrous tissue. These fibrous tumors which grow in connection with the jaws and other bones are equally difficult to distinguish from sarcomata, and reliance must be placed chiefly on the slowness of growth, the healthy condition of the covering tissues, and the regular contour of the growth. Cartilaginous and bony tumors, which may also be mistaken for fibromata, are usually much harder and more nodular.

The *treatment* proper for fibromata is complete removal. This may be performed with the knife; or, if it is desired to prevent hemorrhage, with the *écraseur* or galvano-cautery. Many tumors can be enucleated in their capsules; *e. g.* those in the breast, in the interior of the jaws, and some of those which grow in connection with the sheaths of nerves. Others are dissected out with great difficulty. *Recurrence* is in any case a rare event, although sarcomas, which have become organized in a great part into fibrous tissue, and yet recur as though they were still composed of spindle cells, give the appearance of a tendency to recur to some fibromata.

Chondroma (cartilaginous tumor).—Cartilaginous tumors occur usually in connection with the bones, growing within or upon the phalanges of the fingers, the humerus, the femur, the tibia and fibula of long bones, and on or in the jaws, the upper more frequently than the lower. They occur also in the salivary glands, particularly the parotid; in the testicle, and in the subcutaneous tissue.

Growths of cartilage are found in and around the joints in rheumatoid arthritis, and cartilage occurs in combination with other tissues, or, as a result of organization, in mixed tumors. Sarcomas are very liable to become in part, sometimes in large part, cartilaginous, and this has led to a belief that chondromas are not infrequently malignant.

Pure cartilaginous tumors are generally *slow-growing*, irregular in shape, sometimes rounded, almost always bossed or tuberos or nodular. They are usually very hard, but differ from bony tumors in their great elasticity. Some of them are composed of much softer material, and are compressible, but still very elastic.

They are circumscribed and covered (where they are not attached to bone) by a layer of fibrous tissue, which serves as perichondrium. When they are subjected to friction, a bursal sac forms over them. On section, instead of appearing as a single mass, they more often appear as if made up of a cluster of growths, each of which is inclosed in a capsule, and the capsules unite the separate tumors into one solid growth. The appearance of the cut section is usually that of ordinary hyaline cartilage, with the characteristic pearly hue; but it is common to find also portions which look like fibro-cartilage. Some of the separate masses which compose the growth are diffuent in the center, some are calcified or ossified. Ossification is so common in those tumors which grow near the end of long bones, that all that part of them which lies next, and is connected with, the bone, becomes ossified, while only a thin layer of cartilage caps them. On this account they are generally classed among the cancellous osseous growths (exostoses).

Cartilaginous tumors are generally *single*, but they may be multiple and even symmetrical. Multiple chondromata of the hand are always of doubtful character, for they are not uncommonly chondrifying sarcomas, and are therefore malignant. Cartilaginous tumors may occur at any age, but they are more frequently observed in young persons; and this is true particularly of tumors in connection with the bones. This is only what might be expected, for they grow at or near the junction of the epiphysis with the diaphysis, and are, therefore, much

more likely to originate during the period of activity of the mother tissue. They appear sometimes to be derived by inheritance, and are situated in the same parts in the parent and the offspring.

Although their *rate of growth* is usually very slow, they may attain a large size; but very large size, especially when associated with much more rapid growth than usual, should raise the suspicion that they are malignant. The softening of a cartilaginous tumor, and consequent formation of a liquid resembling synovia, may produce cavities like cysts, and alter the characters of the tumors almost beyond recognition.

The *diagnosis* of a cartilaginous tumor is generally easy. Its hardness, and yet elasticity; the nodules or tumors on its surface; its slow, but continuous, growth; the presence of soft parts, indicating cystic degeneration; the situation of the tumor; these are the characters on which dependence may be placed. From chondrifying sarcomas, for which they are most likely to be mistaken, they may generally be distinguished by their much slower growth, more equal consistence, and sharper contour.

Removal is the *treatment* for all cartilaginous tumors which are growing, or are painful or otherwise inconvenient. Those which grow in the testicle require, almost always, the complete removal of the organ: and some of those which grow in the interior of the phalanges necessitate amputation of the finger. But most of those which grow in the parotid and in the soft parts can be enucleated in their capsules, without disturbing the surrounding parts. The tumors which grow on the surface of the bones may be cut off with small probability of their recurrence; and even the tumors which grow in the interior of bones and distend them (those of the phalanges, for example) may often be scooped out with comparatively little damage to the finger.

The *prognosis* of pure cartilaginous tumors is good. They are not liable to recur after careful removal; and even when small fragments of them have been unavoidably left behind, they may remain quiescent, or perhaps shrivel and disappear. The cases in which recurrence has been noted, with other symptoms of malignancy, are cases of malignant

tumors which have become in large part cartilaginous.

Osteoma (osseous tumor).—As in the case with the chondromata, so with the the osseous tumors, the true bone tumors are liable to be confounded with tumors in which bone occurs largely in consequence of ossification of the elements of the growth. This is especially frequent in sarcomas, particularly in those sarcomas which grow in connection with the bones. But none of these are included in the description of osseous tumors proper; nor are the osseous outgrowths around the diseased joints in rheumatoid arthritis.

Of true bony tumors there are *two chief varieties*: the cancellous and the compact. Both of these are composed of true bone, the former resembling the medullary tissue, the latter the compact tissue of natural bones. The cancellous tumors have been already mentioned in the account of the chondromata, to which many of them may be said to belong more truly than to the osteomata. They grow at or near the ends of long bones, the tibia, femur, humerus, etc., where they form exostoses, which are often pedunculated. A favorite position is the dorsal aspect of the ungual phalanx of the great toe, from which the tumor projects beneath and pushes up the nail.

The compact osteomata occur almost invariably in connection with the bones of the skull and face. The hardest of them, which are composed of layers of bone lamellæ laid concentrically over a central point or pedicle, have been named ivory exostoses. They are so hard that they can, with difficulty, be cut, or even broken, and differ structurally from other bony tumors in the absence of Haversian canals. They grow on the flat bones of the skull, while the ordinary compact osteomata are found in the sinuses and cavities of the face and head, where they slowly grow, filling up the spaces, thrusting aside the adjacent structures, or causing absorption of them by pressure, and producing horrible deformity. The ivory tumors rarely attain the size of a small walnut, but the compact tumors may grow to a considerable size in the course of years.

Although in many instances osseous tumors are single, it is by no means unusual to meet with patients suffering from multiple osteomata, in some in-

stances numbering more than fifty or one hundred. The growths are, in such cases, frequently symmetrical and hereditary, and are first noticed at a very early age.

The *diagnosis* of an osseous tumor usually presents no difficulty. The seat of the tumor; its extreme hardness; its pedunculated shape when forming an exostosis, and its irregular nodulated or tuberos surface when forming a large, continuous mass; its slow growth; all these indicate as clearly as possible its nature. The ossifying sarcomata, with which it is most likely to be mistaken on account of the large quantity of bone which some of them contain, are recognized by their much more rapid growth and unequal consistence.

Treatment.—The only certain method of ridding a patient of an osseous tumor is to remove it. But it is neither necessary nor advisable to remove every osseous tumor which comes under observation. The cases in which operation is desirable are those in which the tumor is painful, or steadily increasing, or very inconvenient, or the source of great deformity, and in which it is possible to remove it without greatly endangering the life or health of the patient. Thus many of the exostoses of the flat and long bones, and some of the tumors of the upper or lower jaw, should be removed. But other tumors of the bones of the face and head, ill-defined, diffused, and extending upward as far as the base of the skull, or perhaps actually into the cranial cavity, should not be interfered with. Nor is it advisable to remove exostoses of the long bones which are attached by very broad bases, and are deeply seated beneath a mass of muscle. The suppuration which follows is often very abundant, and the pus is apt to track up and down the limb, producing great disturbance, and sometimes serious or fatal effects.

The *prognosis* of osseous tumors, after removal, is good, provided the tumor is not an ossifying sarcoma. Even when a part of the base of attachment is left, there is little fear of recurrence. There is, however, an exception to this general rule: that of the cancellous exostosis which occurs on the dorsal aspect of the last phalanx of the great toe. Although it never attains a large size, it is very obstinate, and very prone to recur when it has been even freely cut off the bone. On

this account it is advisable to remove the distal portion of the phalanx, which may be done without endangering the phalangeal joint.

Myxoma (mucous tumor).—There can be no question that many of the tumors included under this head ought to be referred to the head of sarcoma, fibroma, and chondroma, for they are merely degenerated or altered examples of one or other of these growths. It is, however, possible that, after having weeded out all the doubtful cases, there would still remain a certain number of tumors which it would be needful to class under a separate heading. The softening of cartilaginous tumors has been referred to, and the soft variety of fibrous tumor, termed "fibro-cellular," has been described. A typical myxoma contains less fibrous tissue than the fibro-cellular tumor, and presents to the naked eye a jelly-like appearance. The jelly, of which it consists, contains mucin. The tumor is inclosed in a fibrous capsule, and the material so loosely held together within the capsule that, when cut into, it usually oozes slowly away. Examined microscopically, the jelly is found to contain large numbers of very delicate spindle and stellate cells, with long, tapering processes which freely anastomose with one another.

Mucous tumors occur usually in the subcutaneous and submucous tissues, in connection with the sheaths of nerves, and in the mammary gland. They grow for the most part rather slowly, and may attain a large size, although this is not often the case. They present the same characters as fatty and fibro-cellular tumors, are soft and elastic to the feel, and may fluctuate. They cannot be distinguished certainly from fatty and fibrous cellular tumors before removal; but the error of diagnosis is not important, for those of them which are not combined with sarcomatous structures are almost always innocent. This is especially true of the myxomata which grow in the intermuscular spaces, in the submucous and subcutaneous tissues; but those which grow in the breast and in connection with the nerves are far more uncertain in their course.

The *treatment* suitable for all these tumors is removal. Usually the growth shells out in its capsule, but the greatest care should be exercised in removing the mucous tumors which grow about large

nerves. The nerve may pass through the center of the tumor, which must be carefully dissected away from it. I have more than once seen a large piece of an important nerve cut completely out in the removal of such a tumor.

Lymphoma.—See LYMPHOMA.

Myoma (muscular tumor).—The only tumors which appear to contain striped muscular fibers of new growth are congenital tumors; and, even in these, the muscle element forms usually an inconsiderable proportion of the mass.

Tumors composed in large part of smooth muscle fibers occur frequently in the uterus, when they are described as fibrous or fibroid tumors, in the prostate, and more rarely in the bladder, esophagus, stomach, and intestines. In the prostate they usually produce a general enlargement of the entire organ, but in the uterus and other parts they often form distinct and definite tumors, many of which assume the polypoid shape. They are almost always so situated that they are not, at their onset, apparent to sight or even to touch, and the symptoms which they produce are discussed in the articles which treat of the diseases of the organs they affect. It is certain that they usually grow slowly and are quite innocent, although they may give rise to grave inconveniences or danger by reason of their seat. They may attain a very large size, but this is not common. The very large fibroid tumors of the uterus, which sometimes form huge masses in the abdomen, are more often due to the presence of a number of separate tumors than to a single growth. They are very firm, sometimes quite smooth, more frequently nodular or tuberoso. When open, they look like fibrous tumors, and are in truth almost always composed in part of fibrous tissue. Those in the prostate contain glandular structures. They may be removed if they are so situated that they can be reached, but most of those of the uterus and prostate are treated by palliative measures, while those of the bladder and alimentary canal are often not diagnosed during life.

Angeioma (vascular or erectile tumor).—It suffices here to state that the term angeioma includes all tumors which are composed chiefly or almost exclusively of blood vessels, whether they are arteries, veins, or capillaries, and whether the

blood is contained in true vessels or cavernous spaces. It does not, on the other hand, include tumors, however vascular they may be, of which the essential element is sarcomatous or carcinomatous or fibrous or other tissue.

Lymphangeiomata.—See LYMPHANGIOMA.

Neuroma (nerve tumor).—See NERVES, TUMORS OF.

Sarcoma (embryonic connective-tissue tumor).—A tumor of connective tissue origin, formed chiefly of embryonic elements, either round, spindle-shaped, or giant cells, embedded in a more or less abundant matrix. The vessels run between the cells, and are often mere fissures or spaces.

Varieties.—The sarcomata are so numerous and occur under so many different aspects that a fourfold division of them is necessary.

The *round-celled sarcomata* are composed of cells resembling leucocytes, embedded in a homogeneous or granular basis substance, usually without any obvious arrangement. The mass is often held together by a small quantity of fibrous tissue or meshwork. They are very vascular and grow rapidly, sometimes forming tumors of vast size, or becoming rapidly disseminated in different tissues of the body. They may occur wherever connective tissue exists, and are found commonly in the skin and subcutaneous tissue, the bones and periosteum, the lymphatic glands, the testicle, the eye, the antrum, the liver, kidneys, ovaries, uterus, lungs, and brain. Several varieties of round-celled sarcoma are recognized: the lympho-sarcoma, which resembles in structure a lymphatic gland, and occurs in the glands, tonsil, and other parts; the glioma, which has a very similar structure, but usually smaller cells, and grows from the connective tissue of nerve centers, developing in the brain and in the retina; the psammoma or nest-celled sarcoma; the alveolar, which resembles in structure the carcinomata; the melanotic sarcoma, so-called on account of the quantity of pigment it contains, and its subsequent dark color. The last two of these varieties may be spindle-celled instead of round-celled tumors. The melanotic tumor, whether round or spindle-celled, is found as a primary growth chiefly in connection

with the skin and the pigmented tunics of the eye.

The second division is formed by tumors composed of *spindle cells*. The cells vary very much in size and shape, from tiny oats to elongated bodies, with extremely long and delicately tapering extremities. The cells are often arranged in the form of trabeculæ, so that an appearance of fibrous bands is produced, and the tumor may be mistaken for a fibrous or muscular growth. Spindle-celled sarcomata are found in connection with the skin and subcutaneous tissue; growing from the fasciæ and inter-muscular septa; in the interior of bones and beneath the periosteum; in the breast, the testicle, the antrum, and the eye. It is not necessary to particularize the varieties of spindle-celled sarcomata. The melanotic have been already mentioned; the other varieties are determined chiefly by the size of the cells and the effect of organism on tumors.

With the exception of the spindle-celled tumors, which have a trabecular structure, it is not usually possible to distinguish spindle from round-celled tumors with the naked eye.

The third division, the *mixed-celled sarcomata*, occur more often in connection with the bones than elsewhere. They are such tumors as cannot anatomically be included in either of the two preceding divisions, and are composed of round and spindle cells in various proportions, or of cells of different shapes and sizes. They, too, bear the same naked eye characters as the two preceding kinds, and are subject to similar organisms and degenerations.

Of these changes it is necessary to speak more fully, for they often affect a very large part of a sarcomatous tumor, and so transform it that it may be mistaken for a growth of an entirely different kind. Thus, the embryonic tissues may be changed in great part into cartilage and bone and fibrous tissue, and the change may be so universal that only a small part of the original tissue may remain. If this part escapes observation, and all the course and surroundings of the tumor are not carefully considered, it may be mistaken for a simple cartilaginous, bony, or fibrous growth, and the mistake will lead to an entirely erroneous prognosis. The cartilaginous transformations are most common in sarcomas of

the testicle; the bony in those of the bones; the fibrous in those of the subcutaneous tissue, the fasciæ and inter-muscular planes. It is essential to bear them in mind in practice, and not to be too ready to accept as sheep these wolves in their assumed clothing. For, however largely the transformations have proceeded, there is no reason to hope that they will affect the course of a sarcoma or will prevent it from exhibiting all the malignant characters of the less organized growths. These transformations of sarcomatous tumors have, unfortunately, led to a very confusing nomenclature, and to the use of such terms as osteo-sarcoma, osteoid sarcoma, etc. Where they are very extensive and pronounced, they may be fairly recognized by using the terms chondrifying, ossifying, and fibrifying, but even these terms are not necessary, and the other names are odious.

The fourth division of sarcoma is the *myoloid or giant-celled*, which is formed partly of round, spindle, and mixed cells, but chiefly of large flattened cells or masses of protoplasm, containing from two or three to twenty, thirty, or even fifty nuclei. They are found in the interior of bones, usually in the cancellous ends, and affect the lower jaw, the lower end of the femur, and the head of the tibia in preference to all other bones. They can usually be easily recognized by their peculiar color and appearance, which resemble closely those of the muscular substance of the heart.

Course.—All sarcomata are *malignant*, but the manner in which their malignancy is displayed depends partly on the structure of the individual sarcoma and on its origin. In order to give an idea of their clinical characters and the course which they pursue, it may be well to take as examples sarcomas arising in two or three different parts of the body.

A spindle-celled sarcoma of the breast most frequently attacks women about or after the middle period of life. At first it is almost always encapsuled and freely movable, and is hard and nodular. But the age of the patient makes it suspicious, and it soon grows more rapidly than a fibrous tumor. As it increases in size, it may present different consistence in different parts. If, as is not unusual, cysts are developed, fluctuating bosses appear. There is no affection of the axillary glands. The tumor, at first sepa-

rable from the mammary gland, after a while ceases to be so, but rather on account of its size and the thrusting of the gland to one side, than because the gland is invaded by it. The skin does not usually become adherent, and even when growths, forming in the interior of the cysts, at length protrude and fungate through the skin, the latter may still be separate from the fungous mass and freely movable around it. Nor is the tumor adherent to the subjacent tissues. If it remains without operation, it may become adherent at all points and may destroy life by infiltration, by sloughing, or by the formation of secondary tumors in the lungs, the liver, and other internal organs.

A giant-celled sarcoma of the lower jaw forms in the body of the jaw, slowly expands the bone, and produces a smooth swelling both on its outer and its inner aspect. The growth is so slow that several years may elapse before a tumor larger than a walnut is formed. The swelling is not adherent to the surrounding structures; is rarely ulcerated; is not associated with enlargement of the lymphatic glands. The patient is almost invariably an adult, and more often over than under forty years of age. The cavity in which the tumor lies may be opened by removal of its wall, which is thin and perhaps crackles when pressure is made upon it.

A glioma forms in the interior of the eye of a child. The sight of the eye is gradually lost. The growth of the tumor is not usually rapid and does not necessarily cause much pain. If no operation is performed, it fills the eyeball, usually spreads along the optic nerve, not producing in the orbit a large tumor, and enters the cranial cavity, where it enlarges to a mass of considerable size. There are not usually secondary growths, and death is due to the intracranial pressure. If the eye is removed while yet the former is of recent formation, the patient may remain free from disease; but it is not uncommon for a similar tumor to form in the other eye, and later an intracranial tumor. Or the disease may recur in the stump of the excised ball, and thus extend to the brain.

Thus it will be seen how difficult it is to cover all the possible conditions of a sarcoma by any general account of its symptoms and course, and how very diffi-

cult the diagnosis must be in many cases. Both sexes and all ages are liable to the disease, and even children suffer from sarcoma of the eye, the bones, the testicle, the lymphatic glands, and more rarely of the other parts. Sarcoma is, indeed, the malignant disease of childhood, for children are scarcely ever subject to carcinoma.

Most sarcomata *grow rapidly*, but this is by no means invariably the case; for although the growth of secondary tumors is rapid, some of the primary tumors increase in size but slowly. The rapidity of growth and the size attained are influenced largely by the origin of the tumor. Some of the sarcomata of the bones attain an enormous size, while those of the eye and brain are usually small. The shape of the tumor also depends very much on the part in which it grows, and is affected by the resistance of the adjacent structures. Although the tumors are, in the first instance at least, separable from the surrounding structures, they cease to be so as they advance in size; and even those which are encapsuled are not nearly so movable as innocent tumors. With regard to *the capsules* of sarcomatous tumors, though it may be said that those tumors which develop in the subcutaneous tissue, in the intermuscular planes, and in connection with the fasciæ are almost invariably provided with capsules, this is not the case with those which grow from the surface of the bones; and those which arise in the interior of organs, those of the testicle, the tonsil, the lymphatic glands, etc., speedily occupy the whole of the organ, and are only encapsuled by its tunic. From what has been already said, it will easily be understood that the consistence of sarcomatous tumors may vary within the widest limits, from a softness, scarcely, if at all, distinguishable from that of liquid to the hardness of cartilage and bone. Some of the softest sarcomata are found in the testicle and lymphatic glands, while examples of the hardest forms occur in connection with the bones. The important point to recollect in relation to *consistence* is, that the same tumor usually varies in consistence at different parts of its surface, and even hard growths beneath the periosteum are not of equal hardness everywhere. Again, the physical characters of a sarcoma may be greatly modified by the

presence of cysts, and these are frequently found in sarcomas of the breast, the testicle, and bones. Sarcomata are much more liable to ulcerate than innocent tumors; and the ulceration, especially of recurrent tumors, is characteristic. It is not due to mere giving way of integument before advancing pressure, but is preceded in most instances by infiltration of the skin, which is so changed as to form a part of the growth. An exception to this general rule may occur, particularly in the breast, where a cyst wall and the skin covering it may give way before the advancing pressure of an intracystic growth, which afterward protrudes through a circular opening, the edges of which are thin and undermined. Whether the skin is infiltrated or whether it gives way to pressure, it becomes reddened, hot, and tender, and thus presents the signs of inflammation so as to complicate the diagnosis in doubtful cases. A sarcoma, when cut open, may appear to be cartilaginous or bony or fibrous, but, mingled with these tissues, and particularly in the outlying portions, the essential structure of the tumor can almost always be discerned. This is in most instances a succulent gray or brownish-gray material, juicy, and semitranslucent. Many sarcomata are wholly made of such material, but others are composed of a material resembling the substance of the brain or precisely similar to that of a myxoma.

Some sarcomata (those of the subcutaneous tissue and some of those of the breast) *recur* again and again after removal, perhaps ten or fifteen times in the course of many years, yet never affect the lymphatic glands or distant parts of the body; other sarcomata, on the other hand, attack the lymphatic glands within a few weeks or months of the appearance of the primary tumor. This is particularly the case with primary growths of the tonsil, the testicle, and the lymphatic glands themselves. Other sarcomata, again (the subperiosteal tumors of the bones, perhaps, above all others), are disseminated in the bones, the skin and subcutaneous tissue, and the internal organs, but only exceptionally affect the lymphatic glands. The one feature of malignancy which all sarcomata possess in common, is that of infiltration of the surrounding tissues, so that even those which are encapsuled affect the tissues

lying external to their capsules. The instances which have been given in illustration of the course of the sarcomata show how marvelously they vary in the rapidity with which they spread and become disseminated.

The *diagnosis* of sarcoma is often very difficult, and can only be made by careful attention to the peculiar features which the disease assumes in the tissue or organ under examination. Thus, a sarcoma of the breast can be distinguished from an innocent tumor by the age at which it occurs, the greater rapidity with which it grows, the formation of cysts in it; and from a carcinoma by its greater mobility, the freedom of the skin, the absence of retraction of the nipple, the presence of cysts, and the absence of affection of the lymphatic glands. A subperiosteal sarcoma of a long bone may be distinguished from an innocent tumor by the absence of a clearly defined outline, by its unequal consistence, its rapid progress, the pain and heat which are associated with the largest and quickly growing tumors. But these very characters which serve so well in the diagnosis between an innocent and a malignant growth, render it extremely difficult to decide between a sarcoma and an inflammatory affection. Here the unequal consistence of the sarcoma, its uneven surface, its continuous growth (as proved by measurements at frequent intervals), and its greater proneness to attack the ends than the shaft of a bone, are the features which must be relied on. In the most obscure cases, the diagnosis can only be made by an exploratory incision. The diagnosis of a sarcoma of the testicle cannot be made certainly from a carcinoma unless the tumor contains cartilage, or occurs in a child, when it is invariably a sarcoma. In the early stages of the disease it is often mistaken for an inflammatory affection, or a strumous or syphilitic testis. The diagnosis depends on the steady increase of size of the tumor, its varying consistence, the fact that it is the body of the organ which is affected, and the absence of the history and other signs of struma and syphilis. Space will not permit a sketch of the characters by which a sarcoma may most readily be distinguished in every tissue and organ; but, speaking generally, it may be said that reliance must be placed on the unequal consistence of the tumor, the rapidity or con-

tinuity of its growth, the affection of surrounding tissues, the age of the patient, and the circumstance that the affected part of the body is one which is liable to the occurrence of such tumors.

The *prognosis* is never good, so far as the cure of the disease is concerned, but it varies very largely with the part of the body which is the seat of disease. Thus, a sarcoma of the tonsil and of the lymphatic glands is a rapidly fatal disease; a giant-celled sarcoma of the lower jaw is frequently curable by operation. A subperiosteal sarcoma of the femur almost invariably proves fatal in the course of a few months, while a central recurring sarcoma of the subcutaneous tissue of the leg may be removed many times in succession in the course of several years, or be completely cured by amputation. A sarcoma of the testicle is as malignant as a carcinoma, and only a small percentage of either disease is cured by operation.

The *treatment*, like the diagnosis and prognosis, depends largely on the seat of the disease, but it is also influenced by the structure of the tumor. The least malignant sarcomata, and probably none is less malignant than the giant-celled sarcoma of the lower jaw, may be scooped out of the cavity which contains it, and if the cavity be carefully scraped, the disease may not recur. But in all cases, and even in most cases of giant-celled sarcoma, it is far safer to remove, not only the tumor, but as wide an area of the surrounding structures as can be safely taken away. Sarcomatous tumors of the long bones should be treated by amputation of the limb high above the disease, and the same treatment should be adopted for sarcomata (not of the bones) which have been removed and have recurred, especially if they are round-celled tumors. Sarcomata of the breast are best treated by amputation of the entire breast, not by dissection of the tumor out of the breast. For sarcoma of the antrum removal of the upper jaw is practiced, and even then the prognosis is not good. Sarcoma of the tonsil and primary sarcoma of the lymphatic glands had better not be treated by removal, for the results of the operation are very discouraging. Nevertheless, a sarcoma of the tonsil may sometimes be removed with the *écraseur* or the galvano-cautery loop to afford the patient temporary relief in swallowing and breathing. Sarcomata

of the subcutaneous tissue, of the fasciæ, and intermuscular planes, must be removed by dissection when they are seated in the trunk or very high up in the limbs; and, when the disease recurs, the operation must be repeated as often as it is possible to repeat it, and the patient is willing to undergo the operation. Other general rules than these cannot be laid down. The method of removal and the instrument must be decided by the surgeon in each individual instance, according to his inclination and the probable advantages of one or the other means.

Palliative treatment is the same as for carcinoma.

Endothelioma (endothelial cancer).—It is not improbable that many sarcomata, and some, at least, of the carcinomata, are really derived from endothelial elements, and therefore endotheliomata; but for the present it is well to include in this class only those tumors which distinctly arise from endothelial surfaces. They occur chiefly in connection with the serous membranes, growing from the inner surface of the pleura and the peritoneum. They may appear as a single growth, but more often are multiple, and many of the growths are papillary. They are generally soft, and look like quickly growing cancers. Their microscopic structure may resemble that of epithelioma, or the typical alveolar carcinoma, so that they cannot certainly be distinguished by microscopical examination. Such tumors are naturally fatal from their situation, but, more than this, they appear to be decidedly malignant. Besides forming numerous tumors on the surface of the affected membrane, they are quickly generalized, and, before the primary disease kills by inducing effusion or repeated attacks of inflammation, many tissues and organs may be the seat of secondary tumors.

Diagnosis.—It is not easy to diagnose the presence of primary tumors of the pleura, the peritoneum, and other serous membranes, and there are no means by which these tumors can be distinguished from other primary tumors of the same membranes. Nor can anything be suggested for treatment.

Papilloma (warty tumor).— See WARTS.

Adenoma (glandular tumor).— *Varieties.*—There are two types of glandular tumor, one resembling the acinous

glands in structure, the other the tubular glands. The former are composed of sacs and small ducts lined with spheroidal or glandular epithelium, and are represented by the glandular tumors of the mamma: the latter are composed of tubes lined with cylindrical or columnar epithelium, and the best examples of them are found in the polypi of the rectum. But pure adenomata of either type, that is, tumors composed wholly of gland sacs or tubes with only so much connective tissue as suffices to hold together the glandular structures of a natural gland, are very rare.

Site.—They are occasionally found in the female breast, the lower lip, in connection with the salivary glands and the glands of the integument and mucous membranes. On the other hand, it is not at all uncommon to meet with tumors composed of fibrous, mucous, fatty, and other tissues, in which a greater or less quantity of glandular structure is contained. Such tumors occur very frequently in the breast, more commonly, indeed, than in any other part of the body, and comprise the greater number of the chronic mammary tumors. The glandular element is an essential part of their structure, and they are therefore rightly termed adeno-fibromata, or adeno-myxomata, etc., according to the structure of the prevailing tissue.

Course.—Their characters and the course which they pursue depend, however, much more on the structure of the prevailing tissue than on the presence of the glandular structures, so that they are, to all intents, clinically, fibrous, mucous, or mixed connective tissue or sarcomatous tumors, and not adenomatous tumors. The pure adenomatous tumors appear to resemble in all essential points the fibrous and other innocent tumors with which they occur so frequently in combination. In the breast they grow slowly, rarely form large masses, often not larger than a walnut or bantam's egg; are thoroughly defined, nodular upon the surface; freely movable and separable from the mammary gland; very firm or even hard; not adherent to the skin or muscle, and not producing any retraction of the nipple or enlargement of the axillary glands. They occasionally contain cysts, which are due to dilatation of the glandular sacs or ducts. They may be removed without danger,

and are not liable to recur, although the appearance of recurrence may be produced in some cases by the transformation of another lobule of the gland into a similar tumor, or two tumors of the same kind may co-exist in the breast.

In the rectum they usually assume the polypoid form, occur not infrequently in the bowel of children and young persons, and may easily be detached. They are not prone to recur.

The proper *treatment* for adenomatous tumors, wherever they occur, is to remove them, and this can be done in most cases without difficulty.

A good deal of confusion has been introduced into the description of the adenomata by the fact that many different growths have been included under the term adenoma. Thus, not only the mixed tumors to which reference has been made are described as pure glandular tumors, but the French pathologists employ the term to include certain tumors which have lost the typical glandular structure and have become actual carcinomata.

Carcinoma is defined as a tumor of epithelial origin, generally presenting an alveolar structure. The cells resemble usually those of the epithelium from which they are derived. They are not imbedded in a matrix, like the cells of sarcoma, but lie closely packed within alveoli, formed by fibrous tissue: they multiply generally by endogenous formation. The vessels traverse the fibrous tissue, and rarely lie between the cells.

Varieties.—Four great varieties of carcinoma may be made, but it is certain that many specimens of the fourth, if not indeed all of them, are merely altered examples of the first variety. They are the spheroidal-celled (which includes the hard and soft carcinomas); the squamous-celled (epithelioma); the cylindrical-celled, and the colloid.

Spheroidal-celled or glandular-celled carcinoma is derived from the epithelium of acinous glands and those of the tubular glands which are lined with glandular epithelium. It includes the tumors commonly recognized as hard and soft carcinoma, between which the essential difference appears to lie in the greater quantity of fibrous tissue which the hard contain, and the overwhelming preponderance of cells in the soft carcinoma. The hardest examples of the hard form

are usually called scirrhus; the term scirrhus being often applied to the whole group of hard cancers.

Hard spheroidal-celled carcinoma is found primarily in the breast and alimentary canal, where it grows most frequently about the pylorus. A few examples have been met with in connection with the glands of the integument. The tumor forms an indurated, irregular, nodular or tuberous mass; continuous with the gland, but at first freely movable with the gland; growing usually quickly, yet not generally forming a large mass. As it increases in size, it affects the surrounding structures, infiltrating or drawing them into itself, and thus becoming adherent to the skin, the muscles, *faciæ*, and other parts. This property of carcinoma produces some of the most characteristic symptoms of the disease, and is responsible for many of the difficulties in removing it. If the tumor reaches the integument, it may change it into a hard, dull red or livid material, and in time ulcerate. The ulcer forms an irregular chasm, with everted edges, which are very hard and commonly tuberous; the surface of the ulcer is also tuberous or nodular, often partly covered with slough, and seldom or never with granulations. If the primary growth is seated in the breast or the esophagus, the lymphatic glands become enlarged; but if it is seated at the pylorus, they often escape the disease. The case may terminate within a few months by secondary formations of carcinoma in the liver, the lungs, the bones, and other parts; and the skin is very liable to be the seat of numerous nodules. But in the large majority of instances the patients live for as many as twenty-four or more months, and may even exist for as many as ten or twenty years, most of which are passed in enduring a foul ulcer, which bleeds from time to time. Ulcerated carcinomata are generally believed to be less prone to produce secondary affection than carcinomata which are not ulcerated.

The hardest varieties of hard carcinoma (the scirrhus tumors) present this peculiarity, that they tend to draw toward themselves the surrounding structures, extending their long processes from the small shriveled lump which forms the tumor, and dragging the tissues toward the lump, which nevertheless does not

grow larger, but on the contrary rather shrinks. In this manner it sometimes happens that an organ like the breast, which has been the seat of cancer for many years, is actually considerably reduced in size, and there remains nothing more than a kind of cicatrix, bound down to the ribs so firmly as to form one with them. Unfortunately, the tumor is not cured, however much it shrivels; secondary growths may arise in distant parts of the body and the patient may perish from disseminated carcinoma. Some of the worst forms of hard carcinoma are those in which there is no definite tumor when the affected part is cut open after removal or death, and in which there is no shrinking such as takes place in the scirrhus tumors, but the disease is disseminated through the healthy tissues in cords and nodules.

The appearance of a hard carcinoma, when cut into, is usually that of a very firm opaque white mass, of the consistence of a turnip. The cut surface is juicy, often blotched or streaked with blood, in many cases traversed by fibrous bands; creaking when cut, and presenting a concave section. The tumor may be circumscribed and clearly defined, but is scarcely ever encapsuled. It is not separable from the tissues in the midst of which it lies, and frequently islets of fat and other normal tissues can be discovered in the outer portions of the new growth, which has extended between and around them, but has not yet completely transformed or destroyed them.

Soft spheroidal-celled carcinoma, which is also known by the names of medullary and encephaloid, is not so common a disease as hard carcinoma. It occurs primarily in the breast (but rarely), the testicle, the bladder, liver, kidneys, the ovaries, and the interior of the eye. In its typical form it has a brain-like appearance and consistence, which justifies the name encephaloid frequently applied to it. In its clinical characters it differs from hard carcinoma chiefly in the fact that it grows much more quickly, and runs its course in much less time; it forms usually a larger mass; it is, as its name implies, a soft tumor, and may be so soft that it fluctuates like an abscess. The course and general characters of a soft carcinoma of the testicles are so similar to those of a sarcoma of the same organ that the descrip-

tion of the latter would pass for that of the former. The only differences, clinically, are that the carcinoma never contains bone or cartilage, and never occurs in children.

For all practical purposes, it must be borne in mind that there is no essential difference between a hard and a soft carcinoma, and that the two varieties run one into the other. In the secondary affections, the one variety is sometimes replaced by the other, and the distinction is so artificial that a tumor which one surgeon will term soft, another equally experienced will call hard.

Speaking generally of all spheroidal-celled carcinoma, it may be said that the disease is *rare before the age of thirty*, but from that age until the end of life it is not uncommon. Again, it is much more common in persons after than before forty; and it is not improbable, if the proportion of aged persons to the total number of living persons in the community were taken into account, that it might be found to increase in frequency during each decennial period of life. Females are more liable to it than males, chiefly on account of the extreme liability of the female breast to cancer.

The *growth* of soft carcinomata is rapid, while that of the hard carcinomata is usually rather slow, unless it is compared with the rate of growth of innocent tumors, such as the fatty, the fibrous, and the bony tumors. Neither the soft nor the hard carcinomata usually form very large growths, such tumors, for instance, as the huge sarcomatous tumors of the bones; but occasionally a very large tumor is formed in the breast or testicle, and the liver is sometimes enormously enlarged by infiltrating cancer. The secondary growths often greatly exceed in size the primary disease, and attain a huge size in a far shorter space of time. The shape of a spheroidal-celled carcinoma varies very much with the variety of the disease and the organ in which it occurs. Those of the testicle are usually large ovoid masses, with low bosses, separated by shallow grooves. Those of the breast, which are soft, form large globular or tuberous masses. The diffused tumors of the liver, which are generally primary, sometimes maintain very singularly the natural shape of the organ. On the other hand, the hard, shriveled scirrhus cancers of the breast produce only very

little tumors, and sometimes no tumor at all, but only a shriveling and induration of the affected parts. And some of the hard carcinomata of hollow organs, such as the stomach and the bladder, produce a general and very uniform thickening and induration of the walls of the organ, which is often associated with considerable diminution in the size of the cavity, and of course with an absolute incapacity to expand or contract.

Among the changes which spheroidal-celled carcinomata undergo, perhaps none is more important, from a clinical aspect, than the softening, which may be due to fatty degeneration or to other pathological occurrences. The carcinomata which soften when they reach the skin, before they break from large fluctuating masses, are not infrequently mistaken for abscesses. The diagnosis is made by attention to the history of the case, and by observing that the consistence of the tumor varies in different parts, and particularly that the base is hard, or at least distinctly solid, while the superficial parts are soft and fluctuating. Another result of softening is the formation of cystoid cavities in the interior of carcinomatous tumors, cavities of considerable size, so that the tumor gains the character of a true cystic tumor. In addition to cystoid cavities, true cysts form in the carcinomata of the breast, the testicle, and other glandular organs.

The manner of extension of a carcinoma is by infiltration of the adjacent structures, and this produces an important clinical feature, for it accounts for the adhesions of the tumor and the less and less mobility, until in the latest stages it becomes absolutely fixed.

Secondary affection of the lymphatic glands is produced by most carcinomata, or it would perhaps be more correct to say, by the carcinomata of most parts. Those of the breast, the testicle, the bladder, affect the lymphatic glands; those of the antrum and the eye very seldom, and, as it were, only by chance.

Dissemination is common in connection with the carcinomata of almost every part; and the organs liable to be affected are the skin, the bones, especially the vertebræ, the liver, lungs, kidneys, brain, and other internal organs. The possibility of secondary affection ought always to be kept in mind, even when a primary carcinoma has shriveled up and become

apparently quiescent, and when there is no sign of recurrence *in situ* after removal of a primary growth. In such patients pains in the lower extremities, with other obscure symptoms of spinal mischief, should always raise the suspicion of cancerous affection of the spine; and pains in such a bone as the femur, associated with swelling as if from osteitis or periostitis, of secondary carcinoma of the bone. If there is cancer of the bone a spontaneous fracture frequently occurs; often without any previous pain or noticeable swelling, the femur breaks spontaneously by reason of secondary cancerous disease in its medullary canal. In the same manner, anomalous cerebral symptoms sometimes occur many months after the removal of a primary carcinoma, and gradually terminate in death, when the post-mortem examination reveals a secondary tumor of the brain. In some rare instances, the secondary disease affects many bones, and, without producing a distinct tumor in any of them, so changes their structure as to render them peculiarly brittle, that they break with the most trivial accident, or indeed spontaneously.

Diagnosis.—The age of the patient, the comparative rapidity with which the tumor has increased, its adherence to the tissue or organ in which it has arisen, and its increasing immobility, are most valuable signs. Also the characters of the ulceration when there is ulceration. But there are cases in which it is impossible to make a correct and certain diagnosis. Thus, simple cysts and chronic abscess of the breast have been mistaken for carcinoma, and an encapsuled carcinoma (a very rare disease) mistaken for a simple fibrous tumor; while in those parts of the body in which carcinoma and sarcoma are of almost equal frequency, such as the testicle, it is in most instances quite impossible to distinguish between the two diseases. Between chronic inflammation and carcinoma, or chronic abscess and carcinoma, the difference is usually determined by the greater hardness of the carcinoma, the absence of fluctuation, the steady enlargement, and the associated circumstances, such as pregnancy or lactation when the breast is the seat of the disease. Between cyst and carcinoma the diagnosis depends on the circumscribed form and greater mobility of the cyst, and its greater elasticity, even if there is not

perceptible fluctuation. In the later stages of the disease, the condition of the overlying skin and of the neighboring lymphatic glands is of great importance in determining the nature of the tumor.

In those cases in which there is fluctuation, and there is difficulty in deciding whether this is due to the softening of a carcinoma or to the presence of pus or cystic fluid, a puncture should be made with a fine trocar and cannula, or with a grooved needle; and in all cases in which there is the least doubt of the nature of the disease, an incision should be made into the tumor before an operation for its removal is performed. Not long since a breast which had just been removed for carcinoma was sent to me for examination. It was still unopened, and when I cut into it, a quantity of clear liquid escaped and the "carcinoma" disappeared. Had the incision been made before instead of after the amputation, the woman would have kept her breast and been spared the danger of the operation.

The *treatment* of the spheroidal-celled carcinomata will be considered when the other varieties of carcinoma have been described.

Squamous-celled carcinoma.—**Epithelioma** is composed of masses or columns of squamous epithelial cells, like those of the skin and tongue. The masses or columns dip down into the subjacent tissues, and gradually infiltrate every structure with which they come in contact. They contain globes or nests of flattened epithelial cells.

Squamous-celled carcinomata may *grow* from any part of the body which is covered by squamous epithelium, and are frequently found where skin and mucous membrane meet. Of the external parts, they occur, taking the parts from above downward, about the head and face, upon the nose and lower lip, on various parts of the body, on the penis and scrotum in the male, the vulva in the female, at the anus in both sexes. They are rare upon the limbs, but are occasionally seen upon the hands and feet. Of internal parts they attack the tongue, palate, gums, tonsils, larynx, pharynx, and the esophagus down as far as the entrance to the stomach. They are found in the bladder of both sexes, at the orifice of the uterus in females.

Epithelioma is very unusual in persons under the age of thirty, and is much more

usual after forty years of age. It attacks men more frequently than women. Thus epithelioma of the lower lip is a disease almost limited to men; epithelioma of the tongue, the esophagus, and the larynx many times more frequent in men than women. In considering the causes of the disease this point will be again referred to.

Epithelioma may *commence* in the form of a wart or watery growth, a crack or fissure, a tubercle, a nodule, or lump; or an ordinary ulcer may become epitheliomatous. The disease is liable to attack scars, and usually commences then as an indolent ulcer in the middle of the scar tissue. No matter what is the original form in which the disease appears, it almost invariably ulcerates at a very early date, and the ulceration often advances so rapidly in proportion to the rate of increase of the new growth that epithelioma appears rather to belong to the class of ulcers than of tumors. In some cases, however, the new growth proceeds steadily, and the ulceration is only superficial until a tumor of considerable size is formed. Such a tumor presents on section a white, opaque, juicy surface, from which yellowish plugs can be squeezed out. There is no capsule, but the margin of the growth is clearly defined. Its consistence is liable to considerable variation, but the tumor is always harder than the surrounding textures. This harder consistence is of great clinical importance, for the characteristic induration of the edges and base of epithelial ulcers depends upon it. A wart may ulcerate upon the lower lip, but until the characteristic sign of induration around the ulcer is observed the diagnosis of epithelioma is not made. An ulcer forms upon the border of the tongue, remains indolent and unhealed for many weeks, but is not recognized as epithelioma until its base and borders become hardened. If, now, the ulcer is removed, the induration is found to depend on the presence of a layer of the same opaque white substance which forms the larger tumors. The appearance of an epithelial ulcer may resemble that of other carcinomatous ulcers, but it is usually a more indolent sore, sometimes a mere chink or cleft, and in not a few instances it is covered with papillary projections so as to assume the appearance of a warty or cauliflower growth.

The *rapidity of growth* and the *size* attained by epitheliomata are extremely different in different parts of the body. On the lower lip the disease usually extends very slowly, and may take three or four years to reach the size of a nut. In the tongue the rate of growth is often very rapid, and a mass of considerable size may be produced in a few months. The softer and more vascular the tissues are, and the warmer and moister the affected part of the body, the more luxuriant is the growth of the disease. Like other malignant tumors, it affects every tissue with which it comes in contact; fat, fibrous tissue, bone, and even cartilage. An epithelioma commencing in the skin of the leg extends down to and into the tibia, pervades it until the bone is so altered and softened that it breaks spontaneously or with the slightest violence. An epithelioma of the gum affects the surface of the jaw; crumbles it away until it eats into and completely through it.

The *lymphatic glands* are affected by the epitheliomata of most parts of the body, those of the lip, tongue, tonsil, penis, scrotum, vulva, and the skin of many parts. On the other hand, epitheliomata of the antrum, of the skin of the face (many instances of rodent ulcer), of the intrinsic parts of the larynx, rarely affect the glands. The exception in the case of the intrinsic parts of the larynx is the more striking, because epitheliomata of the extrinsic parts affect the glands certainly and early.

Epithelioma may be *disseminated* in other parts of the body, but dissemination is not so frequently observed as in the case of most of the other forms of carcinoma and of the sarcomata. Secondary tumors occur in the liver, lungs, kidneys, the bones, and different parts of the skin.

Squamous-celled carcinoma may usually readily be *diagnosed*. The small size of the tumor, the early ulceration, the indolent character of the ulcer, the induration about its base, the warty surface which it not uncommonly displays, are the signs by which it is recognized. If to these are added the seat of the disease, and the age and sex of the patient, the diagnosis of most cases is singularly easy. As examples may be taken an ulcer of the lip, a lump upon the tongue, and a warty growth upon the scrotum. A

fissure or crack is seated on the prolabium of the lower lip, with induration extending a quarter of an inch or more into the subjacent tissues, so that there appears to be a body like a small nut in the substance of the lip. The ulcer is indolent, discharging watery liquid, having an irregular or warty surface, often covered with scab. There is no surrounding inflammation; probably no pain. The patient is a man of fifty to seventy years of age, and the disease commenced many months previously as a wart or crack, which was perhaps cauterized or picked off, but quickly formed again, and slowly spread. In the second case, an indolent lump exists in the substance of the border of the tongue. It is much firmer than the adjacent portions of the tongue, is smooth, ill-defined, not particularly painful or tender. There is no inflammation about it. Its surface may be cracked or ulcerated. It is very likely situated opposite a ragged tooth, and may be attributed to the irritation of the tooth. The patient may be a man or woman, but is much more probably a man over five-and-thirty years of age, and the disease has existed from four to six months.

The third case is that of a chimney-sweep or worker in tar. There are several, perhaps many, warts upon his scrotum, but one of these is larger and harder than any of the others. It is also ulcerated, and a foul sore has formed, discharging offensive fluid, and having an indurated base and edges. The induration extends some distance beneath the skin. The sore is not inflamed. The man is forty to sixty years of age, and the wart has been slowly changing its character for the last five months.

There can scarcely be a doubt in cases such as these, and if the lymphatic glands are enlarged in association with the disease, the diagnosis is as clear as it can be of epithelioma. The lump in the border of the tongue may possibly be a gumma or a tuberculous mass, but in either case there will almost certainly be some associated signs of syphilis or tubercle.

In those cases in which there is an ulcer, and they form the vast majority of the total number of cases of epithelioma, great assistance in making the diagnosis may be gained by scraping the surface of the sore gently with a knife, and examining the scrapings placed in a drop of

water on a microscope slide. The scrapings taken from syphylitic and tuberculous ulcers, which are by far the most liable to be mistaken for epithelioma, are composed of pus, blood, the débris of food, and micrococci and other parasitic masses. Those which come from an epithelial ulcer contain many epithelial cells, distorted, varying in size and shape, with two or more nuclei, and, not uncommonly, cell nests, or portions of cell nests. In all doubtful cases, this method of confirming the diagnosis should be employed.

Epithelioma can, more certainly than any other form of malignant disease, be clearly ascribed to some *predisposing cause* or source of irritation. Thus, warts or sore places on the lip, which are continually picked or irritated; cracks or sores on the tongue which are rubbed by a ragged tooth; the continual presence of soot in furrows of the scrotum; chronic inflammatory conditions, and white patches on the tongue and cheeks, are all of them conditions favorable to the development of epithelioma.

An account of rodent ulcer, which is a variety of squamous-celled carcinoma, will be found in the article on ULCERS.

Cylindrical or columnar-celled carcinoma is a disease that is much rarer than either of the two preceding. It is often described as a variety of epithelioma, but there are many reasons against this course. It originates from cylindrical epithelium, either from that covering the surface of mucous membranes or lining glands, and in its structure resembles the part from which it grows. There are no cell nests or epidermic globes. It is met with most frequently in the uterus and rectum, but may occur in other portions of the intestinal canal. It has also been described in the air passages, the milk ducts, and bladder. It forms an indurated mass in the wall of the organ in which it grows, produces considerable narrowing of canals, ulcerates at an early period, but varies greatly in the rapidity with which it extends. It infiltrates the adjacent structures in the same manner as other carcinomata. The glands are infected in many instances of primary disease of the rectum and uterus, and secondary tumors, bearing the same general and microscopical characters as those of the primary disease, occur in the liver, the lungs, and other parts.

Colloid carcinoma, also called alveolar carcinoma on account of the cells, or alveoli, in which the colloid material is contained. The alveoli are sufficiently large to be discovered by the naked eye, and are sometimes of considerable size. The colloid material resembles soft jelly, and is usually so diffuent that part of it escapes when the alveoli are opened. The appearance of the disease is thus far very characteristic.

It is doubtful whether colloid carcinoma is not always a degenerate or altered form of one of the preceding varieties of the disease, especially of the spheroidal-celled carcinoma, for cells resembling spheroidal epithelium are found imbedded in the colloid jelly.

The disease occurs frequently in the walls of the stomach and large intestine, in the omentum, and rarely in the breast. When it occurs as an external tumor, for instance in the breast, there are usually no signs by which it can be distinguished from the ordinary carcinoma of the breast. It runs a similar course to the ordinary form of carcinoma, occurring in the parts of the body in which it grows, but is rather slower, and may, therefore, be considered less malignant.

Villous carcinoma may be mentioned, because the term villous is occasionally used in connection with cancer, especially with cancer of the bladder and intestine. It does not, however, imply a special variety of carcinoma, but merely that the cancers which occur in those parts of the body occasionally assume a tufted or villous form. The essential structure of the disease is the same, and the course which it pursues is not affected by the outward form of the tumor.

In the same way it is necessary to warn the student that the tumors which are sometimes named osteoid cancers are almost invariably ossifying or calcifying sarcomata. The formation of bone in true carcinomata, or even the deposition of calcareous salts, is very rare.

The *radical treatment* of all forms of carcinoma is their complete removal or destruction wherever this can be accomplished, and the condition of the patient justifies the operation. When an organ, such as the eye, the breast, or the testicle is the affected part, the entire organ should be removed. But when the tumor is destroyed by means of caustic, the complete destruction of the breast itself

is not rigidly insisted on. In the case of the breast, however, and in every part of the body in which it is possible, a surrounding area of apparently healthy tissue ought to be removed with the tumor. Thus, in the amputation of a carcinoma of the breast, it is customary (and the custom is one which ought not on any account to be departed from) to take away a large elliptical portion of the integument, even when there is no affection of the integument, so far as can be seen. When a carcinoma is deeply seated in a limb, when, for instance, a squamous-celled carcinoma, commencing in the skin of the leg, has made its way into the tibia, amputation must be performed, and the limb should be cut off high above the disease. Glands which are affected in association with the primary disease should be removed when their complete removal can be effected. This is frequently done in the case of enlarged and carcinomatous glands in the sub-maxillary and parotid regions, the axilla, and the groin. Quite apart, however, from the immediate and remote dangers of such operations, the mere fact of the presence of glandular enlargement renders the prognosis of the disease, wherever it is situated, much more gloomy. It is an indication of a more advanced malignancy, and there is much less hope of a successful issue of treatment. Yet, even when the glands are extensively diseased, and there is no hope of removing them, the primary tumor may sometimes be removed with great advantage to the patient. This is particularly the case in carcinomata of the tongue and penis, when the primary carcinoma can be freely and easily removed, and is, or is likely to become, the source of great pain and grave inconvenience to the patient. The prospect of radical cure by operation, of whatever kind, depends largely on the situation and nature of the disease. Epithelioma (squamous-celled carcinoma) of the lower lip is perhaps the most amenable to treatment of any form of carcinoma. Small epitheliomata (rodent ulcers) of the face may be cut out with good hope of curing them. Eight or ten per cent. of operations for carcinoma of the tongue are successful in curing the patients, so that at least no recurrence takes place within two or three or more years, whereas the disease, if left to itself, usually proves fatal in

twelve or eighteen months. Probably a greater number of cases of carcinoma of the breast are cured by operation; and many of them, if they are not cured, are decidedly relieved, the disease returning in some other part of the body, and terminating without any apparent tumor, and without the distress of an open ulcer. Carcinoma of the testicle is a very fatal disease, and carcinoma of the esophagus and tonsil are rarely, if ever, benefited by any operation directed to the radical cure of the disease.

With regard to the manner of dealing with the disease, a great deal depends on its situation and on the age and general condition of the patient. In the vast majority of cases the knife is employed as the surest and most surgical instrument in the hands of a dexterous surgeon. But the tongue is removed more commonly with scissors or with the galvano-cautery or the *écraseur*; small epitheliomata of the face may be destroyed by the application of nitric acid, or the acid nitrate of mercury, or Vienna paste. And even large tumors of the breast in delicate or very elderly women may with greater safety be destroyed by the application of Vienna paste, or chloride of zinc, or finely powdered asbestos mixed with three times its weight of strong sulphuric acid. By one or other of these agents, successive layers of the tumors are removed, until the entire mass is destroyed, and a large cavity is left which gradually heals up from the bottom. The defect of this method of treatment is that the amount of destruction cannot be so certainly regulated as it ought to be, and that it is tedious and infinitely more painful than removal with the knife.

I am not aware of any *internal remedy* which will cure a carcinoma, but I think I may say that I have seen patients improved by the administration of Chian turpentine. The tumor or ulcer has lessened in size, or partly healed under its influence, and the general health has improved. In no instance, however, have I seen a permanent cure effected, although I have seen several patients who have been treated by the originator of the treatment. And on the other hand, I have seen such persons whose disease has not been modified in the least degree by the administration of Chian turpentine. If Chian turpentine, or any similar remedy, is employed in the treatment of carcinoma, it should

only be as an adjunct to other means, or in default of other means in cases in which no operation is admissible.

When a case of carcinoma is considered to be *beyond the reach of radical treatment*, and is, therefore, regarded as hopeless, there is too great a disposition to leave the patient to his fate, only giving opium when the pain of the disease is excessive. This is a very grave mistake, and one which cannot be too severely blamed. Pain may be allayed by the internal administration of morphia or opium, the doses of which must be directed to completely allay the pain, not limited by the mere pharmacopœial notion of what is a sufficient dose for an adult. The external application of menthol, either in the form of a cosmetic stick or mixed with an equal part of oil of cloves and ten parts of spirit, I have known soothe some persons suffering from external cancers which were not ulcerated. An ointment of equal parts of the ointments of belladonna and aconite may be used for the same purpose with good effect. Some of the quickly growing acute cancers are eased by the constant application of lead and opium lotion, or of lead lotion without the opium. For ulcerated cancers, cocaine mixed with water in various proportions may be used as a spray, or carefully painted on the painful part. And in more than one such case I have used, with admirable effect, a powder composed of two grains of iodoform, and a sixth of a grain or more of morphia dusted on the painful spot.

The stench of open ulcers is often more difficult to combat than the pain. For this purpose poultices of charcoal, or powders of iodoform and charcoal, or lotions of sanitas, or bichloride of mercury, or carbolic acid may be used. Gamgee's antiseptic pads may be employed with great advantage in treating fetor.

HENRY TRENTHAM BUTTIN.

Symptomatic Indications.—*Conium* is the most prominent remedy for tumors, particularly scirrhus, coming on after contusion, with stony hardness and feeling of weight. *Baryta carb.* for fatty tumors. *Calcaria carb.*, warts, polypi, and benignant encysted tumors. *Belladonna*, tumors with much inflammation, painful even to light touch. *Bryonia*, indolent tumors of slow growth; imperfect suppuration.

TYMPANITES (Meteorism).—Distention of the abdomen from inflation of the intestines with gas. In very exceptional cases, and then usually after perforation of the stomach or intestine, the gas may be in the peritoneal cavity. It is due partly to an increased formation of gas and partly to a subparalytic condition of the intestinal walls. In peritonitis, enteric fever, and acute intestinal obstruction, it is sometimes very marked, and may be the source not only of some discomfort, but of actual danger to life from the impediment to respiration, owing to the pushing up of the diaphragm. The abdomen is everywhere resonant. In less degree flatulence accompanies all forms of chronic gastric and intestinal disturbance.

Treatment.—Internally, antispasmodics (such as spirits of ammonia in 30-minim doses) may be tried, or brandy may be given; enemata of turpentine have sometimes been found of service. The passage of a long tube into the large bowel as high as possible may give relief, or, as a last resort, the large bowel may be punctured in two or three places with a fine trocar, but this latter measure is by no means free from danger.

TYPHOID FEVER (Enteric Fever).—A febrile disease, produced by a specific poison and characterized by inflammation and sloughing or ulceration of the glands of the small and sometimes of the large intestine, and especially of the agminate and solitary glands of the ileum, together with infiltration of the mesenteric glands, and enlargement of the spleen, and the presence of an inconstant roseolous rash.

Symptoms.—After infection a period of latency or incubation elapses before the commencement of the symptoms. In cases where this has admitted of being accurately fixed, it has generally been between ten and fourteen days, but it may vary from five days to upward of three weeks.

Commonly this period is free from symptoms, but sometimes there is more or less malaise, and occasionally, at the commencement, diarrhea and vomiting, which subside again after a few days.

The onset of the disease is often somewhat insidious, the patient feels languid and indisposed to exertion, has aching pains and a sensation of weight in his

limbs, headache, passes restless nights, his sleep is disturbed by dreams, and appetite is lost. Occasionally, in this early stage, there are signs of intestinal irritation, as abdominal pain and diarrhea, and, especially in children, vomiting. These cases are often at first regarded as ordinary diarrhea. The tongue becomes furred and red at the tips and edges, the pulse accelerated, and the temperature rises, often by somewhat regular gradations, so that every night it is one or two degrees higher than on the previous night, the morning temperature being one or two degrees below the evening.

Usually these premonitory symptoms last from five to six days before the patient is compelled, by increasing weakness, to take to bed.

Not unfrequently, however, typhoid fever begins like other acute diseases with distinct chills or even rigors, headache, pain in the back and limbs, and the patient takes to his bed after two or three days.

Sometimes the early stage of typhoid is accompanied by anomalous symptoms which may greatly increase the difficulty of diagnosis. Neuralgic pains and hyperæsthesia of the muscles, much increased on movement, simulating rheumatism, may occur; these may be associated with cutaneous hyperæsthesia. Sometimes there is hemicrania, or supra-orbital or occipital neuralgia or even earache. In other cases the patient complains of dryness and soreness of the throat, and as there is occasionally a slight diffused febrile blush on the skin and the tongue is red, the case may be mistaken for scarlatina.

By the end of the first week the symptoms of the disease are usually well pronounced, the patient, who complains of headache, thirst, and general malaise, has a wearied, languid aspect, but does not present the stupid, heavy look which characterizes typhus. There is often a pink flush on the cheeks, the eyes are not suffused, the pupils are often large, the tongue is red at the tip and edges, and coated with a white or yellowish fur; sometimes the center of each half presents a furred strip, the intervening portions being red. The lips are parched and desquamating, the pulse may vary from 100 to 120, and though often full, is soft, with a tendency to dirotism; the abdomen is commonly tumid; often there is

gurgling on palpation in the right iliac fossa, with some pain and tenderness. The bowels are usually loose, the motions liquid, of a yellow ochre color, resembling pea soup, and of an alkaline reaction. Not unfrequently, however, there is constipation. The spleen is enlarged, sometimes the lower end can be felt at the costal arch. Usually, the enlargement can only be detected by percussion in the lower axillary region, but when the stomach is much inflated this sign, which is of great diagnostic importance, may be obscured.

Epistaxis not unfrequently occurs, and is sometimes so profuse as to endanger life; it may take place at any period of the fever.

The skin commonly feels hot and dry, but this condition often alternates with perspiration. The temperature may vary from 102° to 105° F. in the evening, and is generally one or two degrees lower in the morning. The characteristic eruption, when present, usually makes its appearance between the seventh and twelfth days. It consists of slightly elevated papules of a rose pink color, measuring about two lines in diameter, uniform in size, and disappearing on pressure. They come out in successive crops, each spot lasting from three to five days and then fading, and they continue to come out during the whole course of the fever. In rare cases the spots have been observed to be acuminated, with a small vesicle on the summit. Sometimes, when the rash is very abundant, the spots are much darker in color, and persist on pressure. The spots have been observed as early as the fifth day, and their appearance may be delayed till the fourteenth, or even later. They generally cease to appear after the middle or end of the third week, but in cases in which intercurrent relapses take place they may continue to come out for five or six weeks. The number of the spots is often very small, so that they may be easily overlooked; they are generally confined to the abdomen, chest, and back. Sometimes the eruption is copious, and may then extend to the extremities, and even to the face. It is often considered that there is no relation between the amount of the eruption and the severity of the attack, but, in the experience of the writer, when the eruption is very profuse and dark, the case is usually a severe one.

The eruption is by no means always present, and is more frequently absent in children under ten and in adults over thirty than between those ages. As in most specific fevers, hemorrhagic spots occasionally occur, but they are independent of the rose spots. In rare cases pale blue spots have been observed, the *tâches bleuâtres* of Trousseau. They appear to have no significance. Sudamina are not very uncommon, and usually the so-called *tâche cérébrale*, a red line with a white border on each side, can be elicited by drawing the back of the nail across the skin; this is an indication of increased irritability of the vaso-motor nerves, and is especially frequent when the pulse is dicrotic. It should most probably be regarded as a phenomenon of fever generally, rather than of the specific typhoid process.

The urine presents the usual characteristics of fever; it is concentrated, high-colored, strongly acid, contains an excess of urea and uric acid, sulphates and potash salts, with deficiency of chloride of sodium. In the later stages of the disease it is often albuminous.

Ehrlich's Test.—The urine of cases of typhoid fever may give a peculiar reaction with sulpho-diazobenzol. This is produced by adding to an equal volume of urine a mixture consisting of 25 parts of a 20 per cent. solution of hydrochloric acid saturated with sulphanilic acid, and one part of a half per cent. solution of sodium nitrite, an excess of strong liquor ammonia is then added. A deep orange-red or purple color is produced; the colorization of the froth on shaking the mixture is especially characteristic. This reaction cannot, however, be always obtained, and may be present in many other diseases, especially measles. The acid solution and the sodium nitrite solution should be mixed together immediately before using.

During the second week, the patient usually ceases to complain of the headache and other pains, but there is increasing weariness, progressive emaciation, and, in severe cases, delirium may begin to appear, at first during the night, or on waking out of sleep. Sometimes the patient is sleepless and restless at night, sometimes drowsy and apathetic; deafness is a common symptom; it is often regarded as not unfavorable, but it usually indicates a severe case.

During the third week, the diarrhea usually becomes more severe, the motions often very offensive, and may contain shreddy sloughs. Signs of pulmonary complications may appear, there is not usually cough, but the breathing is accelerated, the face somewhat dusky, and moist râles are audible over the back of the lungs. In severe cases, what is known as the typhoid state may become developed, the patient lies on his back and sinks down in the bed; there is muttering delirium and stupor, subsultus tendinum, the tongue is dry and brown, or glazed and red, and transversely fissured, there are sordes on the lips and teeth, the impulse of the heart is feeble, the first sound faint and short, the pulse markedly dicrotic, the belly distended and tympanitic, the bladder often paralyzed, the urine albuminous, the motions are passed involuntarily, bed sores form over the sacrum, and the patient may die in a state of coma.

It is only in very severe cases that this condition is developed to such a degree; but during the third week, the patient is liable to severe hemorrhage from the bowels and perforation.

Commonly, toward the end of the third or the beginning of the fourth week, the fever begins to abate, the morning temperature falling more rapidly than the evening, so that the type of the fever becomes more and more remittent, and after a few days defervescence is complete. For some time the temperature is subnormal, but is liable to be temporarily sent up by very slight causes. The presence of complications, or the occurrence of recrudescences, may much prolong the course of the fever, which may thus extend over periods of five or six weeks, or longer. Convalescence, too, is liable to be much retarded by the presence of complications, especially the slow healing of the intestinal ulcers; it is also liable to be interrupted by relapses.

Though this may be regarded as the typical course of a case of well marked typhoid, few diseases are subject to such great variations. The forms of typhoid may be divided into those where the symptoms caused by the general infection of the system predominate, and those in which they are, in the main, due to the intestinal lesions.

The severity of the constitutional affection, and the extent of the intestinal

lesions, though commonly, are not always in agreement.

Varieties of the Disease.—*The acute form.*—This is characterized by severe febrile disturbance of rapid onset, often preceded by rigors, high temperature, great nervous oppression, early delirium, and by a tendency to pulmonary congestion; death may take place in the second or even in the first week, though usually the disease runs on the usual time; there may or may not be severe intestinal lesions.

The abortive form.—Here the early symptoms are often well marked, but sometimes between the eighth and fourteenth day, defervescence takes place often by a pretty sudden crisis. It is probable that in these cases resolution and absorption has taken place in the inflamed intestinal glands without the occurrence of sloughing or ulceration.

The latent form.—The febrile disturbance is very slight, but the intestinal lesions have the usual characters. Commonly, these patients have diarrhea, and some degree of general malaise, and their temperature is above normal, but they continue to follow their ordinary avocations, and walk about as usual, hence this is often termed the “ambulant” form. The neglect of proper precautions renders these cases very liable to perforation and hemorrhage.

The afebrile form.—This form is of rare occurrence. Although the general symptoms, and especially the nervous symptoms, as delirium and stupor, may be well marked, and the rash abundant, the temperature throughout is normal, or even subnormal. The intestinal lesions are usually slight, and the disease often terminates at the end of a fortnight. An epidemic of this type occurred in the German army besieging Paris, and was attributed to the great hardships which the soldiers had undergone. Isolated cases occur occasionally; in these the severe symptoms are seldom observed.

Mild forms of typhoid are often termed gastric fever, bilious fever, infantile remittent fever, etc. In malarial districts, the disease is modified by the influence of the malarial infection, and the term typhomalarial fever has been applied to the fever under these circumstances.

Complications and Sequelæ.—Of the complications due to the intestinal lesions, hemorrhage and perforation are the most

important. They may occur at two periods, which may be termed the early and late; the early during the detachment of the sloughs, most commonly in the latter half of the third and the first half of the fourth week, though they have been met with as early as the beginning of the second week; the late may occur at any time from the separation of the sloughs to the complete healing of the ulcers, and are due to the ulcers not granulating, but becoming atonic. These accidents may therefore occur when the patient appears to be convalescent.

The symptoms of perforation are usually the occurrence of a sudden pain, followed by general peritonitis, diffused abdominal pain, great tenderness, and tympanites, together with symptoms of collapse. The pulse becomes very frequent and small, the breathing is thoracic, the countenance pinched, the temperature may either rise or fall, according as the symptoms of inflammation or collapse predominate. Not infrequently, especially if the patient be in the typhoid state, these severe symptoms are absent, and the chief indications are abdominal distention and increase in the prostration. The abdominal distention is generally due to the intestines being paralyzed by the peritonitis, but sometimes a considerable quantity of gas escapes into the peritoneal cavity. This can often be recognized by the liver dullness being completely obliterated, owing to the gas accumulating in the upper part of the abdominal cavity between the liver and diaphragm and abdominal wall, whereas in flatulent distention of the bowels, the liver is usually merely displaced upward, unless the colon, as sometimes happens, rolls over it. Perforation of bowels almost always proves fatal within two days, but where the extravasation and peritonitis have been limited by adhesions, recovery with or without the formation of a fecal abscess has been known to occur. Acute general peritonitis occurring during typhoid fever, is by no means necessarily fatal, but probably where recovery has taken place there has not been actual perforation. Peritonitis may also be set up by the rupture of an inflamed and softened mesenteric gland.

Hemorrhage.—Intestinal hemorrhage, like perforation, most commonly occurs during the latter half of the third and the first half of the fourth week, and often

recurs several times. The amount may vary from a slight oozing to several pints of arterial blood. The blood passed may be either dark or bright red, and is often more or less clotted. When the hemorrhage is at all profuse it causes a sudden fall of temperature, pallor, and collapse. A moderate hemorrhage does not in itself necessarily give rise to any serious symptoms, but it is an indication of deep ulceration, and we often see hemorrhage and perforation in the same case. Severe hemorrhage sometimes proves fatal. Hemorrhage, like perforation, though more frequent where there has been much diarrhea, may also occur where the bowels have been constipated.

Tympanites is another frequent symptom in typhoid; a moderate degree is usually present; but when the amount is very great it is a most unfavorable symptom. It usually indicates severe intestinal ulceration, and also, especially when it occurs early, a failure of nerve power. It may greatly distress the breathing, and it favors perforation by stretching the ulcerated bowel. Murchison considered that the gas is chiefly contained in the colon, but there can be little doubt but that the small intestines are also distended. It is greatly increased by the occurrence of peritonitis, and often a distended motionless belly is the chief indication of perforation.

Ulceration of the large intestine, affecting the solitary glands, occasionally occurs, and the lesions may even be more extensive here than in the ilium. Hemorrhage and perforation are liable to occur. This condition may often be recognized by the frequency and persistence of the diarrhea, the extremely offensive motions, and often by the presence of a good deal of pain. Sometimes the condition of the intestines is much the same as in chronic dysentery.

Severe gastric disturbance may be present, there is a tendency to great flatulent distention and even acute dilatation of the stomach, and persistent vomiting, rendering the feeding of the patient extremely difficult; this condition may be associated with severe headache. The term "bilious typhoid" is often applied to this form.

Jaundice occasionally occurs, usually in the later stages of the disease, and the cases often terminate fatally, the liver has been found in a condition of fatty degen-

eration, but the cause of the jaundice is somewhat doubtful.

Affections of the larynx and pharynx are not uncommon; sometimes a diphtheritic exudation forms on the fauces; this should perhaps be regarded as the result of a diphtherial infection and not as a manifestation of the typhoid poison. Sometimes hepatic ulcers are present, and cases have been described where circular or oval ulcers of larger size with grayish white surface have appeared on the soft palate.

Ulceration of the Larynx frequently occurs. The ulcers are usually situated on the posterior wall, and often extend deeply; they have been variously ascribed to an infiltration and ulceration analogous to that in the intestine, or to the effects of pressure from the decubitus of the patient. Sometimes they give rise to few symptoms, at others they cause hoarseness and pain in swallowing; they may produce necrosis of the cartilages, œdema and stenosis of the glottis necessitating tracheotomy, or may perforate and give rise to emphysema of the tissues of the neck. Sometimes they cause hemoptysis.

Besides bronchitis and hypostatic congestion, which are often present in severe cases, true lobar pneumonia occasionally occurs; it is most common in the third and fourth weeks. Embolic and pyæmic processes in the lungs may also take place, and may cause abscesses, or empyema or pneumothorax.

The tissues of the heart in severe cases of typhoid fever become granular and softened, sometimes giving rise to a certain amount of dilatation, but endocarditis is very rare. Not unfrequently, as the result probably of asystolism—*i. e.*, a condition in which the cavities do not completely empty themselves—coagulation takes place during life. This may cause sudden death from obstruction of the pulmonary artery, or may give rise to embolism of distant organs.

Thrombosis of the veins, especially of the iliac and femoral veins, is of common occurrence, usually during the period of convalescence. The leg becomes œdematous, and there is pain and tenderness along the course of the affected veins, and often the vein can be felt as a solid cord. Most commonly, in a period varying from two to six weeks, the coagulum becomes absorbed; sometimes, however, the vein remains permanently blocked,

and though the circulation gets carried on by the collateral channels, the patient continues to present some signs of venous obstruction of the limb. Occasionally, portions of the clot get displaced and cause pulmonary embolism.

Renal Complications.—Albumen is often present in the urine in severe cases, but usually disappears with defervescence, but sometimes, though rarely, acute nephritis resembling that of scarlatina occurs, the urine becomes scanty, bloody, highly albuminous, or may be suppressed, and uræmia and dropsy may ensue. The term “nephro-typhus” has been given to this complication by foreign observers.

Sometimes, in addition to the ordinary nervous symptoms of severe fever—as tremors, subsultus, floccitatio, delirium—various spasmodic and paralytic affections occur, as general convulsions, muscular spasm, which may cause retraction of the head, rigidity of the trunk or limbs, strabismus, trismus. Sometimes acute meningitis has been set up, probably of septicæmic origin. Consecutive paralysis has frequently been observed. Sometimes there is hemiplegia from cerebral embolism, more often the paralysis is monoplegic or paraplegic, and must be ascribed to a peripheral neuritis; sometimes the attack is followed by various forms of sclerosis of the spinal cord. Occasionally there is a temporary aphasia; this has generally been noticed in boys. Mania and dementia have often followed an attack of typhoid, but are generally of only short duration.

The deafness of typhoid fever is usually only temporary, but sometimes inflammation of the middle ear takes place and may lead to perforation of the membrana tympani.

Bed-sores, abscesses in the connective tissues, sometimes erysipelas, and occasionally acute suppurative parotitis, or parotid bubo occur. Sometimes during convalescence periostitis or more probably a superficial ostitis, often leading to suppuration and necrosis, affects many of the bones, especially the lower jaw, the sternum, the ribs, the femur, and tibia. All these complications are probably septicæmic in their origin. Occasionally there is pyæmia, set up either by bed-sores or by the intestinal ulceration. This is usually characterized by recurrent rigors, but rigors may occur during the

course of typhoid without any obvious cause.

Sometimes, after an attack of typhoid, the patients do not regain flesh and strength, but fall into a state of marasmus and continue to emaciate. This may be due to unhealed ulcers in the intestine and the persistence of the diarrhea, in other cases to chronic atrophy or caseation of the mesenteric glands, and death may ensue after many months or even after years.

Sudden death is liable to occur either during the attack or when the patient is apparently convalescing; sometimes it is the effect of the granular degeneration and softening of the heart, or to embolism or thrombosis of the pulmonary artery; at other times no cause can be detected.

Relapses are liable to occur between two and twelve or fourteen days after the subsidence of the primary attack, but much longer intervals have been observed, even ten weeks. Fresh infiltration and ulceration of the intestinal glands take place, the rose spots again appear, and all the symptoms recur. Most commonly the attack runs a shorter course, the fever attains its maximum sooner, between the fourth and sixth days, and defervescence begins before the end of the second week, but not infrequently the relapse lasts twenty-one or more days. Relapses are generally milder than the primary attack, but perforation is very liable to occur. Sometimes there is a second or even a third relapse. The relapse is often intercurrent—*i. e.*, takes place before the subsidence of the primary attack, and is indicated by an exacerbation of the symptoms and the reappearance of the rash. The frequency of relapses has been estimated at from three to ten per cent. The causes are very obscure; they have often been attributed to irritation of the intestine by improper food, but this is very doubtful. They certainly frequently occur where every precaution has been strictly observed. There is reason to believe that the germ of typhoid fever remains in the intestinal glands long after defervescence has taken place, and may be excited to fresh activity.

Diagnosis.—In consequence of its insidious onset and the somewhat indefinite symptoms at first, the diagnosis of typhoid fever in its early stage is often difficult. The main points which serve to distinguish it are the type of the fever, the tongue,

the abdominal symptoms, as diarrhea, distention, the enlargement of the spleen, and the rose spots. A temperature of 104° and upward in the first two or three days of illness is more likely to be due to some other febrile disease, as pneumonia, meningitis, typhus, or smallpox. So a normal evening temperature during the first week would generally exclude typhoid. Any fever in this country which lasts six or seven days without any local cause or the appearance of a characteristic rash is almost always typhoid, especially if the spleen be enlarged.

The diseases with which typhoid is most likely to be confounded are, first tuberculosis, especially tubercular meningitis, and general miliary tuberculosis. In tubercular meningitis the vomiting is often more marked, the headache more severe and persistent, there is greater intolerance of light and sound, the tongue is not red, the belly often retracted, there is no enlargement of the spleen, the temperature is more irregular, the pulse often slow while the temperature is high, bowels usually constipated, motions have not the typhoid character. Sometimes tubercles can be detected in the choroid, there is often precedent emaciation. The knee-jerk is frequently absent, whereas in typhoid it is normal or exaggerated. Nevertheless, until spasm or paralysis of the cerebral nerves appears the diagnosis may be doubtful.

Acute miliary tuberculosis may also give rise to many of the symptoms of typhoid; there is, however, usually much greater rapidity of the breathing, and earlier and more severe bronchitic signs and greater emaciation.

Tubercular peritonitis, especially when associated with tubercular ulceration of the intestine, may closely resemble typhoid, but the course is usually much more chronic; often there is peritoneal effusion, and signs of tuberculosis of other organs. In all these cases the presence of the rash is of the utmost importance, but a rash much resembling the roseola of typhoid is said to occur sometimes in acute tuberculosis.

Pneumonia is liable to be mistaken for typhoid, especially the asthenic forms, which may no doubt be caused by septic infection. Generally the physical signs are a sufficient distinction, but as pneumonia itself is not a very uncommon complication of typhoid it may be difficult to

decide whether it is primary or secondary ; pneumonia, however, is a late complication of typhoid, and therefore the history and duration of the illness will generally distinguish them.

Typhlitis sometimes gives rise to symptoms like those of typhoid, but the presence of a swelling in the iliac fossa will distinguish it. This symptom is very unlikely to occur in typhoid, especially in an early stage.

Ulcerative endocarditis and pyæmia from internal causes may closely resemble typhoid, and in the former case may even produce intestinal hemorrhage due to embolism. The greater irregularity in the type of the fever, the occurrence of repeated rigors (though rigors occasionally occur during the course of typhoid), the presence of some local inflammation, either internal or external, the signs of embolism, as purpuric spots, hematuria, hemoptysis, and in ulcerative endocarditis the cardiac lesion, are the chief points of distinction.

In malarial districts, and especially in military practice during the exposure of a campaign, there is often great difficulty in distinguishing malarial and typhoid fevers, and there can be little doubt but that both forms may coexist in the same patient.

For the diagnosis from typhus, see the latter fever.

Pathology.—Typhoid fever belongs to the class of miasmatic contagious fevers—*i. e.*, those fevers whose virus is capable of development outside the body, and which are usually communicated not by direct transmission from the sick to the healthy, but indirectly through the contamination of the soil or water.

In all probability the virus is associated with a specific bacillus described by Klebs and Eberth. The invariable presence, after death, of this organism in the intestine, the mesenteric glands, the spleen, and sometimes the liver, and in blood drawn from the spleen during life, has been verified by so many competent observers that its connection with the disease can no longer be doubted. It is not met with in the general circulation, or in the secondary inflammations, which are probably septicæmic and not due to the direct action of the typhoid poison. The bacillus can be distinguished from all other organisms by its mode of growth when cultivated on the potato, where it

forms a uniform thin layer or pellicle. It has been detected in contaminated drinking water and cultivated. When introduced into rabbits and other animals, though it appears to multiply, and may cause death, it does not give rise to any disease which clinically can be identified with typhoid fever. The injurious effects on the human system are probably due to its generating some kind of poison of the nature of a ptomaine, which gets absorbed into the circulation. It would appear that the bacillus may remain in the intestinal glands for a long time after the subsidence of the fever. In one case it was detected in the discharge of an abscess, due probably to the breaking down of a mesenteric gland, five months after the commencement of the fever. Quincke also found that infection has been communicated by patients many weeks after defervescence.

The characteristic lesions of typhoid fever are an inflammatory affection of the solitary and agminate glands of the ilium and sometimes of the colon, and of the mesenteric glands, together with parenchymatous swelling of the spleen. The changes in the glands consist first of hyperæmia and swelling due to great hyperplasia or exudation of lymphatic elements. Peyer's patches in this stage form raised masses of a pinkish-gray color, with reticulated, rugose, or nearly smooth surfaces, according as the inflammatory infiltration is uniform in all the tissues of the patch, or is greater in the follicles, or in the intervening structures. The solitary glands present similar changes. This stage is usually completed about the tenth day.

In the second stage necrosis of many of the patches takes place, giving rise to yellowish-brown sloughs, the separation of which occupies the third, and sometimes the fourth week also. There is left the typhoid ulcer, which is usually oval and opposite to the attachment of the mesentery, when it corresponds to a Peyer's patch, circular when to a solitary gland. Its surface is smooth, the edges undermined. Its depth depends on the extent of the original inflammatory exudation. Usually, it does not go deeper than the mucous coat, but may reach the peritoneum and so perforate. As the ulcers heal the undermined edges become adherent, the surface granulates, and ultimately the epithelium is restored, no

contraction taking place. The healing of the ulcers takes an uncertain time; it may be completed in a week or ten days. Sometimes the ulcers become chronic, and may continue to extend and give rise to the late hemorrhages and perforations. These changes in Peyer's patches are always most marked and most advanced in the lower part of the ilium near the valve.

The mesenteric glands become swollen by a similar hyperplasia of their lymphatic elements, and sometimes they soften down and burst into the peritoneal cavity. Generally, resolution without necrosis takes place; sometimes they pass into a caseous condition. The spleen also presents a lymphatic hyperplasia with congestion, and it always contains the bacillus.

The other organs show more or less cloudy swelling of their cellular elements; this change is especially marked in the glandular epithelium. In severe cases the heart is more or less softened. Deposits of leucocytes are found in the liver; and here, too, the characteristic bacillus has been detected.

The voluntary muscles, especially the recti abdominis and the adductors of the thighs, usually show the changes known as "myositis typhosa," though they are by no means peculiar to typhoid fever; the muscular fibers lose their striation, become swollen and homogeneous, so as to resemble cylinders of wax, and then break up by transverse cracks into fragments and disappear; at the same time there is an interstitial exudation of leucocytes (Zenker's degeneration). Ultimately the fiber is regenerated by a cell-growth within the tube of sarcolemma. Sometimes this change causes muscular rupture and hemorrhage during life, and is an additional reason for keeping the patient strictly at rest.

Deep ulcers, which may lead to necrosis of cartilage, are sometimes present in the larynx, usually on the posterior wall between the arytenoid cartilages. Bronchitis, lobular and lobar pneumonia, and hypostatic congestion of the lungs are frequently met with.

Ætiology.—Typhoid fever is chiefly disseminated by contamination of the air, or water, or food, by the specific typhoid virus which is contained in the intestinal discharges of persons suffering from the disease. The virus may retain

its activity for an indefinite time in a suitable locality outside the body, and may possibly even multiply.

The most common ways in which it is communicated are:

Inhaling effluvia from drains, cesspools, badly constructed water-closets, etc.

Contamination of the drinking water. This is the most common cause, especially of widespread epidemics. It takes place from soakage of sewage matter from cesspools into wells and springs, by contamination in various ways of ponds, reservoirs, even rivers of considerable size, as was the case in a recent epidemic at Plymouth, Pa.; contamination of house cisterns by the faulty arrangement of waste pipes; by the sucking back of sewer gas into water pipes, etc. The virus has often been distributed by milk. This is in all cases due to contamination of the water used for dairy purposes. Boiling destroys the virus both in milk and water. Outbreaks have also been attributed to eating the flesh in a state of putrefaction of calves affected by the disease.

Pettenkofer considers that contamination of the soil and height of the ground water play an important part, but it is probable that a low height of the ground water favors contamination of the water supply.

Direct contagion from the sick to the healthy. This probably plays but a small part in the dissemination of typhoid, and when it occurs it is probably through the medium of the stools. It would appear that the stools are much less virulent when first passed than after the lapse of some hours or days. Great care should be taken to disinfect all the discharges, to observe perfect cleanliness with regard both to the patient's person and the linen, and the attendants should never eat with unwashed hands. The linen soiled with typhoid discharges has frequently communicated the disease to laundresses. If the sanitary arrangements of a house or neighborhood are defective, the introduction of a case of typhoid may easily cause an outbreak.

Although in civil practice in temperate climates outbreaks of typhoid can almost always be traced to some definite contamination acting in one of the above mentioned ways, in military practice, especially during campaigns, typhoid fever appears to break out among un-

seasoned troops without it being possible to trace any source of infection; hence many military surgeons have come to the conclusion that it may arise *de novo*, and have denied its specific nature.

With regard to *predisposing causes*, typhoid fever occurs in all climates, but is most prevalent in temperate or subtropical regions. In temperate climates it especially prevails during the autumn months, and is favored by a hot dry summer. It occurs in all ages, but is most common in young persons under the age of thirty. It is frequent in children. Age has much less influence on the mortality than in typhus, though it is more fatal in advanced life. It affects all classes of society, and occurs with equal frequency in both sexes. Newcomers into an infected district are generally supposed to be more liable than old residents. One attack confers a protection, though not a complete one, against a second attack.

Treatment.—As soon as we have reason to suspect a patient is suffering from typhoid, he should at once be confined to his bed. A quiet, well-ventilated room should be selected and kept cool, and the covering of the bed should be light. The temperature of the room should not, if it can be managed, exceed 60° F. It is an advantage to have two beds in the room so that, when necessary, the patient can be shifted from one to the other. At least one trained nurse should be in attendance, and the patient must be watched day and night. He should never be allowed to get out of bed, especially after the middle of the second week, but should always use a bed-pan and urine bottle in the recumbent posture. Allowing the patient to get up to stool greatly increases the risk of perforation, hemorrhage, and fatal syncope. His temperature should be taken every four or six hours.

The diet is a matter of primary importance. During the prolonged fever great waste and consumption take place, not only of the fat, but also of the tissue-albumen, and though this cannot be altogether prevented, much may be done to limit it by a suitable diet, which must contain the necessary amount of fat, hydrocarbons, and albumen. The last requires to be given in greater proportion to the other constituents than in health. At the same time the food must be given in a non-irritant, easily assimilable form.

As a rule food should be given at least every three hours, and refreshing drinks, as lemonade, barley water, etc., may be taken in the intervals if the patient be thirsty and his mouth dry. Unless there is great prostration, a longer interval may be allowed during sleep. Often it is necessary to give food much more frequently. The food which best fulfills the indications for supplying albumen and fat is milk, and when it can be digested it should form the chief part of the diet. From two to three pints may be given in twenty-four hours. The stools should be observed to see that undigested curds do not pass. When this is the case the amount must be diminished. It may be given by itself or with arrowroot, barley water, thin gruel, rice water, and soda water. Sugar may be added, to the patient's taste. Beef tea, chicken broth, and other animal broths are useful, and should be given from time to time between the milk foods. Some patients can take without difficulty one to three eggs beaten up during the twenty-four hours, though many are unable to digest them. When milk cannot be digested in sufficient quantity it is often difficult to introduce sufficient albuminous and fatty matter for the wants of the system. Beef tea made in the ordinary way, though no doubt a useful stimulant, cannot be looked upon as supplying much nourishment; we may have recourse to solutions of meat extract by cold water and hydrochloric acid, or the various meat juices and peptonized meat jellies which are so largely manufactured. These should be added to the beef tea. When milk cannot be otherwise digested, Nestlé's food, made thin, can be tried, or the milk may be peptonized.

Severe cases of typhoid fever necessitate the free administration of alcoholic stimulants; the amount will depend on the age, the previous habits, and the actual condition of the patient.

Older subjects need them more than younger ones, free drinkers more than temperate persons. The especial indications for their use are a dicrotic pulse, feeble cardiac impulse, short and faint first sound of the heart, muscular prostration, subsultus tendinum, dry brown tongue, and muttering delirium. The best form is brandy, which should be given well diluted at regular intervals. The amount required may vary from a

few ounces to twelve or more in the twenty-four hours. To tide over a period of temporary collapse perhaps the best stimulant is ether administered subcutaneously, 30 to 60 minims at short intervals. The less severe forms of typhoid, especially in young persons, do not require alcoholic stimulants.

The next point is the treatment of the febrile condition. Very different opinions are entertained as to the effect on the system of the high temperature of fever. Some regard it merely as an indication of the severity of the disease, but as not in itself exercising any injurious influence, nay, as possibly a conservative process. Others consider that it has a most injurious influence by increasing the febrile combustion and disintegration of the tissues, and by impairing all the functions of the body, especially those of the nervous and circulatory systems. There can, however, be no doubt in the minds of those who have observed the effects of systematically reducing the temperature in typhoid, especially by the external application of cold, that by this means the disease is made to run a much milder course, and that the mortality is greatly lessened. Under this method of treatment, if begun sufficiently early, the so-called typhoid symptoms, delirium, etc., are seldom seen. It is, however, very probable that the mere reduction of the temperature is only one factor in the treatment, and the good results are largely due to the stimulating effect on the nervous and vascular systems, by which the tone is restored to the relaxed vessels, and then to the paralyzed heat-regulating centers.

By far the most effectual way of applying this treatment, when circumstances permit, is by tepid baths, and, as a rule, whenever the temperature exceeds 103° F. the patient should be lifted into a bath of a temperature from 85° to 80° F. The duration of the bath must vary with the condition of the patient and the obstinacy of the temperature; generally from fifteen to twenty or thirty minutes are necessary. It is sometimes advantageous to lower the temperature of the water after immersion, but it is not, as a rule, advisable to begin with a temperature below 80° F. At this temperature the bath is generally agreeable to the patient's feelings, though toward the end he usually begins to feel shivery. Brand, as is well known, obtained the most successful results by baths of

65° , but his cases were mostly soldiers—*i. e.*, strong young men in the prime of life.

The treatment by tepid baths is especially indicated in the acute forms of the disease and during the earlier stages; the more completely the fever is held in check during the first fortnight the less severe will be symptoms during the third week. Hemorrhage or peritonitis is of course an absolute contra-indication, and when toward the end of the fever the morning temperature begins to fall below 100° we may safely neglect a high evening temperature. We should administer a stimulant to the patient before each bath. As substitutes or adjuncts to bathing are cold sponging, cold compresses, and the cold pack; the two former may be used when, from the want of sufficient assistance, bathing is impossible, or when in the third week, from the occurrence of hemorrhage or from fear of perforation, we do not like to move the patient.

Temperature may also be reduced by various drugs, the most important of which are quinine, antifebrine (acetanilide), and antipyrine, and there can be little doubt but that, when judiciously employed, they have a beneficial action; it is, however, very doubtful whether in a long fever like typhoid they can be safely used continuously as a substitute for bathing.

In order to produce a decided fall of temperature quinine requires to be given in doses of from 10 to 25 grains, and should not be administered oftener than once in twenty-four to forty-eight hours. It is liable to cause sickness, to prevent which a little opium may be added. Perhaps the most convenient form for these large doses is the hydrobromate. It is, of course, liable to cause the usual disagreeable effects of cinchonism. It is best adapted for the later stages of the fever when the temperature is assuming a more remittent type. Antifebrine is to be preferred to antipyrine; smaller doses are required, it is less depressing, and is not liable to cause a measly rash. Like the former drug it often produces profuse perspiration, though its antipyretic effects do not appear to be due to this. The requisite dose does not usually exceed 5 grains. It is best given dissolved in rectified spirit and added to warm water. An occasional dose will much increase the effect and enable us to diminish the frequency of the baths, and it may

be employed where baths are contra-indicated. It must be borne in mind that all these remedies, if pushed beyond moderate limits, have a depressing effect on the heart.

Recently the practice has been introduced of treating typhoid fever by antiseptic remedies; in the earlier stages with the intention of destroying or weakening the specific typhoid virus, in the later with the hope of preventing the septicæmia caused by the sloughy condition of the intestinal glands. Their efficacy for either purpose is still very doubtful.

Complications and Special Symptoms.—These are numerous and require careful treatment. If the diarrhea be only moderate in amount it need not be interfered with; if the number of motions exceed four daily, it should be held in check. The best remedy is opium, which may be advantageously administered as an enema. Where there is constipation a small enema may be administered from time to time to unload the rectum; for this purpose glycerine is often useful, but purgatives should never be given after the end of the first week. It is the custom in Germany to commence the treatment with one or two doses of calomel, and this is said to render the subsequent course milder.

If a profuse hemorrhage should occur our aim must be to keep the bowel perfectly at rest; the patient should not be allowed to move from the recumbent posture. It is best for him to pass his motions into a drawn sheet, and no food should be given for some hours. If there be danger from collapse, a little cold brandy and water may be administered or a hypodermic injection of ether. An ice bag or an ice compress may be applied to the abdomen. The only drug of much use is opium, which arrests peristaltic action. It should be given in full doses, either by the mouth or in a clyster, or hypodermically, as morphine. Many practitioners also administer styptics, especially gallic and tannic acids, turpentine, ergot, the latter hypodermically, but their utility may be questioned.

Peritonitis requires full doses of opium or morphine subcutaneously, and food should only be administered in very small quantities. If the temperature be high a cold compress should be applied to the abdomen; when not due to perforation, peritonitis admits of recovery. If we are

satisfied that perforation has taken place, from the sudden onset of pain in a particular region, collapse, the presence of gas in the peritoneal cavity, the treatment will depend on the period of the disease; if during convalescence, the peritoneal cavity should be opened and washed out, and the perforation excised, and the bowel stitched up. This operation has been successfully performed, and affords a sufficiently fair prospect of remedying an otherwise fatal accident. If, however, perforation takes place during the third or fourth week, when the bowel is sloughy and the patient still under the influence of the fever, the prospect must be regarded as almost desperate. In one case where the operation was performed at this stage, the patient died, collapsed within five hours, and the stitches in the bowel were beginning to slough. If it should be thought advisable to attempt an operation, it is evident that no endeavor should be made to excise the perforation, but the gut should be brought to the surface of the wound and allowed to discharge externally.

Meteorismus is a dangerous and distressing symptom and one which it is very difficult to overcome; an ice bag or iced compresses to the surface of the abdomen, the administration of stimulants and opium are useful measures. Zemmsen recommends a turpentine enema. Attempts have been made, sometimes with success, to draw off the gas by a long narrow rectal tube or elastic catheter.

Obstinate vomiting, in the bilious form of the disease, must be combated by ice, by limiting the food and by subcutaneous injections of morphine. Sometimes it becomes necessary to desist from food and to administer nutrient suppositories.

Pulmonary complications, as hypostatic congestion, lobular and lobar pneumonia, which latter are probably of septicæmic origin, require stimulants. Counter-irritation may be used in the form of turpentine stupes, and stimulant expectorants, as ammonia and turpentine, may be given.

Sleeplessness and delirium are best relieved by tepid baths; we should also give opium in moderate doses, or a subcutaneous injection of morphine; other hypnotics may be tried, but as a rule opium agrees best. It is of great im-

portance not to allow the patient to pass restless, sleepless nights.

The other complications must be treated on general principles. Bed-sores must be guarded against by great cleanliness; sponging the back with spirit lotion, the early use of a water mattress; the bladder also must be carefully attended to.

Great care is needed during convalescence; we have especially to guard against the too early resumption of solid food; three or four days should elapse after the evening temperature has fallen to the normal point, before any solid food is given, and a longer interval may be necessary if the signs of ulceration continue; but it must be remembered that, in order to get atonic ulcers to heal, ample nourishment is necessary. The patient should begin with a rusk and a lightly poached egg, then a little boiled fish, and then chicken. Bread, potatoes, and other vegetables should not be allowed at first. The patient should not sit up too soon for fear of causing fatal syncope. If thrombosis occur, the leg should be kept motionless by sand bags on each side, and belladonna ointment and hot fomentations may be applied along the course of the vein, if there be pain.

Persistence of the diarrhea is often due to ulceration of the large intestine. Astringents are now useful, especially the metallic ones, as lead and copper combined with opium.

W. CAYLEY.

Brand Method.—Cold bath with friction and stimulation if necessary. A large bathtub half full of water from 60° to 70° F. is kept at hand, and whenever the patient's temperature reaches 102.5° F. he is given a bath. His clothes are removed and he is wrapped in a sheet, and either assisted or lifted bodily by his nurses into the bath. As he enters the bath water is poured over his head to lessen the shock. While in the bath, which should cover his entire body and neck, he is briskly rubbed through the sheet and stimulants administered if necessary. The friction, effusion, and stimulants serve to control the cyanosis and shock which usually come on at the end of ten minutes. After fifteen or twenty minutes he is taken out, the wet sheet quickly removed, and he is wrapped up in a dry one and covered with a light blanket.

The patient often strongly objects to the bath, and shivering and cyanosis almost always follow. Frequently a stimulant is given after the bath. The only contra-indications are peritonitis and intestinal hemorrhage. Bronchitis and pneumonia are not induced by this treatment, and their existence does not contra-indicate its use; likewise pregnancy is no contra-indication. It is not necessary to renew the water more than once in twenty-four hours.

TYPHUS FEVER.—An acute specific infectious fever, distinguished by its sudden onset, by a peculiar rash, which usually appears on the fifth day of the disease; by profound prostration accompanied by cerebral disturbance, and by its termination by a crisis which most commonly occurs on or about the fourteenth day.

Symptoms.—The incubation period usually lasts twelve days. The onset is well marked as a rule, and may be sudden. Shivering, frontal headache, loss of energy and of appetite, severe aching pains in the limbs and back, thirst, and constipation are generally the earliest symptoms. The tongue is pale in color, covered at first with a thin white coating, later on plastered and finally often incrustated, as are also the teeth, gums, and lips, the latter being usually dry and cracked. The color of the coating changes, as the disease advances, to yellow, and finally to brown, or even black in severe attacks.

Early in the disease the patient takes to his bed and lies low down in it, flat on his back. He looks vacant, dull, and apathetic, and is careless of his fate. His eyes are half shut, the conjunctivæ injected, and the mouth not firmly closed. A dull red flush covers the face.

Usually on the fifth day, but in some cases on the fourth, sixth, or seventh, the *rash* appears; the percentage of attacks in which it is absent being very small. It consists of a subcuticular mottling and of very slightly raised "spots," but both are not always present in the same case. The mottling varies in character in different cases; in some having the appearance of a marbling, in others seeming to be made up of spots similar to those visible upon the surface, but dimmed by being seen through a partly transparent layer. The "spots" much

resemble those of measles, and, when very numerous, may be similarly grouped, but their size is smaller and their distribution different, the typhus rash being very seldom seen upon the face. Their color is at first pink or red, and fades upon pressure, but in the majority of cases soon becomes browner and persistent, in some petechial. The spots may be very few in number, and the rash easily overlooked, or there may be an abundant crop. It is found chiefly on the sides of the chest and abdomen, on the arms and on the back, in which latter situation, as on the dorsal surface generally, the color is usually darker. The legs may be invaded by the rash. The dull red flush usually seen upon the face sometimes covers the whole surface. The rash does not appear in crops, as in enteric fever, but attains its maximum development in a few days. Sudamina and miliaria are not uncommon, though the skin is usually dry.

A distinctive odor is said to be given off from the skin, but it is doubtful whether it is sufficiently characteristic to be of any use for diagnostic purposes.

As a rule, headache is present during the first week of the illness, delirium during the second. The latter is commonly of the stupid, muttering kind, more rarely of the violent or erotic. In grave cases coma or coma-vigil may supervene. Deafness is a common symptom. Other affections of the nervous, or nervous and muscular systems, come on for the most part toward the end of the attack, and are presumably due to the exhausting effect of the fever. Of these muscular tremors, paralysis of the bladder and rectum, and in very severe cases subsultus, carphology, and hiccough occur most frequently. Convulsions, which are said to be usually uræmic in origin, are seldom followed by recovery.

Of the digestive organs the state of the tongue has already been mentioned. Abdominal distention, or tenderness, and vomiting had been observed in a small percentage of cases, but the tenderness may often be ascribed to an enlarged liver and spleen.

The urine is usually diminished in quantity, dark in color, of high specific gravity, and albuminous. The presence of albumen or blood is seldom of serious import unless in large quantity, or associated with a very marked diminution of

the excretion. Urea is in excess, although its elimination is probably defective. The chlorides are sometimes absent and usually deficient.

The action of the heart is much impaired, the impulse being rendered feeble and the first sound weak. The pulse is rapid, soft, and compressible, full at the beginning of the attack, small and weak as the end approaches. Its rapidity varies as a rule with the gravity of the case, seldom exceeding 100 in a mild one, but rising to 140, 150, or even more in a very severe one. In a few instances, a remarkable slowing of the pulse has been noticed.

Hypostatic congestion of the lungs occurs in all but very mild cases.

The *temperature* may be considerably elevated even on the first day, and often attains its maximum by the third or fourth day of the attack, keeping nearly at the same height until about the seventh day, when, unless the type be very severe, there is a fall, and the average temperature during the second week is lower than during the first. About the fourteenth day, if all go well, the crisis usually occurs, the temperature rapidly declining to the normal. In some cases it rises again after the critical drop and then falls gradually. Complications may alter the course of the fever, and in fatal cases death is often preceded by a rapid rise, or by a fall of the temperature to a point much below the normal. The average morning remission is stated to be $1\frac{1}{4}^{\circ}$ F.

Complications and Sequelæ.—Of the former, bronchitis and pneumonia are the most common. Gangrene of the lung is much rarer. Venous thrombosis and pyæmia sometimes occur (either as complications or as sequelæ); meningitis hardly ever. Of the sequelæ, gangrene is the most frequent, either in the form of bed-sores, or of necrosis of the tips of ears, heels, or nose. The gangrene commencing in the feet may extend up the legs. The marked inefficiency of the circulation and the tendency to thrombosis easily account for these and other forms of gangrene. The corneæ sometimes slough. Buboës often form in the parotid and axillary glands, in those at the angle of the jaw, or in the groin. Paralysis of various muscles may supervene, and the patient may be left in a state of temporary mental imbecility. So profound are the changes in the organism

which must necessarily be brought about by the fever, when severe in type and affecting persons already weakened by privation and unhealthy surroundings, that almost any sequelæ may be expected.

Termination.—If the patient live long enough the disease ends by crisis or by a mixture of lysis and crisis, but death may follow later from persistence of complications or from sequelæ. Death from the primary fever occurs usually toward the end of the second week and by exhaustion or coma, or both combined.

Diagnosis.—At the outset of the attack the case may be mistaken for one of pneumonia, meningitis, variola, or enteric fever, but in a few days all except the last of these diseases may be excluded. If, as sometimes happens in typhus, there be no rash and the attack be a mild one, it may not be possible to ascertain whether the case be one of typhus or of enteric fever without rash and terminating abruptly at the end of the second week.

At the eruptive period enteric fever may simulate typhus, if the onset be more sudden than usual, the rash very profuse, and if there be constipation and delirium. In some instances the rash of measles is not unlike that of typhus, but the spots are larger and more conspicuous in the former disease, and the pre-eruptive symptoms quite different. Malignant variola is often confounded with typhus, but in the former the rash appears early, in no way resembles that of the latter, and is accompanied by subconjunctival and other hemorrhages, but not, as a rule, by pyrexia.

Prognosis.—The chief factors which have to be taken into account are the age, sex, and mode of life of the patient, the intensity of various symptoms, and the type of the epidemic. The average mortality at all ages is fifteen per cent., but it varies from two per cent. or three per cent. between the ages of ten and fourteen, to about seventy-five per cent. at seventy, and to a still higher rate above that age. In children under ten years old the case-mortality is higher than in the next ten years of life, but with this exception the percentage of deaths increases steadily with increasing age. The mortality is greater in males than in females. Intemperate habits, destitution and debility, and the general impairment of health caused by unhygienic surround-

ings, will of necessity lessen the patient's chance of recovery. Of unfavorable symptoms the chief are: high average temperature and pulse rate, failing heart, severe lung affection, delirium with sleeplessness, carphology, general convulsions, great distention of the abdomen, and deficient elimination of waste products by the kidneys, especially if there be much albumen or blood in the urine. A very dark-colored and profuse rash is also a sign of great danger.

Post-mortem Appearances.—Rigor mortis is not well marked. The blood is dark and fluid or forms but soft clots, which rapidly decompose, as also does the body generally. The liver and spleen are large, dark, soft, and congested. The kidneys may show signs of acute inflammation. Peyer's patches are not swollen or otherwise affected. The heart is fatty and friable. In addition all organs show signs of the degeneration which is caused by continued fever. There is no distinctive affection of the brain or its coverings.

Ætiology.—Although no germ which can be looked upon as the exciting cause of typhus has as yet been discovered, the character of the disease renders it almost impossible to doubt the existence of such a microbe.

The best known predisposing causes are dirt, overcrowding, famine, fatigue, certain climatic conditions, and personal predisposition or susceptibility. Some of these may act by providing the germ with a better soil for its maintenance outside the human body; some by increasing the number of germs which can obtain access to it, and others by lessening the resistance to the germs effecting a lodgment, or producing conditions more favorable to their multiplication within the body.

Treatment.—The patient, both for his own sake and for that of his attendants, should be placed in a well-ventilated room. If possible, nurses who have had typhus fever should be procured or, if this be impracticable, only young nurses should be employed. The room should be kept cool and the bed-clothing light, but the patient's extremities should be kept warm. A combination of hair mattress and close-woven wire mattress forms the best bed, unless the attack of fever be very severe, in which case it is better to place the patient on a water bed at once.

He should never sit up, but his position in bed should be often altered.

Food should be given at short and regular intervals, and should consist of milk, eggs, meat-juice or peptonized beef-jelly, and in most cases alcohol. Water and other diluents may be given in moderation.

As medicines, the mineral acids and sodic chloride have been recommended, and tea, coffee, or caffeine may be of use if it become necessary to stimulate the kidneys. Complications may be treated by the ordinary methods.

The ill effects which are produced by the continuance of a high temperature may be minimized by antipyretic treatment. Cold baths or sponging, antipyrin or acetanilide are the most commonly used means to this end. The first named is especially useful for inducing sleep. When the temperature has fallen to the normal the patient's appetite quickly returns and solid food may be given. During convalescence care should be taken not to overtax the strength either of mind or body.

At the conclusion of the illness thorough disinfection should be carried out.

E. O. HOPWOOD.

Symptomatic Indications.—*Belladonna* is useful to clean and moisten the tongue, control the delirium and reduce the pulse; when there is much cerebral congestion: *arnica*, when there is much depression of vital forces; sore, bruised sensation; all over involuntary discharges; dry tongue stupor; indifference. *Hyoscyamus*, furious delirium continuing while awake; great restlessness; twitching and jerking of the limbs; subsultus tendinum; *opium*, extreme drowsiness and coma, with stertorous breathing; pulse full and labored, or slow and feeble; impending paralysis of brain; involuntary stools and retention of urine. *Rhus tox.*, the most generally indicated remedy in true typhus; patient prostrate and stupid; dullness of hearing; severe pains in limbs, worse during rest; involuntary stools, with great exhaustion. *Arsenicum*, in severe cases; great prostration; emaciation; restlessness; great anguish; face pale, shrunken, cadaverous; darkish or greenish fetid stools.

TYROSIN, like leucin, is a product of the decomposition of nitrogenous bodies, and is never found except in association

with leucin. It is present in the liver and in the urine in case of acute yellow atrophy of the liver, and appears under the microscope as fine, colorless needles.

ULCERS.—An ulcer is the sore or wound left after the loss by decay or destruction of some superficial part of the body, whether skin or mucous membrane. It may begin deep in the substance of the tissues and work its way out; or, as in the case of aphthous, catarrhal, or eczematous ulcers, it may start from the surface. The process is essentially the same, but the name of ulcer is not generally applied unless the whole epithelial layer has been detached and the subepithelial tissue exposed.

When the nutrition of a superficial part of the body is much impaired, it either sloughs *en masse* or undergoes molecular disintegration, leaving behind it a sore which is called an ulcer. Injury alone may do this, the vitality of the part being so completely destroyed that it sloughs and leaves an ulcer. So will inflammation, whether it follows an injury or is excited by some specific cause; the tissues may be killed at once by its severity, but much more frequently it leads to molecular death only, so that they melt away in fragments, leaving a sore behind. This happens all the more readily if the circulation through the part has been interfered with by other causes, so that its power of resistance is not what it ought to be; and new growths such as rodent ulcer and epithelioma undergo degeneration and leave ulcers, or, as in the case of lupus and syphilis, are assisted to the same end by inflammation.

Ulceration consequently is the result of the decay of a part near the surface of the body, and may be caused by injury, by the development of new growths, or by inflammation, however produced. Any one of these by itself is sufficient; but much more often two or three combine together, and their power is all the greater when the nutrition of the part on which they act has been impaired in any way by other causes.

Causes.—*Exciting* and *predisposing* agencies. The former are sometimes so intense as not to require any assistance, and the latter, as, for example, in old age or in limbs affected by infantile paralysis, may almost suffice of themselves; a

scratch, in circumstances such as these, producing an effect such as would not follow a serious injury in healthy tissues.

Among *exciting causes* are included injuries of all kinds, wounds, pressure, friction, heat or cold, chemical irritants and specific poisons, such as those of syphilis, typhoid, or diphtheria. Of these, some destroy the life of the part at once; others only by the inflammation they excite, which may or may not end in ulceration, according to its degree and the circumstances under which it acts.

The *predisposing causes* are either local or general. Some are inherited and others acquired. Scrofula, gout, scurvy, anæmia, syphilis in its later stages, disease of the kidneys, and old age owe their influence to the way in which they impair the general nutrition. The tissues are too delicate to resist, or they are unnaturally prone to inflammation and decay, so that ulcers which are often characteristic of the disorder develop much more easily than they should. Or the circulation fails from fatty degeneration of the heart, valvular disease, general obesity, venous engorgement consequent on bronchitis, and emphysema or other reasons. As a result, congestion and œdema set in, and, of course, owing to the influence of gravity, they are most marked in the lower extremities. The skin and subcutaneous tissue become swollen and sodden with serum, and the slightest irritation suffices to excite an eczema which rapidly runs on to ulceration.

Other causes are *purely local*. Arterial obstruction from atheroma, embolism, or ligature, especially if there is any impediment to the collateral blood supply; cold, ergotism, or infantile paralysis involving a limb; varicose veins, thrombosis; phlegmasia alba dolens; obstruction to lymphatics from old lymphangitis or deep cellulitis, such as often occurs after compound fractures; gravity, especially when there is long-continued standing; the pressure of tumors in the abdomen; repeated pregnancies; every single thing, in fact, that tends either to check the flow of blood toward a part or to prevent its return, that interferes with the arteries, capillaries, or veins, must be regarded as a local predisposing cause. The more feeble the circulation, and the greater the amount of œdema, the slighter the injury

required to commence the process, and the more persistent and grave it becomes.

The process of ulceration is much the same, whether it starts from the surface or deeper down. When the subcutaneous or submucous cellular tissue is inflamed it swells up and becomes œdematous, partly from the increased amount of blood flowing through it, partly from the exudation of leucocytes and plasma into its substance. At the same time, the fibers soften and yield, and the intercellular substance melts away. If the skin over this dies or gives way, there is left an excavation, the walls and sides of which are built up of softened tissue, infiltrated everywhere with leucocytes; and either cleanly cut, if the slough has come away in one piece, or ragged and irregular with shreds of fibrous tissue, yellowish or grayish in color, not yet separated off, studding its surface. If, when this has happened, there is nothing further to interfere with the healing process, the number of leucocytes rapidly increases until they constitute nearly the whole of the surface; the superficial vessels lying in the softened and semi-liquid tissues yield before the continual pressure of the blood in their interior, and stretch longer and longer in the direction of least resistance (that is to say, outward), until, in a day or two, they form little tiny loops, which project upon the surface covered with a cap of leucocytes. In this way the base and sides of the ulcer become covered with minute papillæ (granulations) characteristic of the healing process, where there is nothing to interrupt.

It is essentially the same when it commences from the surface. If the epidermis is anywhere rubbed off, the vessels dilate and an exudation is poured out that softens and loosens the tissues and epidermic cells until the latter are carried away. Then the swollen and distended papillæ are exposed, covered on the top only by leucocytes and freshly formed epidermis, and give rise at length to granulations that cannot be distinguished from those already described.

Ulcers present certain varieties, which are well marked in proportion to the specific nature of the cause that has excited them; some (*e. g.*, the primary syphilitic sore and rodent ulcer) being absolutely characteristic; others, as in the case of lupoid and scrofulous ulcera-

tion, shading off, as it were, into the commoner forms; and they exist under different conditions, *e. g.*, healing, stationary, and spreading, which are sometimes, though wrongly, described as varieties, owing to the constancy of their character and the frequency of their occurrence.

The healing ulcer.—During the healing stage all ulcers present the same appearance; the cause does not signify; if it was specific, its action must have come to an end for the ulcer to be healing. The surface is smooth and even; if depressed, it shelves down gradually from the surrounding skin. It is covered over with bright red, small, uniform granulations, neither painful nor tender, and not inclined to bleed when touched. The discharge is small in quantity, and consists of healthy, laudable pus. The margin is soft and pliable, with a well-marked band between the granulations and the skin where the new cuticle is forming. This band, which is of a peculiar bluish tint, from the red blood vessels seen through the thin layer of opaque cells, never appears except in close contact with already existing living epidermic cells. If it should start from any other point it is either because some epidermic cells have been detached from their natural site and fallen on healthy granulations (as in skin grafting), or because some of those more deeply placed (as in hair follicles) have been left behind, the whole thickness of the skin not being destroyed. Only the thinnest, last formed part has this peculiar tint; as it becomes thicker and older the blood vessels underneath are obliterated by the progressive contraction of the deeper strata of cells, and the color gradually fades, until, in an old cicatrix, there is a peculiar dead-white tint, shaded sometimes here and there with patches of pigment derived from the hemoglobin of old extravasations.

The skin around is soft and flexible, able to move freely on the adjacent tissues, otherwise the base of the sore cannot contract. This power of shrinking at the base, which is due to the organization of the deeper lying strata of cells, is essential to the healing process. If the skin is fixed down, or if the size is so great that contraction is impossible, cicatrization either never takes place at all, or is very much delayed. The scar of a circular ulcer surrounded by healthy skin is seldom half the diameter of the

original sore, measured as soon as healing is complete, so that the contraction is at least four times more efficient in bringing this about than the formation of the new cuticle round the margin.

The spreading ulcer.—An ulcer that is increasing in size presents an appearance in nearly every respect the reverse of this. According to the rapidity of its progress it is said to be *spreading*, *inflamed*, *phagedenic*, or *sloughing*. There are no granulations; the base is covered with shreds of sloughing tissue of all sizes, hanging on by the fibrous septa that resist the longest. The color varies from ashy gray to a dirty yellow, unless, as is commonly the case, there have been small hemorrhages on or beneath the surface. It is no longer uniform and level, but, according to the rapidity of the progress and the size of the sloughs, is eaten out and excavated in the most irregular manner. So also with the margin; if the ulcer is merely slightly inflamed, this is thickened and rendered firm by the exudation, and the edge of the sore is sharp and cleanly cut; or there may be sloughs of all sizes. When it is spreading rapidly, the edge and base melting away in minute fragments, so that without there being any large sloughs its size increases visibly from day to day, it is said to be phagedenic. This seldom occurs except in connection with syphilis, or as the result of exposure acting on a broken-down constitution. The more severe sloughing form, where extensive tracts in the neighborhood suddenly become gangrenous, is almost confined to such affections as hospital gangrene.

The discharge from a spreading ulcer is always greater in amount than when it is healing; often it is offensive, or irritating to the skin round, loaded with *débris* of broken-down tissue floating in a thin semi-purulent fluid, or stained with blood. The tissues round a sore in this condition are swollen, reddened, and hot, the seat of a burning, throbbing pain, and often covered with a number of small vesicles or acute eczematous ulcers.

Sometimes in senile ulcers, or those which are slowly getting larger, small spots of gangrene make their appearance on the base or round the margin, due to sloughing of the granulations. This is most commonly met with after prolonged exposure to cold or wet in chronic ulcers of the leg, where the nutrition has for a

long time been carried on with difficulty, and leads to the sloughing appearance so common in ulcers of this character during the winter months.

The chronic ulcer.—The most typical chronic ulcers are those met with on the lower extremity in persons who are past the prime of life, and who are compelled to stand for a long time every day. The favorite situation is just above the ankle, on the inner side of the limb. Here, from many causes, poverty of blood, disease of important organs, gravity, obesity, obstruction to veins and lymphatics, ulcers are more common than anywhere else; and owing to the persistent nature of the causes and the peculiarity of the local conditions, the scantiness of the subcutaneous tissue, and the readiness with which the base becomes adherent, are kept in a chronic, almost permanent, condition, sometimes healing a little, and again, when circumstances are unfavorable, breaking out once more as bad as ever.

The size, shape, appearance, character of the edge and base, present the greatest variety. They may extend completely round the limb; but unless there is some specific cause, such as syphilis, they seldom reach above or below the limit mentioned. The base may be pale, smooth, glistening, and painless, or it may be irregular, with deep cavities exposing the muscles and tendons beneath.

They are called *exuberant* or *fungous* when covered over with large irregularly sized granulations, that bleed at the least touch, such as form commonly after extensive burns; and *weak* or *œdematous*, when they are large, pale, and flabby. True granulations, small, uniform in size, and bright in color, are never to be seen, though here and there, if the surface is smooth, small vascular elevations ready to become such may be detected.

In the same way the edge never shows the smooth, even, shelving level leading from the surface of the granulations to the true skin around. The margin of the latter may be concealed completely, in the fungous form, by the overhanging granulations which project above it; or it may be steep and sharply cut, with an edge as well defined as if the ulcer were inflamed. This is due in general to the state of the tissues around which are thickened and hardened so as to be almost solid from chronic congestion and œdema. In

the *callous* form this change has gone farther still, for here the edges are raised and rounded, firmly adherent to the tissues beneath, and covered over with a thick layer of whitened, sodden epidermis.

The character of the skin around a chronic ulcer gives rise to still further subdivisions. It may be congested, swollen, as if it were inflamed, dusky red in color, and deeply stained with pigment deposits of long standing (the congested ulcer).

Of it may be eczematous, with numerous minute and superficial ulcers surrounding a larger one, which has commenced in the same way. These are, for the most part, shallow and associated with varicose veins, though this is only one of many causes, all of which tend toward the same end (the eczematous ulcer).

The history of a *congested ulcer* usually is that on the inner side of the leg a small reddened patch makes its appearance in the skin, not affecting the surface; this becomes larger and larger, and, as it spreads, the color in the center becomes more dusky from old blood staining mixed with recent congestion. After this the skin and subcutaneous tissue alter their textures; the former becomes dry and scaly, the latter shrinks, becomes tough and hard, no longer flexible or accommodating itself to the movements of the tissues lying beneath, but firmly adherent and bound down. When this stage is reached, if a scratch detaches a small portion of the epidermis (and at times even this is not required), the skin, being badly nourished from the prolonged congestion, decays and leaves a chronic ulcer, often circular, deeply cut, and surrounded by hard, unyielding tissues.

The true *eczematous ulcer* is, as a rule, the consequence of an attack of eczema in a leg that is œdematous from any cause. Under these circumstances the blood vessels and lymphatics are distended with fluid, and all the intercellular spaces, even in the papillæ and between the epithelial cells, loaded with an accumulation of serum. If, then, an attack of eczema breaks out, vesicles form readily on the surface, lifting up the firmer layers of epithelial cells, and exposing, when they break, the softened tips of the enlarged papillæ, covered still by a stratum of the cells that have not yet

been able to undergo the normal keratin change. These rapidly melt away, owing to the large amount of fluid discharged, and the swollen, tender, and congested papillæ are irritated and inflamed so that they spring up in the form of granulations. All stages of this process may be seen at once; often there are several small eczematous ulcers close together, all superficial, and covered with coarse congested granulations; around them are numerous vesicles discharging a slightly tinged fluid that stiffens on linen as it dries, and resting on a reddened, scaly, tender, and congested skin. Farther away the changes are less and less marked, until the region of unaffected skin is reached. Properly speaking, so long as it is superficial and surrounded by skin, in a state of acute eczema, this should be regarded as a variety of eczema rather than as a special or peculiar form of ulcer of the skin. When deep it merits the term ulcer.

As a rule, chronic ulcers are devoid of severe pain. There is often, especially after long standing, a dull, aching sensation, owing to the tension to which the tissues are subjected, but unless a nerve filament is exposed on the surface or involved in some way in the margin, acute pain is generally absent.

The croupous ulcer.—Sometimes ulcers, no matter what their origin may have been, assume a croupous, and even a diphtheritic condition. In the former a firm yellow coating forms on the granulations, from which it may be easily peeled off without any serious result. It seems as if, from causes at present unknown, the discharge, that is in general thrown off as pus, coagulates and forms a dense rind of fibrillated material, mixed with fungous spores, which may be renewed from day to day. In the latter the appearance is the same; but, in addition, there is severe local inflammation, with high fever, and even typhoid symptoms.

The scorbutic ulcer.—Another ulcer, known *often* as the hemorrhagic, has been described in connection with scurvy. The surface of the ulcer is covered with clots, owing to the state of the blood, and the granulations, when they are present, bleed with the greatest ease.

The epitheliomatous ulcer.—Malignant disease gives rise to several different forms of ulcer, which are quite definite and derive their importance from the nature of

the growth that incloses them. Epitheliomatous ulcers rarely occur under forty years of age, and become after that period each year more and more common. Their ordinary situation is at the junction of the skin and mucous membrane, or on cicatrices, and where parts have been for a long time subjected to irritation.

The base is hard, nodular, and irregular, often covered with sloughs and a foul purulent discharge; the edges are just the same, hardened and everted by the growth around them, which spreads into the tissues in the neighborhood and binds the sore firmly down. The rapidity of the growth varies much, according to the situation, and so does the enlargement of the neighboring lymphatic glands; but it is always an affair in which months make a distinct difference. No matter how careless they may be, patients rarely allow three months to pass before they seek advice. The amount of pain varies in different cases; exceptionally it is altogether absent; more often it is constant, increasing tenfold when the sore is touched.

The scirrhus ulcer.—The type of scirrhus ulceration is seen on the breast in cases of atrophic hard carcinoma. The base is very deeply excavated, pale pink in color, perfectly smooth and glazed, without any signs of granulations, and with little discharge. Under and round it is a mass of dense growth, rendering it perfectly immovable on the tissues below. The edges are raised, often overhanging from the ulceration eating them out, peculiarly hard, very steeply cut on the side of the ulcer, but shading off gradually into the skin outside, which is often puckered and wrinkled in a radiating fashion from the contraction that has taken place. These ulcers are naturally much more common in women; rarely occur under forty, and may last without apparent change for five and even a greater number of years. They are always preceded by a deep-seated tumor, which slowly and gradually involves the skin lying over it.

The fungating ulcer.—Soft sarcomatous and carcinomatous growths may, moreover, give rise to fungating ulcers of the most frightful description. There may be an opening in the skin, through which protrudes a mass of malignant growth, mixed with granulation tissue, and yielding a discharge of pus and

blood, breaking down at the slightest touch ; or the skin itself may be involved in the growth, so that there is no cavity from which the fungus can sprout, merely a rapidly growing, protruding, bleeding mass. These are unmistakable ; when once the skin is broken, and all pressure removed, the pace at which they grow is amazing. They may follow any form of malignant disease, even epithelioma, if it is continually irritated by mild caustics, and of course depend for their age and their clinical significance on the nature of the growth that has given rise to them.

The rodent ulcer.—Another form of ulcer frequently confused with epithelioma is that known as rodent, distinguished clinically from the former in that it never involves lymphatic glands, or causes secondary deposits, or induces any cachexia. Like epithelioma, it is most common in elderly people, but its situation is almost confined to the head and face, and particularly to the neighborhood of the eyelids. Its growth, too, is infinitely more slow ; it takes years to make as much progress as epithelioma does in months. The base is smooth and glossy, with little or no discharge, and the edges, though they are hard from the new growth that infiltrates their tissue, are smooth, rounded, and “rolled over.” Its first commencement is a small hard tubercle, often seemingly a wart, which slowly increases in size, sometimes becomes very prominent, and then ulcerates ; the growth does not extend deeply into the tissue until it has lasted a long time, so that the base remains freely movable, able to be pinched up, for a much longer period than in the case of epithelioma. Histologically, it seems to belong to the same class of tumors, and not improbably is epithelioma of the sebaceous glands ; clinically, it is totally different, as, after free removal, no matter how long it may have lasted, it never returns. Pain in connection with it is very rare.

The lupoid ulcer.—Lupoid ulceration is of a totally different character, even when it occurs on the face, which is the most common situation. It is, by far, most frequent in young people, and affects particularly the *alæ nasi*, at the junction of the skin and mucous membrane. It is preceded and surrounded, so long as it is spreading, by small tubercles ; but these are exceedingly soft, and break down and

ulcerate with the greatest readiness. Its growth varies much in rapidity, but it is always chronic, often spreading slowly at one part, healing at another, and then again breaking out fresh, as a soft red spot in the center of the old cicatrix. The edges are sharp, irregular, and eroded, never hard ; generally, small characteristic tubercles are present in the neighborhood. The depth of the base varies ; it may be quite smooth and superficial, with pale flabby granulations, secreting a small amount of pus, which dries and forms scabs and crusts on the surface ; or it is deeper and more irregular, when the new growth has eaten into the cartilages. As it spreads in one direction it cicatrizes in another, which rodent and epithelioma never do, leaving a thin, red, and irregular scar, which often breaks down again.

This form of lupoid ulcer is most often associated with scrofula, but there are others of which this does not hold good. One is common on the hands, particularly on those who have much to do with post-mortem work, and is quite independent of age or diathesis. It commences generally as a wart-like growth, covered over with scales, under which a slow process of ulceration takes place, and gradually involves the adjacent tissues. There are no small, even-sized, pale or gelatinous tubercles, such as are met with in strumous lupus, but it closely resembles this in the way it infiltrates the tissues and spreads.

The syphilitic ulcer.—Syphilitic ulceration presents the greatest variety. Particularly in the tertiary stage, sores may appear on the face, which simulate very closely some of those already mentioned. They are, however, always much more rapid ; at the most, it is a question of weeks, more often of days. As a rule, they occur about middle life, though other ages are not exempt. The base is never bound down to the subjacent tissue, as it is in epithelioma, and the margin never presents that cartilaginous hardness which is the characteristic feature of this disease and of rodent. The edge may be sharply cut, especially if the ulcer is progressing rapidly, and even overhanging ; but it is always soft, never raised above the level of the skin round it, or everted. So long as syphilitic ulcers are in the spreading stage, that is, so long as they retain their specific

character, the base and margin are either covered with slough, or are of an angry, dusky red tint, with a thin blood-stained discharge, mixed with broken-down *débris*. The skin round is reddened for a slight distance, and may, especially in those cases that simulate lupus closely, be thickened and congested for a considerable distance; but there are never any small translucent lupus tubercles with healthy skin between. This alone, with the different character of the base, would distinguish them, even if the rapidity of the process were not taken into consideration. Tertiary syphilitic ulceration will spread farther and wider in a week than lupus will in six months. The character of the cicatrix formed is quite as distinct. In lupus there is nearly always, at one point or another, some evidence of cicatrization, of the formation of a thin, red, unstable scar; in tertiary syphilis, except in the serpiginous form, which is characteristic in other ways, this is never present. When the violence of the poison has been overcome, the ulcer heals, leaving more or less of a depression, occupied by a dead white cicatrix, with pigment patches here and there, wrinkling up like tissue paper when it is pinched laterally, and never breaking down.

There are certain parts of the body which are especially the seat of syphilitic ulceration. They are the scalp, the angles of the mouth, the alæ of the nose, the junction of the hairy part of the scalp with the neck and face. Serpiginous tubercular syphilitic eruptions are especially common in the last-named region; also over the sternum and round the knee-joints. It has been said that every ulcer on the leg, above the middle, is syphilitic. But they may occur anywhere. The ulcers on the scalp are often associated with exposed bone. Those about the mouth are apt to leave peculiar linear scars.

There are two forms, distinguished by the locality and the amount of the syphilitic deposit. In the one there are large accumulations (gummata) in the subcutaneous tissue, which slough out and leave deep circular holes, with overhanging edges, of all sizes and in any number. In the other the deposit is in the substance of the skin, raising it up in the form of dusky red, scaly tubercles, arranged in circles, or parts of circles. Sometimes these subside without leaving

ulcers; or they break down, and then a ring of superficial sores is left with a patch of reddened congested skin in the middle. These ulcers are peculiar in the way they spread, healing on the concave side and extending on the convex, so that often horseshoe-shaped sores are formed, which creep, in this fashion, over a large surface of skin before they finally get well.

The strumous ulcer.—Scrofulous and strumous sores are most common in the neck, in the groin, over diseased glands, and over inflamed joints; but they may occur anywhere, particularly on the legs, in young and poorly nourished patients. They are chronic, painless, and discharge only thin, oily pus. The base is pale and flabby, with coarse œdematous granulations, and the skin round is undermined for long distances, so that the edges overhang, with loose flaps of a blue or purple color; sometimes distant sores are connected together in this way by long superficial sinuses running under the skin lined with unhealthy granulation. When they do heal, the cicatrices are thick and irregular, with seams and bars running across them.

These various forms of ulceration are not always clearly distinguished from each other. A varicose ulcer of the leg, for example, may have had both an eczematous and syphilitic origin; and become chronic, as much from general malnutrition as from the impediment to the circulation, of which again varicose veins may be only one cause out of many. Local and constitutional causes in nearly all cases combine together, and the ulcer breaks out at the spot where the two can act with the greatest intensity.

The *treatment* of ulcers depends entirely on the cause. It may be local or constitutional; generally both together. In those that are caused by malignant growth the latter is of but slight service. Cancerous or rodent ulcers must be treated as carcinoma is.

Others, such as lupus and syphilis, require both; in the former the growth must be got rid of by scraping with a sharp spoon (which removes all the new tissue without injuring the old), and afterward applying the actual cautery, or the acid nitrate of mercury. But the tendency to return must be stopped by good food, fresh (especially sea) air, tonics, and cod-liver oil.

In syphilitic ulcers the constitutional treatment, by iodide of potash in gradually increasing doses, with bichloride of mercury, if the patient has not already been subjected to a prolonged course, is even more important. The spreading of the ulcer is due to the diathesis, its outbreak at a particular spot to local conditions.

If it is phagedenic, iodoform at night, with continuous warm baths during the day, will nearly always stop it. When this cannot be carried out the surface of the sore must be destroyed.

Iodoform succeeds nearly as well in ordinary syphilitic sores, especially if the taint is dying out. The more recent the infection and the more characteristic the ulceration, the more successful is the use of mercury, locally, in the form of black wash or blue ointment.

Many cases of tubercular ulceration, which obstinately resist treatment, yield readily when, in addition, subcutaneous injections of pilocarpin are made use of.

In scrofulous and strumous ulcers the constitutional treatment is even more important. They are often benefited by having all the unhealthy granulation tissue scraped out, the overlaying bridges of skin cut off and pared down, and, especially if they occur in the flectures of joints, by being maintained in thorough rest; but unless constitutional treatment is combined with this, the cure will not be permanent.

Ulcers that are healing get on best when left to themselves as much as possible. The tendency to exuberance must be checked by astringents, changing often from one to another; they rarely require more. *Skin grafting* assists very much in those of large size. Small fragments are removed from healthy skin, either by means of a sharp pair of scissors or by a proper pair of grafting forceps, and laid on the granulations near the healing edge. Each graft must include the growing stratum of epidermis, but need go no deeper. Within twenty-four hours it will be quite firm, and by the next day will have become the focus of fresh cicatrization. This, however, only succeeds when the ulcer is already healing; if the granulations are not quite healthy, either the graft does not take at all, or in a short time, especially in the case of burns, the whole of the newly formed epidermis melts away again.

Rest, elevation of the limb, warmth, or cold, according to the patient's wish, are the most effectual methods of checking the course of a spreading or an inflamed ulcer.

Deodorants and disinfectants may be made use of, but it is much more important to check the causes that have led to the sloughing. When this has ceased, the discharge will rapidly become healthy.

Irritable ulcers must be treated either by dividing the nerve that is exposed on the base, or by covering the surface with a protecting layer, such as that formed on the application of caustic. Under this it will generally heal as under a scab.

Chronic ulcers require a much greater variety of treatment, as the congestion and solid œdema, which help materially to originate them, generally depend on causes which it is impossible to prevent. In the most incurable the base cannot contract. Attempts have been made to remedy this by means of longitudinal incisions into the subcutaneous tissue on either side; by blistering, which, by the increased discharge it causes, helps to carry off some of the infiltrating material; and by careful and even strapping over the ulcer. This, especially if the discharge is slight, and the ulcer not eczematous, is one of the best. It causes absorption by its pressure, it prevents further congestion, and it tends to approximate the edges. The same result may be obtained, when the edges are thick and raised, by bandaging a thin piece of sheet lead directly over the sore. Here, in addition, the lead, which is gradually eroded, assists by the contraction it induces in the superficial vessels.

Martin's bandages, applied next to the skin during the daytime, from the foot up, are the most excellent when there is no tendency to eczema. When this is the case a number of small eczematous ulcers form from the retained secretion, and often make matters worse.

Of all local remedies, elevation and rest are the most efficacious; but ulcers healed under these conditions rarely remain sound when the patient gets about again. It must never be forgotten that the congestion and œdema, which help to originate the process, and more than anything else make it persistent, are only in part of local origin; that visceral degeneration, obesity, general malnutrition, and many other causes, all add their

quota, so that local remedies by themselves can rarely be successful.

When the sore completely surrounds the leg, or when the pain is continuous and unbearable from deep adhesions of the cicatrix, it sometimes happens that amputation is advisable, particularly if the patient is young and the blood vessels not affected by atheroma.

C. MANSELL MOULLIN.

Symptomatic Indications.—*Arsenicum* is valuable for inflamed ulcers with raw surface, red and hot; phagedenic and sloughing ulcers. *Belladonna* is useful in painful ulcers, allaying the pain and limiting inflammation. *Mercurius*, when ulcer is extending; especially ulcers presenting a raw appearance; syphilitic ulcers. *Phytolacca*, ulceration of mucous membranes, especially of nose, throat, and rectum. *Calcium sulphide* controls and limits suppuration; ulcers with bloody suppuration, smelling like old cheese. *Phosphorus* is useful for small ulcers having a punched out appearance; also in chronic cases with debility. *Arsenicum*, in old irritable ulcers in scrofulous subjects; fetid, corrosive discharge.

ULCERATIVE COLITIS AND ENTERITIS.—Ulceration of the intestine most commonly arises in the course of certain diseases, and is referred to under the appropriate headings (*see* **INTESTINES, TUBERCULAR DISEASE OF; TYPHOID FEVER; DYSENTERY; DUODENUM, ULCER OF**). The following affections are described in this article:

Simple Ulcerative Colitis.

Follicular Ulceration.

Distention Ulcers.

Ulceration due to Vascular Obstruction.

Stercoral Ulcers.

Ulceration due to Perforation of the Intestine from without.

Catarrhal Ulcers.

Neurotic Ulcers.

Simple Ulcerative Colitis.—A disease, without obvious cause, which is characterized by severe symptoms, and by a peculiar form of ulceration attacking chiefly the colon.

Symptoms.—The onset is insidious, diarrhea, which begins gradually, being the most striking and constant symptom. The bowels are ultimately open very frequently, sometimes every two hours. The motions are fluid, the color is very

various, depending much upon the amount of blood present, which, however, is not thoroughly incorporated with the motions. These are never dysenteric, and probably never contain pus; the amount of fecal matter is small, sometimes there is a little mucus and sometimes the odor is offensive, and in rare cases an occasional slough may be seen. The diarrhea very often alternates with constipation, lasting two, three, or four days at a time. In about a third of the cases there is some vomiting. Abdominal pain is usually present from the beginning of the illness, but it bears no relation to the ingestion of food. Abdominal tenderness is exceptional. The usual course is for the patient soon to become sallow, to waste and to get weaker, and finally, to die collapsed in about eight weeks, with a subnormal temperature and a feeble pulse. The disease is uncomplicated by any other malady, but chronic Bright's disease was present in three out of eleven fatal cases. It may kill by perforation of the intestine.

Diagnosis.—The rarity of the disease and want of knowledge concerning it make it quite likely that slight cases very often pass unrecognized. In severe cases the character of the motions and the absence of an exciting cause separate it distinctly from dysentery. The duration and the alternating attacks of constipation distinguish it from simple diarrhea. Especial care must be taken to avoid confounding it with intestinal obstruction; in one case the severe vomiting, the collapse, and the fact that the bowels had not been open for a few days led to this mistake, which was corrected by an enema, which first brought away scybala and subsequently caused the passage of much fluid motion and flatus. In another case motions full of blood, abdominal pain, and the fact that an ulcer could be felt per rectum led to the diagnosis of malignant disease of the intestine.

The *prognosis* is grave; if the patient die, it is usually about eight weeks from the time when the symptoms began; occasionally, however, the malady is fatal in a few days.

Pathology.—In a typical case, the muscular coat is exposed, and the ulceration is so extensive that only islets of mucous membrane are left here and there. Often these are considerably swollen, and con-

sequently they look taller than they otherwise would, and frequently they are more or less sessile, because the irregular ulceration undermines them. The result is that a careless observer concludes that the islets of mucous membrane are polypoid growths and the exposed muscular coat is the natural level of the colon. The vessels of the mucous membrane are dilated, and sometimes it is black, as though from long-standing congestion. The muscular coat is hypertrophied. Sometimes perforation occurs and sets up peritonitis. Usually, the large intestine is the only part of the gut which is affected, but in some cases enteritis and ulceration are present in various parts of the small intestine. Even at the autopsy sloughs are exceptional, from which we may conclude that the dead tissue is discharged as small shreds. Generally there is no attempt at repair, but one case is recorded in which, while one part of the bowel was severely ulcerated, pigmented spots in other parts were very suggestive of healed ulcers. As a rule, Peyer's patches are healthy, but in some cases they may be slightly swollen. Enlargement of the mesenteric glands is rare. Constriction of the bowel and plugging of the mesenteric vessels are unknown. In the majority of the cases the rest of the body is healthy, but in some the kidneys have been granular.

Ætiology.—The disease is not dysentery; the clinical differences are so well marked that this is certain, although in some cases there may be a resemblance in the pathological anatomy of the two conditions. Some have considered that the ulceration begins in small submucous collections of pus, which burst and discharge, but this is not so; others have thought that it commences in the solitary follicles. The reason against this view will be given under the head of Follicular Ulceration. On the whole the most probable hypothesis is that the disease begins as a catarrh of the intestinal mucous membrane. Of the ultimate cause we know nothing. It is commoner in men than in women, in the proportion of eight to three. It never occurs in childhood, but usually between thirty-five and fifty-five years of age.

Treatment.—The best hope for the patient lies in abundance of easily digestible food, peptonized if necessary, so

that there may be as little fecal matter as possible to irritate the ulcerated surface; hence the patient should take little but milk in small quantities each time, but at frequent intervals, and any alterations in diet which may be resorted to during convalescence must be made very gradually. He should be kept under the influence of opium, as it is probably the best drug for restraining the diarrhea. Usually he is better for some alcohol.

Follicular Ulceration.—This variety is frequently found in patients who die of exhausting diseases; sometimes, therefore, it complicates malignant diseases of the intestines, typhoid fever and tuberculosis, and thus cancerous, typhoid or tubercular ulcers, as well as follicular ulcers, may be present at the same time. The condition is far more common in the large intestine than the small; it consists in the disintegration of the solitary follicles, the result being many small round ulcers with sharply cut edges, not at all undermined and not extending deeply. In a well-marked example the gut is quite honey-combed. No attempt at healing can even be seen, therefore there is no cicatrization. Perforation does not occur. The mucous membrane between the ulcers is usually not affected at all, but it may be slightly inflamed. It is doubtful whether these ulcers are of themselves capable of causing death, and no symptoms can for certain be attributed to their presence. The distinctions between simple ulcerative colitis and follicular ulceration are the following: (*a*) the appearance of the two conditions is quite different; (*b*) the two forms of ulceration are never seen to pass one into the other; (*c*) in simple ulcerative colitis the follicles are not described as affected, and when the small intestine is ulcerated Peyer's patches are rarely implicated; (*d*) simple ulcerative colitis is usually uncomplicated, and is generally the sole cause of death; follicular ulceration is usually a complication of some exhausting disease and is never the sole cause of death; (*e*) perforation of the intestine occurs in simple ulcerative colitis, but not in follicular ulceration; (*f*) chronic Bright's disease is the commonest complication of simple ulcerative colitis, but it is very rare in association with follicular ulceration; (*g*) other intestinal lesions are common in follicular ulceration, but are very exceptional in simple ulcerative colitis.

Distention Ulcers.—Whenever there is any obstruction of the passage of the intestinal contents, the distended gut behind the seat of obstruction is very liable to become ulcerated. The exact mechanism of the production of these ulcers is not known; probably they are due to irritation of the coats of the intestines by its contents. There is nothing particularly characteristic about the ulcers as regards their shape and position. They begin as small superficial erosions, and if the obstruction lasts long enough they, like all chronic intestinal ulcers, tend to become transverse to the long axis of the bowel. They may slough and lead to perforation of the gut, or may extend so deeply as to set up peritonitis without perforation. Usually, but not always, they are immediately above the seat of obstruction. The furthest distance above the obstruction in cases observed by the writer was six feet. The ulceration furthest from the obstruction is usually the least severe, and, if recovery take place, the first to heal. The obstruction must last some time for ulcers to form, but they have been found in abundance nine days after the onset of acute obstruction. The lymphatic follicles are not more liable to be ulcerated than any other part of the intestinal wall.

Ulceration due to Vascular Obstruction.—Severe ulceration of the intestine is sometimes due to a growth pressing upon the mesenteric vessels, and sometimes to vascular obstruction from atheroma, thrombosis, or plugging by infarcts of the mesenteric arteries. Our knowledge is too scanty for us to say whether there is anything characteristic in this variety of ulceration. It is interesting to observe that it may be transverse even when not chronic; possibly this is due to its following the distribution of the vessels. Strange to say, although the inner coats of the bowel are inflamed and ulcerated, the peritoneum usually escapes and peritonitis is generally absent; the ulceration may be severe without producing any symptoms.

Stercoral Ulcers.—In cases of long-standing constipation, especially if it be severe enough to constitute fecal impaction, the irritation of the hard masses of feces leads to the formation of small ulcers. These do not produce any symptoms and usually heal when the consti-

pation is overcome; they, and the intestinal catarrh which accompanies them, are the cause of the diarrhea, which may persist for a few days after the removal of the feces in a case of fecal impaction.

Ulceration due to perforation of the Intestine from without.—This is an extremely rare condition, seen in those cases of chronic peritonitis in which a number of small localized abscesses have formed between the matted coils of intestine, which, bursting into the gut, form a number of small rounded ulcers.

Catarrhal Ulcers.—Some authors describe simple catarrhal ulcers, which may begin with simple lesions of the epithelium, or as minute collections of pus, which burst and give rise to small ulcers. This form of ulceration is decidedly rare, and nothing is known of the symptoms which it produces.

Neurotic Ulcers.—It has been suggested that ulcers due to nervous diseases may form in the intestine just as a perforating ulcer forms in the foot, but on this subject we have no information of value.

In certain cases severe ulceration of the intestine, which cannot be referred to any known group, is found on autopsy,
W. HALE WHITE.

URACHAL FISTULA (Abscess).—The urachus is occasionally patent at the time of and after birth; very frequently the urachus at birth is tubular for a short distance above the bladder, but in after life it becomes a mere fibrous muscular cord. The urachus retains the tubular character of the allantois till about the thirtieth week of fetal life.

The kind of orifice is not the same in all urachal fistulae.

1. In some, a button-like papillary projection at the umbilicus, having an orifice at its summit, has been described. This has been kept constantly moist by a slight discharge having the odor of urine.

2. The urine may escape at several points on the surface of a hernial protrusion.

3. The orifice may be a mere deficiency (circular, oval, or irregular) in the linea alba.

4. It may be situated in a cup-like depression of the navel, or hidden from view by the falling together of the skin of the umbilicus.

5. The external covering of a hernia at the umbilicus is mucous membrane, which becomes pale and dry after prolonged exposure. The fistulous opening is at the side or on the summit of the hernia. In some cases, the protrusion acts like a plug to prevent the continual escape of urine, but is withdrawn during the act of micturition by the traction of the vesical muscular fibers, and thereupon urine is ejected at the fistula as well as along the urethra.

6. The fistula may be indirect. It will probably be so when an abscess precedes it. In one case there were pains in the lower part of the abdomen, with frequent desire to micturate, and conditions very similar to those caused by the presence of a calculus in the bladder. Afterward there was a discharge of pus, and of nearly all the urine, through the umbilical fistula.

Urachal fistulæ may either be *congenital* or *non-congenital*.

When preceded by an abscess, the fistula is non-congenital; and in some cases where there has not been an abscess, the fistula is not congenital, though, in all, the defect which predisposes to it, namely, the non-obliteration of the urachal tube, is of course congenital.

Mode of origin of non-congenital fistula.—When the lower end of the urachus remains open, some of the urine is forced into it at the commencement of each act of micturition, especially of straining micturition. If the bladder becomes in course of time inflamed, the straining in micturition will increase the dilatation of the urachus. If the vesical orifice of the urachus becomes very minute, or even closes, the tube may be converted into a shut sac; and then, if any urine or mucus is inclosed within it, inflammation and abscess will be caused, and the abscess may either burst spontaneously or be opened by the surgeon at the umbilicus, where it points. A non-congenital fistula may thus be formed, independently of any mechanical obstruction, at the neck of the bladder or in the urethra.

When an abscess occurs after the obliteration of the vesical end of the urachus, and opens at the umbilicus, the resulting fistula is non-congenital, and may or may not be complete or urinary, according as there is, or is not, a communication between the abscess and the bladder.

Complications of urachal fistula.—

Some of the complications are in part causes, others are results, and others, again, merely coincident. Polypus of the bladder, urethral calculus, phimosis, congenital stricture, and everything which prevents the free discharge of urine by the natural passage, are only in part causes, as there must be also an imperfect closure of the urachus to permit of a true urachal fistula. When this patency does not exist the bladder, ureters, and kidneys may all become sacculated without any tendency being shown to dilatation or reopening of the urachus. This is proved by cases of congenital hydro-nephrosis.

Prognosis.—When the fistula is congenital, and caused by some obstruction to the outflow of urine, the prognosis is unfavorable, as death from renal disease is likely to result, unless the source of obstruction be removable, like phimosis or urethral calculus.

When the fistula is non-congenital and follows cystitis or abscess, the health of the patient will have been probably greatly destroyed before the fistula is established, and death will subsequently occur from exhaustion, cystitis, or pyelonephritis. Simple patency of the urachus without urinary obstruction, though inconvenient, need not interfere with life.

Treatment.—When phimosis exists, circumcision should be performed. When a calculus is present, it must be removed. If cystitis exists, dilatation of the urethra in the female, and median external urethrotomy in the male, will assist in relieving the cystitis if it does not cure the fistula.

If the umbilical orifice is a vent for pus or urine which cannot easily be made to pass by the urethra, no attempt to close it should be made. When the opening is on a papillary outgrowth, it is sometimes sufficient to apply a ligature round the base of the papilla, which will soon dry up and fall off, leaving the fistula permanently closed. In other cases, nitric acid or the cautery may be applied to freshen the edges of the orifice and start healthy granulations. In some cases, dissecting off the skin around the opening, and bringing the raw surfaces together with hare-lip pins, has proved very successful. C. MANSELL MOULLIN.

URÆMIA.—A condition caused by the retention within the body of poison-

ous products which should be eliminated by the kidneys.

Symptoms.—The animal organism is a laboratory in which poisons are being constantly generated. Many of these are eliminated by the kidneys as rapidly as they are formed. If, however, from any cause these organs make default, or if there be any prolonged obstruction to the outflow of urine, accumulation of some or all of the poisons takes place, and characteristic symptoms are manifested. But the accumulation may be very slow, and the earlier symptoms, corresponding to the comparatively small dose of poison, may be but slight; yet they are in kind, though not in degree, as indicative of uræmia as are the more alarming ones which appear toward the end, and to which alone the name of uræmia is often given. Not only from the varying rapidity of this accumulation, but from other causes to be mentioned, will the symptoms of different cases of uræmia vary greatly. Whatever be their nature or intensity, however, they always point to an intoxication, and most frequently to an intoxication of the nervous centers. From healthy urine Bouchard has obtained at least seven distinct poisons, of which two are convulsivant, one diuretic, one narcotic, one sialagogue, one pupil-contracting, and one temperature-reducing; and has shown that these poisons are produced in different relative amounts at different periods; for, whereas the night urine contains so large a proportion of the convulsion-producing substances as to make it predominantly convulsivant, the day urine has more of the narcotic poison, and is hence soporific in its action. In diseased conditions there is evidence of the formation of yet other poisons, over and above those produced in health. Taking these facts into consideration, and remembering the occasional deviation from the usual symptoms in cases of poisoning by a single substance like arsenious acid, depending probably upon the special reaction of the individual, there is no reason for surprise at the anomalies presented by uræmia. There is good evidence, too, that poisonous alkaloids, such as xantho-creatinine and others, whose nature is only now beginning to be studied, are formed within the animal body in health and still more in disease, and that they, if retained, as they are apt to be in derangements of

the kidneys, produce special toxic effects.

One of the earliest and most constant of all the symptoms is vomiting. It is seldom entirely absent, and sometimes is so frequent and persistent as ultimately to lead to death by exhaustion. In such cases the nervous system usually remains unaffected throughout, neither muscular twitchings, convulsions, paralysis, coma, nor other nervous symptom appearing. The writer has seen this not only in cases of acute and chronic parenchymatous and interstitial nephritis, but in permanent plugging of both ureters. No special poison having emetic properties has as yet been obtained from urine, but urinous products are certainly at times excreted freely by the gastric mucous membrane in uræmia; and, when there is such excessive vomiting, the amount of liquid thus discharged seem often to be in excess of what is ingested. The patient under such circumstances wastes rapidly, even if sustained by nutrient enemata.

Much more frequently, however, the retained poisons affect the nervous centers; headache, or various disturbances of special senses, especially of the sight, convulsions, coma, paralyzes, or nervous dyspnoea of asthmatic type, with, at the same time, always some amount of vomiting, occurring alone or variously combined, and presenting various clinical pictures allied to those of alcoholic intoxication, epilepsy, or apoplexy, but always distinguished by the fact of a relation to antecedent renal trouble.

As to the mechanical theories of uræmia, such as cerebral anæmia, or œdema, or plugging of arteries, it is not necessary to do more than allude to them here, for although cerebral œdema and anæmia are doubtless often present, and when present must produce symptoms, it is equally certain that they are often absent, and that the only constant and invariable factor is the retained urinary poisons. One must not omit to mention among the signs of the uræmic state unpleasant and sickening odors both from lungs and skin, which are sometimes recognizable on approaching the patient's bed. Volatile poisonous products are probably discharged from the lungs and skin to the partial relief of the patient.

The relation of the amount of total

daily urinary products of the body weight of the individual is a matter of great importance, and where for several successive days the proportion falls below what is normal, some significant symptom or symptoms of poison will certainly appear. If the kidney be contracted and the heart large, besides the headache and epistaxis which may simply result from heightened blood-pressure, vomiting is almost certain to occur, or irritating cutaneous eruptions. Later, sight may suddenly disappear and as suddenly reappear; the ophthalmoscope revealing no change in the fundus oculi.

Uræmia, as manifested by one or more of the symptoms mentioned, may occur in all forms of Bright's disease, but it is only in the acute parenchymatous inflammations of the kidney, such as those following scarlatina, that it is ushered in very suddenly and sometimes with overwhelming violence; convulsions, coma, and death succeeding each other in a few hours. In most, if not all other conditions, there are significant warnings that should prevent us from being surprised by the patient lapsing into stupor or some similarly alarming state.

The safe plan is to regard the earlier and slighter symptoms, not as indicative of a condition that may lead up to uræmia, but as indicating uræmia itself.

Treatment.—The four great sources whence the urine derives its toxicity are: (1) Aliments, and especially their potassium constituents; (2) the absorbed products of intestinal putrefactions; (3) secretions, such as bile, etc.; and (4) tissue disintegrations. We can control the food, disinfect the intestinal contents, limit the secretions, and to an extent check disintegrations, and by all these means do good. Milk contains but little potassium compounds, requires but a small amount of bile for its digestion, and is closely allied to healthy blood. Milk is hence the best diet. By the use of such drugs as salol, or Bouchard's well-known mixture of naphthaline, iodoform, and animal charcoal suspended in glycerine and water, we can disinfect the intestinal contents. In very acute cases, such as those following scarlatinal nephritis, a free bleeding will often abstract enough of the poison to restore the patient from an apparently desperate condition and even permanently cure him. Free purgation

will almost always give relief; while transfusion has, in extremely critical cases, occasionally warded off death for a time. Experience has shown the value of free purging and diaphoresis; while there is growing evidence that increased oxidation, obtained by active exercise, when the condition of the patient permits this to be taken, by the employment of the compressed air bath, or by the inhalation of oxygen itself, is useful instead of injurious.

When the pupils are dilated and the preponderating physiological effects of the retained urinary poisons are like those of atropine, the hypodermic injection of morphine is of the greatest advantage. Where purgation is required, but vomiting is persistent, the slow introduction of the enema *magnesii sulphatis* will produce a copious evacuation in from five to seven hours.

WILLIAM CARTER.

Symptomatic Indications.—*Jaborandi* has proved useful, eliminating urea. *Asclepias syr.* may be useful, increasing urinary solids. *Digitalis*, in contracted kidney, gave relief, when drowsiness, insensibility, and frequent convulsions were present.

URETHRA AND BLADDER, FEMALE, DISEASES OF.—**Dilatation of the Urethra** is occasionally met with. It has been produced by the passage of calculi or tumors; by excessive dilatation for surgical purposes; by the introduction of foreign bodies; by the patient herself; by lupous ulceration; and there are cases in which the urethra appears congenitally of unusual capacity. The condition gives rise to irritability of the bladder, or in the worst cases to incontinence of urine. In simple congenital largeness there are no symptoms, or they are slight only.

Treatment.—The best treatment is to insert a bulbous actual cautery into the urethra for a second or two, so that a small slough may be produced, and the resulting cicatrix contract the urethra. In bad cases treatment is very unsatisfactory.

Partial or Saccular Dilatation of the Urethra (*Urethrocele*).—This condition is rare. Such diverticula as are of any size are produced by cysts which have opened into the urethra. Saccular dilatation of the urethra, independent of a cyst in its

wall, is exceedingly rare, does not reach a high degree, nor, when uncomplicated, cause any symptom.

Prolapse or Inversion of the lining membrane of the urethra, or even of the bladder, is occasionally met with. The latter is the rarer. It seems to be associated with congenital largeness of the urethra. Prolapse of the urethral mucous membrane occurs usually in children, as a result of some straining effort, such as a violent attack of coughing. It forms a sort of deep red frill round the urethral orifice. The protruded part quickly becomes congested, deep red or purple in color, and readily bleeds, but is not very tender.

Treatment.—The protruded part should be cut off, either with the Paquelin cautery knife or with scissors, the edges of the cut mucous membrane being in the latter case united by sutures.

Stricture of the Urethra is much less common in women than in men. Normally, the female urethra is almost always large enough to admit a No. 14 catheter, and generally No. 17, but it may be congenitally small.

As in men, urethral stricture may be the result of gonorrheal inflammation. It may be cicatricial, following injury received in labor, or result from syphilitic ulceration. There is a form of stricture met with in old women, in which there is fibrous thickening of the whole length of the canal. As the urethro-vaginal septum is the homologue of the prostate gland in the male, these cases may be analogous to enlargement of the prostate in the male. There are also cases of stricture due to the fibrous overgrowths which accompany the disease known as lupus of the vulva (*q. v.*). These growths sometimes surround the meatus, and make the channel so small that it is difficult to get in even a fine probe. Cancer occurring in the anterior wall of the vagina leads to great narrowing of the urethra. Lastly, there are rare cases of passing retention of urine following cold, drink, and debauchery, and believed to be due to spasmodic stricture, such as occurs in the male. It is very rare for stricture of the female urethra to lead to the serious diseases of the bladder, ureters, and kidneys that are such common results of stricture in the male, for the reason that the treatment of stricture in the female is so simple and so success-

ful. But these secondary morbid changes do sometimes occur.

The *symptoms* are simply irritability of bladder, with often tenesmus and pain in micturition, and occasionally retention of urine.

The *diagnosis* is readily made by the obstruction encountered by the catheter.

The *treatment* of stricture in the female is rapid dilatation by the passage of bougies of gradually increasing size. This treatment is almost invariably successful, except in cancer, in which the best course is to open the bladder from the vagina with the knife, and so establish a vesico-vaginal fistula. This will relieve the patient from the intolerable tenesmus. In spasmodic stricture the passage of a catheter is all that is required.

Urethritis (*Inflammation of the Urethral Mucous Membrane*) is very common, arising by extension of inflammation from the vagina. It is usual in gonorrhea, and in vaginitis from other causes. Some reflex congestion of the bladder and urethra occurs in most pelvic inflammations, and causes the vesical irritability and scalding in micturition which are usual symptoms in these conditions. This slight superficial urethritis seldom requires special treatment apart from the accompanying inflammation elsewhere, to which it is due.

Congestion of the Urethra and of the cellular tissue around it is most often seen during pregnancy. The urethra is swollen, thickened, and tender; it may feel like a cord as thick as the thumb, or even larger. The symptoms are pain and frequency in micturition, and dyspareunia. The cause of these symptoms will be ascertained by vaginal examination, when the tender swollen urethra will be felt. The treatment consists in recumbency, laxatives, warm hip baths, and vaginal douches, and avoidance of alcohol. If not treated this form of disease is apt to be very chronic, and may go on to the formation of an *abscess* in the urethro-vaginal septum. In that case the swelling becomes larger, harder, rounder, and more tender, and the symptoms more troublesome. The condition may remain apparently stationary for many months, but at length the abscess bursts, and the patient is relieved.

Treatment.—If there be doubt about the nature of the swelling the urethra should be dilated and the abscess opened,

either on the urethral or the vaginal aspect, according to the side on which the tissue limiting the pus seems thinner.

Dermoid Cysts sometimes occur in the urethro-vaginal septum. Cysts are also met with which do not show evidence of a dermoid character. Such cysts, dermoid and others, sometimes suppurate and discharge into the urethra. A suppurating cyst will be distinguished from an abscess by its internal surface being smooth, not irregular and granular like the cavity of an abscess, and later on by its course, for it does not heal but continues to discharge.

The *treatment* is to excise from the vagina as much of the cyst-wall as forms a diverticulum from the urethra, and then bring together with sutures the raw surfaces left by the incision.

Urethral Caruncle is a small, bright red growth from the posterior part of the meatus urinarius. These growths vary from the size of a hempseed to that of a filbert. When large they look something like a cock's comb. They consist of connective tissue, which may be found to have undergone at places myxomatous degeneration, are very vascular, are usually covered with pavement, sometimes with columnar epithelium; they may contain many glandular follicles, and are very rich in nerves.

Symptoms.—These depend upon the extreme sensitiveness of the growths. They consist of severe pain during micturition, during sexual intercourse, or whenever the part is touched. If the growth be large, walking therefore becomes painful. They readily bleed, and hemorrhage on contact is a frequent symptom.

The *diagnosis* is easily made by inspection. The growth is quite superficial, springing from the mucous membrane, and not invading deeper parts; this distinguishes it from cancer.

Ætiology.—Nothing is known of this. They are hardly ever seen in children; but may occur at any age after puberty. It has been asserted that they are of gonorrheal origin; but they are often found without any evidence of past or present gonorrhea. They occur in virgins as well as in those who have borne children.

The *treatment* is to cut away the growth and destroy its base. This is most easily done by putting the patient

in the lithotomy position, protecting the adjacent mucous membrane with a piece of wet lint, guarding the rest of the urethra by a wooden staff passed into it, and then cutting through the base of the growth on to the staff with the red-hot knife of the Paquelin cautery. These growths are apt to return, even after what appears to be thorough removal.

A condition resembling caruncle, viz., *bright red patches*, exceedingly tender, is sometimes seen along the course of the urethra. Attention is called to this condition by the pain which the patient suffers in micturition, and the great sensitiveness which is manifested when the catheter is passed. If then the interior of the urethra be examined with a speculum, these red patches will be seen. Their nature has not yet been ascertained.

The *treatment* which is generally successful is the application of iodoform. This may be blown in by means of a quill, or applied in the form of an iodoform bougie.

Very similar symptoms are produced by the presence of *congestion and ulceration* around the vesico-urethral opening. These changes have been seen by the endoscope. They are cured by *treatment* such as is effective in cystitis—viz., urethral dilatation, or the making of a temporary artificial vesico-urethral fistula.

Varicose veins in the wall of the urethra are occasionally seen in women who have had many children. They usually accompany varicose veins of greater size in adjoining parts. Such varicose veins and urethral caruncles have alike had the term "urethral hemorrhoid" applied to them. But the purplish red swellings which varicose veins form do not present the extreme tenderness and characteristic of caruncles. They scarcely ever require special treatment.

New growths are occasionally met with in the urethra, but are comparatively unimportant, because they are so rare. *Mucous and fibrous polypi* have been observed. They can be removed by twisting them off, if small and near the meatus; but if large and near the neck of the bladder, their removal should be accompanied by opening the bladder from the vagina. *Sarcoma* of the urethra has been once observed. The urethral orifice may be affected in common with other parts of the vulva by various diseases

which are described elsewhere, such as syphilitic condylomata, ulceration, etc., follicular inflammation, lupus of the vulva (*esthiomène*). The urethra may be invaded by cancerous or tubercular disease; but these diseases very seldom primarily affect it.

Neuroses of the urethra have been described, but this is generally a convenient term for a case which has been incompletely investigated, and in which consequently, therefore, the real disease has not been diagnosed.

Bladder.—Cystitis (*Inflammation of the Bladder*).—Cystitis in women differs from that disease in men as to its causation. It is most common as a result of retention of urine due to retroversion of the gravid uterus; or following labor, or after operations on the uterus or its appendages, but it is rare as a result of urethral stricture. In connection with pregnancy and labor cystitis of great severity is sometimes seen. It may go on to sloughing and exfoliation of the whole vesical mucous membrane; or it may produce gangrene of the vesical wall at one spot, having as its result perforation of the bladder.

The *symptoms* are the same in both sexes. Exfoliation of the vesical mucous membrane should be suspected when, in a case of severe cystitis, the urine containing much deposit, we find the bladder apparently full, and on passing a catheter urine flows out, but suddenly stops before the bladder is emptied, and the point of the catheter feels as if it pressed against a solid substance within the bladder. When this is suspected, the best treatment is to cut into the bladder from the vagina.

The *treatment* of cystitis in the female is easier and more surely successful than in the male, because it is so easy to explore the bladder and remove foreign bodies by a vaginal incision. Exploration may be effected by dilating the urethra until it is sufficiently large to admit a small finger; if carried further, much risk of permanent incontinence of urine is entailed. To extract a stone, a growth, or a foreign body, an incision should be made in the middle line from the vagina. This can be closed with sutures, when what is required has been done. Even if not closed, it will often heal. In cystitis that has resisted all other treatment, and especially in painful cystitis (supposed to

be due to ulceration of the neck of the bladder) a cure may be affected by maintaining the vesico-vaginal opening patent for two or three months. It can then be closed by an easy operation, and usually the urine will then be found clear, and the function of the bladder free from pain.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is valuable in spasmodic stricture and in inflammatory conditions. *Cantharides* is useful for spasm; *camphor*, for pure spasm and for spasm from use of cantharides; *mercurius* is useful for purulent discharge. *Aconite* is the primary remedy in urethral inflammation and usually suffices to cure. *Belladonna* may be useful if the bulbus of the urethra is inflamed; *cantharides*, when there is much urging to urination; cutting and tearing pains. For inflammation of bladder see CYSTITIS.

URETHRA, STRICTURE OF THE.—Stricture of the urethra may be congenital or acquired. The former is rare except at the meatus, or within a short distance of it. The latter is due to the deposit of lymph in its walls, so that the diameter is lessened and the elasticity impaired.

The *causes* are: 1. Gonorrhea. In slight cases the mucous membrane only is involved. There is hyperæmia, a profuse secretion of mucus, and an excessive production of epithelial cells, which are thrown off, and form a semipurulent discharge. If severe, the inflammation spreads more deeply into the submucous tissue, and even into the corpus spongiosum; a large amount of exudation is poured out round the urethra, the swollen and congested walls of which are thrown into folds, and compressed together. The lymph may be absorbed; but, if not, it becomes organized round the collapsed tube, and leaves a firm, hard ring of variable extent and depth, with, like all other circular bands of lymph, no matter where, an inveterate tendency to contract.

2. Injury. Blows in the perineum (*e. g.*, from falling astride a rail) cause partial or complete rupture of the urethra immediately under the public arch; the rent is repaired by the exudation of lymph (which is often so abundant as to form an abscess), with the same tendency to contract, until a stricture is produced

more obstinate and tighter than any other.

3. Ulceration of the mucous membrane. This is most often due to chancre, but it may occur in gonorrhea, or be the result of injury, as, for example, impacted calculus and violent catheterization.

4. Masturbation and urethritis form other causes. No history of injury or of gonorrhea can be obtained in many cases, so that it is possible it may occasionally be due to these. Whenever an organic stricture is present the urethra is irritable, and there is a tendency to congestion of the mucous membrane, and spasmodic contraction of the unstripped muscular fiber in its walls. Indeed, organic stricture rarely causes retention of urine by itself. Some slight irritant, that would not affect the urethra when healthy, excites one or both of these additional obstructions, and complete retention is the result.

Sometimes, when there is no stricture, retention of urine is caused by swelling of the mucous membrane, as in acute gonorrhea and prostatitis, or by spasmodic contraction, due to reflex irritation from the rectum or other sources, but the pathology and treatment of such cases of obstruction differ totally from those of organic stricture.

Varieties.—There are various terms applied to strictures. When a band of lymph stretches across the urethra, attached only by its ends, it is called a *bridle stricture*; it is *annular* when the constriction is circular, as if a piece of string had been tied round; and *indurated annular* if the base is much infiltrated. Sometimes this is so extensive that it is said to be *cartilaginous*. Some strictures, again, are *irritable*, if chills or rigors often occur; others are called *contractile* or *recurring*.

In the strict sense of the term, no stricture is *impermeable*, except those in which, as a result of injury or of inflammation, a large portion of the wall of the urethra has sloughed away. But in reality, in many old cases, owing to the length and tortuous character of the channel left, it is impossible to pass a bougie, even though urine may continue to trickle away drop by drop.

Locality.—Strictures are met with in different parts of the urethra, with very different degrees of frequency. They

are never found in the prostatic portion; this is the widest and most easily dilated part, and no case of stricture affecting it exists in any museum.

In the penile part they are very common, and may exist in any number. As many as six different ones have been found, but the favorite spot by far is just in front of the membranous urethra, in the bulb. Here the wall is soft and very vascular, and there is abundance of submucous tissue, so that the amount of lymph thrown out, whether the result of gonorrhea or injury, is great in proportion. Admittedly this part is capable of great dilatation, but it must be remembered that, except while the urine is actually flowing through, the walls, here as elsewhere, are wrinkled up into folds and compressed together.

Otis and Verneuil, as a result of clinical observation, hold that strictures are more common in the anterior part of the urethra, and that deeper ones are really but spasmodic muscular contractions, secondary to them, consequent on the irritation caused by the true stricture in front. These, of course, are not strictures in the correct sense of the term, and cannot be found post-mortem.

Consequences.—The mucous membrane in the neighborhood of a stricture does not long remain unaffected. The outflow is obstructed, and the uniform elasticity of the canal destroyed, so that undue stress falls on it, and irritates it. Hyperæmia and inflammation result. The *urethra* behind becomes dilated, and its walls thinned; often it presents a reticulated appearance from the dilated orifices of the numerous small ducts that open on its surface. The amount of secretion increases, and this flowing away is the cause of the gleet. Ulceration even may ensue, and then there is extravasation of urine into the corpus spongiosum, or wider still in the tissues round. These changes are not limited to the surface; a large amount of lymph is poured out all round, so that sometimes abscesses form independent altogether of the urethra, and either open into it or burst on the exterior.

The *bladder* suffers even more severely. Owing to the increase in the labor of expelling the urine, the muscular coat becomes uneven and hypertrophied; the walls lose their uniform flexibility, and become irregular, unyielding, and inelas-

tic; the cavity itself diminishes, and when the bladder contracts, the mucous membrane is no longer thrown into regular folds, so that some of the contents remain behind. Chronic inflammation is the consequence. Then the bladder empties itself more and more often; the capacity diminishes steadily; the walls get thicker and more irregular from the increased amount of work, and the weaker portions yield from the pressure until they project outward as pouches or sacculi between the hypertrophied bands of muscle. The



FIG. 1.—Double Stricture of the Urethra, with Dilatation of the Prostatic Urethra.

walls of these dilatations rarely contain any of the muscular coat; they are formed merely of mucous membrane and of peritoneum, so that they are never emptied. Then, if it has not already taken place, the urine decomposes, and matters become tenfold worse. The inflammation becomes more intense, and either the sacculi themselves become abscess cavities, or deposits of pus form in the walls and burst into them.

Sometimes, on the other hand, when

the obstruction is sudden, and the obstacle too much for the bladder to overcome, the bladder becomes distended so as to reach the umbilicus, and its overstrained walls lose altogether their power of contraction (atony), or it gives way (though this more commonly happens to the urethra behind the strictured part) and the urine is extravasated into the cellular tissue of the perineum and scrotum.

These alterations are not confined to the bladder. The *ureters*, the pelvis of the *kidneys*, and the renal secreting structure itself all share the same fate. The continual pressure gradually but surely causes absorption, and chronic inflammation and suppuration follow in its wake, due partly to the tension, partly to the gradual upward extension of the inflammation. Suppurative pyelitis or nephritis is present in at least one-half of the fatal cases of stricture.

Symptoms.—The symptoms depend on the length of time the stricture has lasted, and on the degree of contraction it presents; but in all cases of this kind there is a very large personal element to be taken into consideration. It is not merely that some people pay attention to, and are much more anxious about, small symptoms than are others, but that the urethra in some is more sensitive, much more likely to be affected by spasm and congestion. In some cases irritating conditions of the urine, such as an excess of uric acid, alcoholic or other indulgences, exposure to cold or wet, constipation, and many other slight causes, bring on such a degree of spasm and congestion that complete retention of urine results, when the real stricture present would of itself admit a No. 6 catheter.

The most constant symptoms are: A chronic urethral discharge or gleet, especially in the morning and after exercise. The first few drops of urine at each act of micturition wash out from the urethra shreds and filaments of mucus from the inflamed part; the rest follows quite clear.

Pain, felt at the seat of stricture during micturition, owing to the state of tension set up in the inflamed and congested part. Sometimes a thickening of the tissues, especially in old cases, may be felt in the same place.

Alteration in the stream of the urine. It may be forked, or twisted, or flattened; often it is diminished in size, so that when

the stricture is old the urine only comes in drops. Frequently, even in slight cases, there is some trouble at the end, the last few drops flowing away of themselves.

Retention. This may be the first and only symptom. As already mentioned, it may come on suddenly, even when the diameter is, comparatively speaking, of good size. The urethra, when inflamed, is more sensitive even than in the normal state, and a very slight cause will set up sufficient spasm to close the already narrowed canal.

Later, many other symptoms follow, due to the implication of other organs. The character of the urine is changed; its reaction becomes alkaline, and it is loaded with mucus and phosphates. The bladder is irritated, and empties itself more and more frequently, so that often it is impossible to secure a night's rest. Pain is felt over the pubes, in the perineum, and across the loins. The constant straining affects the rectum, so that hemorrhoids or prolapse occur, and the patient is unable to pass water without emptying the bowel at the same time. The kidneys suffer next in order; the condition of the blood is seriously changed. Digestion is impaired, nutrition fails; the patient becomes weak and anæmic, prone to rigors, and if some accidental source of inflammation does not prove too much for his powers of resistance, he sinks gradually from weakness and exhaustion, or succumbs to partial or complete suppression of urine.

Diagnosis.—Stricture must be diagnosed from (a) subacute inflammation of the prostate, and (b) urethral irritability, set up either directly by disordered conditions of the urine, or reflexly through some of the neighboring organs, such as the rectum.

In the former the symptoms are dependent on the inflammation of the mucous membrane of the urethra, just as they are in stricture, so that without further exploration it is impossible to be certain. The presence of induration, felt outside along the course of the urethra, or of retention, would point to stricture, and rectal tenderness to inflammation of the prostate, but neither of these would exclude the possibility of the other.

So also with urethral irritability; stricture itself is one of the many causes of this

complaint, so that from the symptoms alone, without further exploration, it is not possible to form a certain diagnosis.

The instruments made use of for exploring the urethra are catheters, bougies, and sometimes sounds. If the presence of a stricture is suspected, and it is considered advisable at once to explore the urethra, an instrument must be selected of such size that while it will pass without much discomfort through a normal urethra, it will not catch in any of the irregularities (as a small sharply pointed one does), but will open out all the folds as it passes along; and of such material

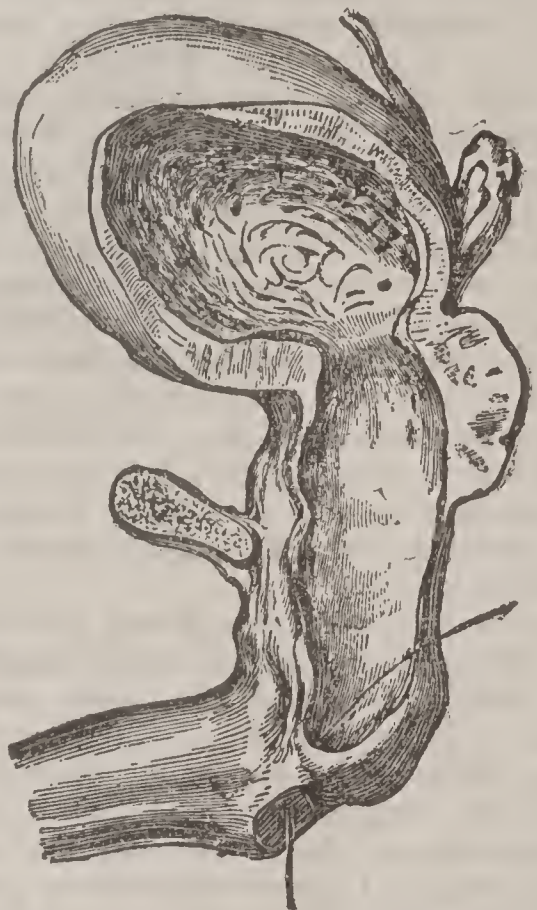


FIG. 2.—Dilatation of the Urethra and great Hypertrophy of the Bladder behind a Stricture. The Stricture is shown by a bristle.

that the slightest roughness of the surface will at once transmit an impression to the hand of the operator. These conditions are best fulfilled by a metal instrument of eight or nine English gauge, rather smaller in the shaft than at the end; this will pass through any normal urethra, will not raise up folds of mucous membrane in front of it, and transmits sensations much better than a gum elastic or black one.

The passing of catheters.—The patient should lie down, with his shoulders slightly raised, the hips a little flexed, the thighs abducted, and the umbilicus ex-

posed. The operator stands on the patient's left, and having well warmed and oiled (or better, covered with vaseline) the instrument, he holds the penis with his left hand, and quietly draws it over the end. The catheter is to be kept exactly in the middle line; there is no advantage to the patient in deviating either to the right or left. The penis should be well stretched forward and upward, so as to obliterate as far as may be any folds of mucous membrane in the interior, and the point of the catheter should be kept at first toward the floor, to avoid its catching in the lacuna magna.

The force required for the introduction of a catheter is so slight in a healthy urethra that its own weight is almost enough. Sometimes, when the mucous membrane is very sensitive, as it often is in gouty people, the unstriped muscular fiber grasps the instrument firmly, so that it does not move easily in either direction. It is best, under these circumstances, to wait a minute or two. The spasmodic contraction of unstriped muscle comes on slowly, lasts some little time, and then inevitably tires itself out. When the first catheter is held in this fashion, it often happens that one or two or three sizes larger may be passed quite easily immediately after.

Gradually, as the catheter enters, the handle rises up until the position is almost vertical. The point has now reached the bulbous portion of the urethra. Here there is a considerable dilatation on the floor, and the mucous membrane is very loose and readily thrown into folds. The orifice of the membranous part is much smaller, quite rigid, being situated in the triangular ligament, and well above the middle line. Unless, therefore, the handle of the catheter is depressed between the patient's legs (and sometimes, in the case of an enlarged prostate, it has to be depressed so far that it becomes horizontal), and unless the point is kept pressed against the roof, it cannot hit off the opening. False passages nearly always start from here, and run upward and backward between the rectum and the prostate, entirely because this caution is not observed. If the finger at this stage is introduced in the rectum, the point of the catheter can be felt just at the apex of the prostate gland.

If the catheter is not held firmly, it

often slips into the membranous part with a smart jerk, and gives the patient a good deal of pain. This is normally the most sensitive part of the urethra and the most likely, when injured, to cause reflex trouble.

It sometimes happens that a catheter must be passed at once for the relief of urgent symptoms, but it must never be forgotten when it is being done merely for the purpose of exploring the urethra, that it is always a serious matter for the patient, especially if it is the first time; and that though men whose kidneys are diseased, and who are suffering from long-standing stricture and bladder trouble, are infinitely more liable to serious after-consequences than others, yet that these have happened, and have proved fatal, even when no predisposing causes of this nature were present.

Hemorrhage, false passages, urethritis, perineal abscess, prostatitis, cystitis, and epididymitis (none of which are uncommon), may be reasonably assigned in the majority of cases to causes apparent on the surface, and the same may possibly be said of urethral rheumatism and pyæmia; but shock, rigors, urethral fever, and especially suppression of urine, may occur without the least violence having been used or the slightest lesion being found. It is probable that nearly all operations, no matter how slight, about the deeper portion of the urethra and the bladder (the penile part seems exempt), cause, by some obscure reflex action, congestion and hyperæmia of the kidney. If this is slight and the kidney sound, the only result is a certain amount of blood in the urine for some short time; if it is continual, probably interstitial nephritis results; but if the kidney is already diseased the congestion may be so intense as to cause suppression.

The patient should, if possible, always be prepared beforehand; the bowels should have been well opened, he should be kept warm, made to lie down afterward, and should be directed not to pass his urine for some considerable time, and to remain quiet after he has done so. If symptoms of a rigor come on, a large dose of quinine or a breakfast-cupful of hot tea sometimes cuts it short.

Hydrochlorate of cocaine may be made use of in these cases with great advantage. Five minims of a four per cent. solution injected into the meatus,

followed, in three or four minutes, by a somewhat larger amount, injected, by means of an elastic catheter or a syringe, into the bulbous part or on to the face of a stricture, entirely gets rid of the pain without quite destroying sensation, and thus depriving the operator of the advantage he may derive from the patient's guidance.

In a case of supposed stricture a No. 9 English passes easily, without being held at any one spot (though it may at first be somewhat tightly grasped along its whole length), and particularly if it slides out smoothly and evenly, a larger one (No. 11, or even 12, if the meatus permits) may be introduced. If this passes and is withdrawn equally easily, without coming across any roughness or obstruction, and particularly if there is no acute pain except when the point of the instrument is at the membranous part, it may be taken for granted that there is no stricture present.

It is true that Otis in particular has described what are called strictures of large caliber as existing in the anterior part of the urethra, and causing the symptoms of organic stricture deeper down by the reflex spasm they excite; and it is not denied that sometimes infiltration in the mucous or submucous tissues may cause a certain amount of hardness and of reflex irritation of the unstriated muscle of the urethra (just as sometimes obstruction to the passage of urine is caused by reflex irritation from the rectum), but it is impossible to class such cases of obstruction with those in which this symptom is due to a firm band of lymph round the urethra, so tight that it will scarcely allow the passage of a drop of fluid. In the one there is a permanent cicatricial contraction, the result of inflammation; in the other there is obstruction, due to muscular spasm, which may be caused, in this particular case, by the presence of an irregular or tender spot in the anterior part of the urethra, just as it may be by fissure of the rectum.

If a moderate-sized catheter does not pass, smaller and smaller sizes must be tried. In this way the distance of the stricture from the orifice, and the diameter of the smallest part, may be ascertained, but not the length or the possible presence of deeper ones. The latter point, if the deeper stricture is larger in diameter than the nearer, can, of course,

only be cleared up by the dilatation of the latter. The former can be ascertained fairly well, either from the exterior, or by passing bulbous bougies on a metal stem. If one of these is passed through the stricture, on drawing it back the spot at which it meets it can be accurately noted, and marked on the stem; but it must not be forgotten that the submucous tissue of the urethra is lax and loose, and that it is easy, by a little gentle pressure or traction, to displace a stricture a considerable distance. Flexible bougies with bulbous ends manufacture strictures for themselves, unless they are kept exactly in the axis of the canal, by doubling up folds of mucous membrane, and slipping over them.

Treatment.—Strictures may be divided into two classes: A. Those through which a catheter can be passed. B. Those which are practically impermeable.

The former may be treated by (1) Dilatation: (a) continuous; (b) intermittent. (2) Rupture or splitting. (3) Cutting or urethrotomy: (a) internal; (b) external. (4) Excision.

It must not be imagined that because a catheter cannot be introduced on the first occasion into a stricture that it is, therefore, impermeable. If the urethra has sloughed, or if it is a long cartilaginous stricture of many years' standing, with a very small tortuous passage, this may be the case; but in the vast majority of instances, as already mentioned, the immediate cause of the closure is the congestion of the mucous membrane and spasmodic muscular contraction. This may easily be relieved; and it will often be found that an apparently impermeable stricture in a few days admits a No. 3, or even No. 4, catheter if the patient is kept quiet in bed, on low diet, without stimulants, and given a hot bath night and morning. Opium, too, is of great service; but the bowels must be kept open at all costs. Not until this has been thoroughly tried, and every form of catheter used, should a stricture be condemned. In this respect the treatment of stricture must be carefully distinguished from that of retention. The former may wait a short time; the latter is immediate in its urgency.

1. *Dilatation* is the easiest and the safest method. It succeeds best with strictures of recent formation in young subjects, whose kidneys are still fairly

sound, who are not prone to rigors, and whose strictures have not yet assumed the dense cartilaginous resistance common later. It may be intermittent or continuous. In *intermittent dilatation* catheters are passed every two or three days, but are not left in; they are simply introduced and withdrawn. Three or four sizes may be passed at each sitting, but it is always as well not to commence with the largest used on the previous occasion; one a size smaller is much less apt to cause irritation.

In *continuous dilatation* a small catheter is introduced through the stricture, and tied in so that the end only lies just within the bladder. For this the patient must be confined to bed, or, at the very most, allowed to sit up; certainly not to move about. The catheter may be left in three or four days, but it is better to change it at least every second one, for fear of its setting up a cystitis and becoming incrustated with phosphates. It need not be a large one, or, indeed, fill the stricture. It is a singular fact, and one for which there is no satisfactory explanation, that a stricture dilates equally well with a small as with a large one. Indeed, a catheter that just fits should not be tied in, as it is not unlikely to cause irritation.

The former of these methods depends entirely on mechanical dilatation. A catheter passed every third day can have no other effect. In the latter there must be some other influence, for it is often found, when the instrument has been left in some days, that it lies quite loose in the stricture; the process is not merely a mechanical one, whether it is or is not true that the effusion in the submucous tissue is absorbed by the pressure.

Neither of these methods can be said to cure stricture. After dilatation a catheter must always be passed at first every third day, then every week, and after some considerable time every month: otherwise the contraction will recur. Each method is liable to all the accidents of catheterism; the continuous more especially to the inflammatory ones, such as urethritis and cystitis.

Metal instruments are for this purpose not nearly so useful as flexible ones. The object here is not diagnosis, but to insinuate down a tender and contracted passage some instrument that will inconvenience it least. The more flexible it is, the more easily it finds its way and ac-

commodates itself to the turns and twists of the urethra, and the less damage it inflicts. The stem must have sufficient rigidity to bear the onward pressure; the point must be rounded and slightly enlarged, so that it may not catch in obstructions; and the neck as flexible as is consistent with strength, so that the point may bend in all directions with the least touch.

If these fail, even after the patient has been kept perfectly quiet, recourse must be had to catgut and other bougies. The former are particularly useful, as the point may be slightly bent on itself, so that when the bougie is twisted round in the urethra, care being taken that the direction corresponds with the make of the gut, it will explore a circle on the face of the stricture, and not a single central point, as it does when it is straight. In this way an orifice lying a little to one side of the center may often be hit off. The search, however, must be carried on in a regular manner and with a definite object in view, not blindly here and there.

Whalebone bougies are not so much to be recommended; they are much stiffer, and it is exceedingly easy to make a false passage with them. The same holds good of a silver instrument of small size; unless this is held with the lightest possible touch, its point inevitably perforates the mucous membrane, and makes a false passage.

Sometimes it is advisable to use long, flexible, whip-like bougies, attached to the end of a stiff one of larger size, so that the whole length is at least double that of an ordinary catheter. If the flexible part can find its way, the stiffer portion will follow, and the former coils itself up in the bladder out of harm's way. Or the same result may be obtained by railroad catheters, *i. e.*, catheters with an eye at each end, so that they can slide along the catgut into the bladder, and remain there after the guide has been withdrawn.

The simplest fashion of securing a catheter in the bladder is to attach two threads to its eyes, one on either side, and fix them to the skin of the penis by a piece of strapping wound round it near its root. Or, as this plan has certain obvious objections, and is not too secure, to knot the threads (which must be double) on either side about an inch and a half from the catheter; then, taking the two

threads of one side, carry the one over, the other under the penis, so as to inclose it in a loop; knot them together on the opposite side, and tie them to the pubic hair. The other pair is then to be treated in the same way.

Or a tape is fastened round the abdomen, and, starting from this on either side, a loop is carried over the outer side of the opposite thigh, then under it, so as to come up in the groin by the side of the scrotum, and be fastened again to the waist belt. The tapes from the catheter are tied, one on each side, to the band in the groin, just opposite the root of the penis, so that it can assume any position that is convenient without allowing the unstriped muscular fiber of the urethra to push the catheter out.

2. *Rupture or splitting*.—The dilatation of a stricture may be accomplished at one sitting by the rupture or the splitting of the fibers. The instrument commonly used for this purpose is that known as Holt's, or some modification of it. The principle consists in passing down through the stricture an instrument shaped like a catheter, but composed of two parallel halves, which are suddenly separated from each other by forcibly driving down between them a large metal rod, made for the purpose, in different sizes. It is claimed for this that it dilates the tissue of which the stricture is formed without lacerating the mucous membrane, and certainly the process is simple enough; but there is no guarantee that the force is applied to the right place, and it is certain that relapses after this method of treatment occur very early. In the case of a stricture in the bulbous portion it can scarcely succeed; the diameter here is so much wider than that at the meatus or in the membranous part that dilatation sufficiently extensive to cause complete rupture is impossible.

3. *Urethrotomy*.—Urethrotomy is either external or internal, that is to say, with or without an incision in the perineum.

In the latter, the stricture may be divided from before backward in exceptional instances, but nearly always the instrument is passed through it first and then withdrawn with the blade exposed, so as to incise the constriction freely from behind forward. Consequently, it is essential that the stricture should be dilated first to the size of a No. 5 catheter.

Certain kinds of stricture are especially suitable for *internal urethrotomy*.

1. Strictures near the meatus, and, to a less degree, those deeper in the penile part.

2. Strictures which recontract rapidly after dilatation.

3. Strictures in patients who suffer severely from rigors or other troubles whenever a catheter is passed. In cases such as these it is best to finish the operation at a single sitting, so that, if rigors follow, there is but one. It is often found, when a stricture is thoroughly divided, that the urethra completely loses its irritability.

4. Dense cartilaginous strictures that refuse to dilate. Though, so far as these are concerned, it is doubtful if external urethrotomy does not answer better.

It is usual to make the incision on the floor, but this is not essential. There are, it is true, a few large veins on the roof in the angle between the corpora cavernosa and spongiosum, but even if these were incised the hemorrhage would not be serious.

It is more important to divide the stricture completely through its whole depth. Anything short of this is followed by failure. It may be performed in two ways, either with a urethrotome, such as Thompson's, consisting merely of a bulb on a stem concealing a blade which, by means of a screw, may be protruded any depth that seems to be required; or with Otis's, in which the urethra is first of all put on the stretch in the strictured part, and then incised a certain fixed depth by drawing a blade back along a grooved guide. If the stricture is not thoroughly cut through, the side rods of the instrument may be screwed apart again, and a fresh incision made. Urethrotomy has been compared with tenotomy, and no one would willingly divide a tendon when it was relaxed.

Both of these plans succeed admirably in the anterior part of the urethra; the one because the strictured part can be held with the fingers through the skin, fixed, and every fiber felt as it is divided; the other because the touch of the instrument is so exceedingly light when it is but a short way down the mucous canal. It is much more difficult when the bulbous portion of the urethra is involved. Probably here Thompson's urethrotome is the

handiest, as the instrument can be held lightly, and the division of the tissues can be felt. Owing to the divergence of the corpora cavernosa and the gradual separation of the veins from the corpus spongiosum, the incision, if on the roof, may be carried to a very considerable depth without wounding any important structure.

Whatever instrument is employed, a large bulbous sound (No. 14 English) should be passed immediately after. If this enters easily, particularly if it can be withdrawn without meeting with any obstruction, it is taken for granted that the stricture is thoroughly divided. There is no need to tie a catheter in unless hemorrhage is feared. The edges of the incision, if the division is thorough, retract so that immediate union cannot take place, and the presence of a catheter does not prevent urine finding its way into the cut, for, when a catheter is tied in the bladder, some always makes its way out round it. The bladder should be emptied at the time of the operation, and a morphia suppository introduced into the rectum; if the patient is left quiet in bed, without too much to drink, there is no urgent call for him to pass water for at least six, and, perhaps, twelve hours.

By that time the surface of the wound is glazed over, and this affords the best protection both from the entrance of urine into the cut and the rigors that sometimes follow the first act of micturition after an operation.

Internal urethrotomy is liable to be followed by the same complications as simple catheterism, but some are more common and more serious than others. Hemorrhage (not so much at the time, but some hours later, in the course of the night, especially if there is an erection) is not rare, though it is seldom grave. Supporting the penis and perineum on a well-padded, but firm, crutch, and laying an ice bag over it, generally controls it; or, if in the penile part, a catheter may be passed, and a bandage placed firmly round. Extravasation of urine, leading to perineal abscess, also occurs; but though this is painful, and delays convalescence, it rarely leads to any permanent trouble if the stricture has been divided completely.

Urethritis, or cystitis, if existing before the operation, is generally made worse for a time; but unless a catheter is tied

in, they rarely originate from it. Rigors may occur either immediately or when urine is first passed, but, as a rule, they are not followed by anything further. When they come on at other periods they are more serious, as they may be the first indication of urethral fever, suppuration, nephritis, or even pyæmia. The prognosis, so far as life and health are concerned, depends on the state of the kidneys more than anything else, as it does in all operations on the urinary organs. If they are diseased, suppression of urine, or some other trouble, is very likely to happen; if healthy, it would be quite exceptional, though not altogether unknown.

Three or four days after the operation the patient may be given a hot bath, and a soft flexible catheter (No. 12) passed; if it enters easily, it may be repeated in two or three days' time, and after that at regular intervals. This should not be omitted any more after internal urethrotomy than after dilatation. In each it is essential to continue the passage of a catheter, with intervals gradually getting longer and longer, for years. A patient who has once had a well-defined stricture is never free from the fear of relapse.

External urethrotomy.—Two conditions chiefly render an incision in the perineum advisable. The first is the presence of a stricture so dense and unyielding, or so complicated with fistulæ, that internal urethrotomy cannot succeed; the second, where it is not possible to get a catheter into the bladder at all, whether this is due to obliteration of the urethra or to the length and tortuous character of the stricture. In the first case an instrument is passed, and the stricture divided upon it. This is external urethrotomy in the strict sense of the term. Syme's staff is the one generally used. It is grooved on the convexity, and consists of two parts of different diameters, which meet with an abrupt shoulder at the junction of the straight portion with the curve. The latter is the smaller of the two, so that it can pass through the contracted part of the urethra until it is brought to a standstill by the shoulder coming in contact with the face of the stricture. The patient is placed in the lithotomy position, and a median incision made into the groove, taking care to divide thoroughly the whole length of the stricture. A probe is then introduced into the

bladder to act as a guide, the staff withdrawn, and a catheter passed to make sure there is no further obstruction. It should not be tied in, but passed again on the third or fourth day, and then at intervals afterward.

This method of operating is exceedingly valuable in cases that are not so far advanced as those mentioned above. Under the free suppuration that follows, a great deal of the old inflammatory deposit melts away, and if, when the wound is healing, catheters are passed regularly, the new tissue that forms does not acquire the density of the old. It is a more severe operation than internal urethrotomy, but it is free from the objection sometimes urged against this, *i. e.*, that urine may collect in the wound, set up a large amount of suppuration which has not free escape, and leave behind a tougher and firmer stricture than the one divided.

If a catheter cannot be passed through the stricture, the urethra must either be opened in front of the stricture, after Wheelhouse's method, or perineal section must be performed.

In the former, the patient is tied up in the lithotomy position under an anæsthetic, and a grooved staff, with a button on its end, carried down to the face of the stricture. An incision is made in the middle line down to the groove, so as to open the urethra freely, and the sides of the incision held apart by means of two sutures passed through the mucous membrane and given to one of the assistants. If the upper angle of the incision is then hooked up by means of the button on the end of the staff, the hemorrhage which sometimes obscures the view is checked by the tension, and the whole interior of the urethra in front of the stricture thoroughly exposed, with the light falling on its inferior angle. Under these circumstances the orifice can generally be seen, and a probe insinuated down it. As soon as this is done, the stricture is divided freely, and a catheter passed along it into the bladder.

Perineal section.—In this the urethra is laid open behind the stricture. The patient is placed in the lithotomy position, care being taken that he is perfectly straight, and that the perineum is perpendicular. The operator sits in front, and with his left forefinger feels for the apex of the prostate. He then takes a

long straight knife, and, with its back toward the rectum, plunges it steadily in the middle line underneath the bulb, so as to hit off the membranous part or the apex of the prostate. A director is then passed into the bladder, and a soft catheter introduced, and, if necessary (as these wounds close very rapidly), tied in. Later, when the fistula is well established, it is frequently found that the stricture, which obstinately resisted all attempts before the operation, can be passed easily and divided.

4. *Excision.*—Attempts have been made to excise portions of the urethra, the seat of stricture, but the procedures have not met with any degree of success. For excision the stricture should be of limited extent and in the penile urethra, and stenoses so placed are amenable to simpler treatment. At present the operation cannot be advised.

C. MANSELL MOULLIN.

Symptomatic Indications.—*Aconite* is valuable in spasmodic stricture, especially when attended with inflammation. *Nuxvomica* is the principal remedy for spasmodic stricture, especially when induced by use of liquor. *Camphor* in pure spasm is useful and often controls; valuable after cantharides. *Clematis* sometimes relieves incipient symptoms of organic stricture. *Cannabis sat.* is useful in organic stricture after gonorrhea. *Mercurius*, when there is a purulent discharge from the urethra.

URETHRA, RUPTURE OF.—

Causes.—This occurs either on the deep or the superficial surface of the triangular ligament. The former is generally associated with severe injuries to the pelvis, such as separation of the symphysis; the latter, with violent blows in the perineum compressing the membranous part of the urethra under the subpubic arch, and causing it to give way either partially or completely.

Symptoms.—When the rupture is on the deep surface the symptoms are the same as those of extra-peritoneal rent of the bladder. The patient is unable to pass urine of himself, though a catheter can be introduced without much difficulty. The blood, being unable to escape by the urethra, regurgitates into the bladder, so that it is intimately mixed with the urine, and infiltrates the cellular tissue behind the symphysis, no ecchymosis becoming

visible for some time. If free exit is not given to the urine, it gradually makes its way in the same direction, causing symptoms of septic intoxication, from which the patient succumbs.

When the rupture is superficial there is tenderness and ecchymosis in the perineum, extending forward into the scrotum, a drop or two of blood escaping from the meatus shortly after the accident; and either a scalding pain on micturition from the urine passing over the raw surface, or complete retention, according to the degree of injury sustained. Extravasation of urine is inevitable in all cases in which the rent is more than a superficial laceration of the mucous membrane, unless steps are taken to prevent it.

Treatment.—A catheter should be passed at once, selecting for choice a metal instrument with rather a short curve. If this fail, a soft elastic or a black one may succeed. The urine should then be drawn off, and if there has been the least difficulty in the introduction of the catheter, or any amount of hemorrhage from the urethra, an incision should be made in the middle line of the perineum and the instrument withdrawn.

Under these conditions a certain amount of extravasation will inevitably follow; in all probability, if the rent is so extensive as to cause the loss of more than a few drops of blood, it has taken place already, and an incision is the best way to meet it. It cannot be prevented by tying in a catheter. There is this further advantage in making an early perineal incision, that there is no suppuration due to the retention in the tissues of decomposing extravasated urine; consequently the amount of cicatricial tissue when the wound heals is much less, and the danger of traumatic stricture is reduced to a minimum. Three or four days after a soft catheter may be passed, and then others at intervals until the wound is sound. If it heals without any evidence of constriction of the urethra, the patient may escape; but he should always be warned of the possibility of its setting in some time afterward, and advised to pass a catheter for himself occasionally. When the urethra is completely torn across, it is sometimes possible to find the two ends in the perineal wound, and unite them together by means of a deep cutgut suture.

C. MANSELL MOULLIN.

URINE, EXAMINATION OF.—The total amount of urine passed in twenty-four hours should be collected and measured.

Color.—The healthy urine has a yellowish color, which may vary in depth of tint at different times, according to the varying physiological states of the body. The depth of tint is diminished when the watery element is in excess. Thus the urine is limpid after profuse potations, after hysterical or other nervous attacks, in cases of simple anæmia, in both the forms of diabetes, and in granular kidney. The color of the urine is increased in intensity when from any cause, such as excessive sweating, the urine is concentrated, also when pyrexia is present, and in certain wasting diseases, and in some cases of so-called pernicious anæmia. In the pathological states mentioned it is probable that the increased depth of color is not due merely to a greater proportion of coloring matter being present, but also to the presence of a pathological pigment produced by the profound changes in the physiological processes. The normal coloring matter, urobilin, may be replaced by febrile urobilin, or by urohematoporphyrin, substances which are to be distinguished from the normal pigment by the spectra they exhibit on treatment with various reagents.

The pathological admixture with the urine of certain normal fluids of the body, will alter its color in a characteristic manner.

Bile is present in the urine in cases of jaundice and causes the urine to assume a brownish hue, which may in extreme cases appear almost black. On standing exposed to the air for some days such an urine occasionally becomes of a green color.

Tests for Biliary Pigments.—Two reactions serve to detect the biliary coloring matter in the urine, and thus distinguish the brown color due to the presence of bile from that produced by other pigments.

Gmelin's Test is applied by placing side by side on a white porcelain slab a drop of the urine and a drop of strong nitric acid and allowing the two to come into contact, or by floating a layer of the urine on the surface of a little nitric acid in a test tube. At the point of contact of the two fluids a play of colors—green

violet, red, and yellow—will indicate the presence of bile. But the play of colors is not easily distinguished from the red color which other matters in the urine give with nitric acid, and therefore the following test is to be preferred.

Maréchal's Test.—A test tube is filled to about one-third its depth with water, and to this are added a few drops of tincture of iodine, so as to form a light brown liquid. This is then mixed with a little of the urine, when, if bile be present, a bright green color is almost immediately developed. If the urine be very dark it is desirable to dilute it before applying the test.

Urobilin Icterus.—Gerhardt has drawn attention to a condition which he calls urobilin icterus. The skin and conjunctiva are colored yellow, the urine is dark brown in color, and it may be supposed that slight jaundice exists. Yet, when the tests for bile pigment are applied to the urine, none is found. The pigment which is present is an excess of urobilin, a normal constituent of the urine, and such excess is produced in the body by oxidation of bile-pigments. Gerhardt has applied to such urines the following test: To a chloroform extract of the urine tincture of iodine and caustic potash are added, when a green fluorescence appears.

Tests for Biliary Acids.—The biliary acids are detected by *Pettenkofer's Test*, though this is not easily applied to urine. A little cane-sugar should be dissolved in the urine, and this poured gently on to the surface of sulphuric acid in a test tube. A purple color at the junction of the two fluids indicates the presence of biliary acids.

Urine containing much bile occasionally deposits crystals of bilirubin.

Blood, according to its degree of admixture, causes the urine to assume either a smoky tint or a bright red color, not easily confounded with any other condition. The blood-coloring matter alone may occur in the urine, as in **hemoglobinuria**. In ordinary hematuria blood corpuscles will be also found by microscopic examination. Hematoidin crystals are sometimes found as a urinary deposit.

Tests.—The blood-coloring matter is detected by its reaction with *Tincture of Guaiacum and Ozonic Ether*. A little of the urine to be tested is placed in a tube,

and with it about two drops of tincture of guaiacum; then ozonic ether is added, and the whole well shaken, when, if blood-coloring matter be present, a bright blue color is developed. Should this not appear at once, the test tube should be allowed to stand for a short time until the ether rises to the surface of the mixture. Such blue color as has been produced will be absorbed by the ether, and will then be more easily seen. Should the urine contain iodide of potassium, as will happen when the patient is taking that drug, or saliva, a similar reaction will be shown, even though no blood be present.

Heller's Test.—If urine be boiled with liquor potassæ the phosphates contained in it are precipitated as a gray flocculent mass, but, if blood be present, the precipitate is colored red or brown.

Chyle makes its appearance in the urine when there is leakage from the lymphatic vessels into the urinary passages. The urine is then of a milky color, and is sometimes spontaneously coagulable. Under the microscope, granules and occasionally fat globules are seen; while the clot, if such has formed, will be seen to consist of threads of fibrin.

Pus causes the urine to be of a milky color, but the greater part of the pus separates on standing, and its detection is easy with the aid of the microscope (see PYURIA).

Effects of certain Drugs upon the Color of the Urine.—The administration of certain drugs causes the urine to assume characteristic colors. Carbolic acid and salol, which contains it, cause the urine to become black. It may happen that the black color, which is due to oxidation products of hydrochinon, does not develop until the urine has been allowed to stand for a little time in contact with the air, and it rarely develops to a marked extent if the urine be highly acid in reaction. Resorcin, hydrochinon, pyrocatechin, tannic and gallic acids and tar, used externally or internally, may cause the same appearance. It occasionally happens that, without any drug having been used, the urine becomes of a black tint. Occasionally this is due to the presence of protocatechnic acid, and Dr. Kirk has also found in such urines a new body, which he has named uroleucic acid. When malignant tumors of a

melanotic nature are present in any part of the body, but especially when they affect the skin, the urine may be dark in color, and may deposit a black pigment. Here, again, the pigment only appears when the urine has stood for some time in contact with the air, or when the urine has been treated with an oxidizing agent such as hydrochloric acid and chlorate of potash or liquor ferri perchloridi. The dark pigment may also be demonstrated by the addition of bromine water, which gives a precipitate, at first yellow, afterward black.

Rhubarb or chrysophanic acid produces a dark yellow color of the urine, changing to red if ammonia be added. Senna causes a similar color to appear. Santonin, when given internally, often causes the patient to pass a urine which is bright yellow if the urine be acid, orange red if it be alkaline. When logwood is administered internally hematoxylin is excreted in the urine, and gives a violet color if the urine be alkaline or if ammonia be added. Large doses of quinine cause the urine to become dark in color, kairin produces a brown, thallin a green, and antipyrin a deep red color of the urine. Antifebrin is stated to produce no change in the urine, but in two cases this drug caused the urine to assume a deep red tint, due to the presence of hematoporphyrin, which was separated from the urine and examined by the spectroscope.

Indicanuria.—An alkaline urine after standing in contact with the air for some time may be covered by a blue scum. A few cases have been recorded where the blue color had developed within the body and was seen in the urine, as soon as it was voided, in the form of a generally diffused blue tint and bluish particles. The coloring matter is indigo-blue derived by oxidation from indican, which is a normal constituent of the urine. Indol, a product of pancreatic digestion, is absorbed from the intestines and becomes changed in the body into indican, which is excreted in the urine as an ether-sulphuric acid.

Tests for Indican.—The urine is mixed with an equal quantity of strong hydrochloric acid, when a reddish-violet color is formed, caused by the production of indigo red. If now a weak solution of bleaching powder be added drop by drop, the violet changes to a blue color (indigo

blue) which is quite bleached by excess of the chloride of lime. The blue color may be extracted by shaking with ether, and the depth of color in the ethereal extract shows roughly the amount of indican present in the urine. Indican is excreted in greater amounts when putrefactive processes are going on actively in the intestine; consequently, greater quantities are found in cases of peritonitis and of obstruction of the small intestine. Other products of the decomposition of proteids, among which the most important are skatol and kersol, are absorbed from the intestine together with the indol, and are similarly excreted in the urine as ether-sulphuric acids. These bodies cause a deep red color to develop in the urine when strong nitric acid is added, and, consequently, interfere somewhat with the nitric-acid test for albumen and bile.

Odor.—Normal urine has a peculiar odor, which can only be styled urinous. When the urine is heated with a mineral acid the odor is intensified. Urine containing a fixed alkali has a sweetish smell like that of the urine of a horse. Ammoniacal decomposition of the urine can be detected by the sense of smell, since the presence of ammonia and also of sulphureted hydrogen is at once perceived. A few cases have been recorded in which sulphureted hydrogen gas was present in the urine before any decomposition had set in, indeed as soon as the urine was voided. In many cases of diabetes the urine has an odor resembling that of chloroform. The urine of a person who has imbibed turpentine in any way, either medicinally, or, for instance, by sleeping in a newly painted room, smells of violets. Asparagus imparts a very disagreeable and intense odor to the urine. Copaiba and cubeba similarly impart a peculiar smell to the urine.

Specific Gravity.—The specific gravity of the urine is determined by the urinometer, the form of which is well-known. In using it, it is necessary to make sure that the test glass is sufficiently wide to allow of a moderate quantity of urine remaining between the sides of the glass and the urinometer, and also that sufficient urine is present to float the urinometer free from the bottom of the glass. If there is not sufficient urine obtainable for this purpose, two courses are available:

either the urine may be diluted with an equal quantity of distilled water, and when the specific gravity of the mixture is obtained by the urinometer, the decimal points be doubled; or beads of different degrees of gravity, which are sold for the purpose, may be used, the bead which will float in the urine determining the specific gravity of the fluid. For more accurate determinations it is well to weigh a known quantity of the urine and compare it with that of the same quantity of distilled water.

The specific gravity of the urine is expressed in its proportion to that of water taken as 1, the comparison being made to the third decimal place, or more frequently, for convenience, the specific gravity of water is taken as 1000.

The specific gravity of urine is a measure of the amount of solid matter dissolved in it. If the two last figures of the specific gravity be multiplied by 2 or, more accurately by 2.33, the amount of solid matter per 1000 parts of urine is approximately obtained.

The urine in health has a specific gravity ranging between 1015 and 1025. Abundant potations on an empty stomach will lower the specific gravity to a figure very nearly that of distilled water. In disease, the lowest specific gravities are met with in hysteria, diabetes insipidus, and albuminuria. In regard to the latter affection it must, however, be remembered that it is not the presence of albuminuria which produces the low specific gravity. Gouty urine, for instance, may contain albumen and yet be of high gravity. In the majority of cases, nevertheless, albuminuria is the result of some disease of the kidneys which diminishes the secretion of solids, and is accompanied by high arterial tension which increases the amount of water. The disease, *par excellence*, which increases the specific gravity of the urine, is diabetes mellitus. On the other hand, the writer has met with sugar in an urine having a specific gravity of only 1013.

Reaction.—The reaction of the urine is ascertained by dipping into it a strip of litmus paper colored red or blue. If alkaline, the red paper becomes of a blue color; if acid, the blue paper becomes red. For practical purposes it is well to use litmus paper colored purple, since this is tinted red by an acid, and blue by an alkaline fluid. The normal urine, as usu-

ally examined, is of an acid reaction, by reason, mainly, of the presence in it of acid salts. Yet, if passed at frequent intervals, it is found that the urine varies in its reaction at different times of the day. Food has a marked effect upon the reaction of the urine. Shortly after a meal, the urine begins gradually to lose its acid reaction, and may actually become alkaline. After a time, the reaction gradually returns to its acid character; indeed, the meal, finally, to a certain extent, increases the acidity of the urine. This phenomenon of the "alkaline tide" has been variously explained. According to Dr. Bence Jones it is due to the withdrawal of acid gastric juices from the blood, for the purpose of digestion, while Sir William Roberts has suggested that it is produced by the accession to the blood of the alkaline bases contained in the food. The matter, however, is not so simple as would appear from what has been said above. Thus the urine of the forenoon is specially prone to be alkaline. The writer observed this when, after fasting for many hours, he took as his sole meal the raw whites of a dozen eggs diluted with water. Again, at other times of the day and without any relation to food, the urine may lose its acid reaction. The reasons for these phenomena are not yet known.

It is important to notice, when the urine is alkaline, whether the alkalinity is due to fixed or volatile alkali. The volatile alkali is ammonia, and, if present in considerable quantity, its vapor alone will cause a moistened litmus paper to turn blue, when the latter is held close over the urine. The question is conveniently determined by dipping a red litmus paper into the urine and then allowing it to dry slowly in the air. If the blue color has been produced by fixed alkali it will remain after the paper has dried; if by ammonia, it will disappear when the alkali has evaporated.

The urine is easily rendered alkaline by drugs, especially by the carbonates of the alkalies, or by the alkaline salts of the vegetable acids, which appear in the urine as carbonates. It is important to bear this in mind when testing for albumen by boiling, since the albumen will be changed into alkali albumen and is then not coagulable by heat. The urine is also liable to become alkaline from fixed alkali in many diseases, especially in

those of a debilitating character; alkalinity from ammonia is in almost every instance the result of putrefactive changes in the urine, an effect of the action of micro-organisms, which change the urea of the urine into carbonate of ammonia. The chief of these organisms is the micrococcus ureæ first described by Pasteur.

The acidity of the urine can be also increased by drugs, but only to a limited extent. The most efficacious drug for this purpose is the benzoate of ammonia, which is excreted in the urine as hippuric acid.

Estimation of the Degree of Acidity.

—The acidity of the urine can be estimated by neutralizing it with a solution of caustic soda of known strength. The strength of this solution is determined by a standard solution of oxalic acid, and is conveniently such that 1 cubic centimeter neutralizes 0.063 gram of oxalic acid. A burette is filled with the soda solution, best diluted to $\frac{1}{10}$ or $\frac{1}{5}$, and the solution is then gradually added to the urine until complete neutralization is attained. From the number of cubic centimeters of the alkali solution used, the acidity of the urine, reckoned in milligrams of oxalic acid, can be easily calculated. The attainment of the neutralization is ascertained by the reaction of the urine on litmus or rosolic acid.

Deposits.—The normal urine is perfectly clear when it is first passed from the bladder, but is prone to become turbid, and to deposit a faint hazy cloud, consisting of mucus and epithelial cells after it has stood for a little time, but before ammoniacal fermentation has set in. In diseased conditions, many other deposits are found in the urine, and they may be conveniently discussed under two heads, the inorganic and the organic.

In order to examine the deposit from urine, it should be allowed to stand in a conical glass, when the deposit will fall into the apex of the cone, and can then be examined by the microscope.

Inorganic Deposits. — *Urate.* — The most common deposit from the urine is that composed of the amorphous urates. These fall from acid urines, and form a mass more or less dense, having no appearance of crystallization, which usually soon settles to the bottom of the glass. The amorphous urate deposit may be pale gray in color, but most frequently

it carries down with it some of the coloring matter of the urine, and thus assumes varied tints, which may, however, be classified as pink and red. The surface of the urine which has deposited urates is commonly covered by a faint purplish bloom. Under the microscope the deposit is seen to consist of amorphous finely granular matter. The deposit redissolves on warming the urine, and also when alkalies or their carbonates are added. Acids, however, first increase the amount of the precipitate, and will even cause it to appear in a urine in which no deposit has previously occurred. In a little time acids decompose the deposit, and cause the appearance of crystals of uric acid.

The *Amorphous Urate* deposit is a quadrurate containing one atom of alkali and three of hydrogen, combined with two molecules of uric acid. Sir William Roberts has shown that it is very easily decomposed, and is, in fact, always decomposed after standing for a time in contact with the urine, being transformed into bi-urate and uric acid. The bi-urate is again changed into quadrurate, and again decomposed until, in this way, the whole of the uric acid of the urine, whether combined or uncombined, is at last thrown down. The decomposition is hindered by the presence of the salts and the pigments of the urine.

This deposit is produced by a low temperature, an acid reaction, and concentration of the urine. It is hence common in cold weather and after profuse sweating, without the presence of any pathological condition. Among the diseased states which are associated with it, the most important are digestive troubles and pyrexia. The dark-red-colored urate deposit is significant of very serious organic disease, commonly the presence of malignant tumors of the abdomen, while the pale pink urates are of little clinical importance.

Urate of Soda is sometimes deposited from the urine, and frequently before the urine has left the bladder. It occurs as "hedgehog" crystals, globes with spiny projections. It forms a white or gray deposit in acid urines, and is associated especially with the gouty state and with the pyrexial attacks of children. The rough crystals are prone to cause severe vesical irritation.

Urate of Ammonia is sometimes found, together with a deposit of phosphates, in urine which has undergone ammoniacal decomposition. It occurs in the form of spheres and dumb-bells.

Uric Acid.—Uric acid is also a very common urinary deposit. The uric-acid deposit occurs in acid urines, and generally, but not invariably, in those of high density. It may, for instance, occur in the limpid urine of low specific gravity, which is passed in chronic Bright's disease. The deposit is almost always colored red or brown, whence its common name of "urinary sand." It is even to the naked eye crystalline, and while it falls for the greater part to the bottom of the glass, some of the crystals arrange themselves in lines on the sides of the glass, others form a slight scum on the surface. Under the microscope the crystals are seen to assume the most varied forms, of which perhaps the most common are flat, elliptical plates. Cubes, prisms, and rhomboids are also met with, and these may collect into groups so as to assume most fantastic forms. Even under the microscope the uric-acid crystals usually retain a little of the color which is evident in the microscopic deposit.

The uric acid deposit is soluble in alkalies, insoluble in acids, but is decomposed with effervescence by strong nitric acid. The *Murexide Test* is most delicate, and at once decides the nature of the deposit, if this is in doubt. A little of the deposit should be placed in a porcelain evaporating dish, and on it poured a drop or two of strong nitric acid. Gentle heat is now to be applied, preferably by means of a water bath, until the nitric acid is evaporated and an orange-yellow deposit remains. To this is now to be added a drop of liquor ammoniæ, when, if uric acid be present, a beautiful purple color will be immediately developed. The quantitative estimation of uric acid will be discussed later in this article.

The deposit of uric acid from the urine relates rather to the reaction of the urine than to the absolute quantity of uric acid contained therein. A perfectly healthy urine will deposit uric-acid crystals if allowed to stand sufficiently long (*see* CALCULUS, RENAL). Yet when the urine habitually deposits uric acid within a short time of its

emission this is distinctly a pathological phenomenon.

Oxalate of Lime forms a white deposit, which falls to the bottom of the glass, and is limited above by a wavy, film-like layer. On the sides of the glass, too, it forms lines of crystals, in the same manner as does uric acid, but without the color of the latter. Under the microscope the deposit is seen to be constituted by crystals, which have the forms of small octahedra, dumb-bells, or ovoids. The deposit does not disappear when the urine is heated, and is insoluble in acetic acid, alcohol, and ether, but soluble in the mineral acids. The conditions of its formation will be found in the article upon OXALURIA.

Cystine.—One of the rare urinary deposits. The urine depositing it is generally turbid when first passed, showing the great tendency of such an urine to form calculi within the urinary passages. It is usually faintly acid, and has sometimes a yellow color and an oily appearance. The deposit, which settles on standing, is light gray in color, and under the microscope its nature is readily recognized by the shape of the crystals composing it, hexagonal plates. Further, it can be recognized easily by its chemical reactions. It is soluble in ammonia, in solutions of carbonate of potassium or sodium, and in the mineral acids, but it is insoluble in a solution of carbonate of ammonium and in vegetable acids, water, and alcohol. It is not dissolved by heat. From its solution in ammonia it crystallizes in the form of hexagonal plates and square prisms. When the deposit is heated to incandescence it gives off thick white fumes having an odor of garlic. The urine containing it decomposes very easily, and Dr. Golding Bird found that in doing so it changed color from yellow to green.

The occurrence of cystine as a deposit in the urine is especially interesting, by reason of its liability to form urinary calculi. The tendency to excrete cystine may last for years without any deterioration of the general health, beyond that which the irritation of urinary calculi may cause. It is more common in the young and in males, and shows a decided tendency to run in families.

Cystine contains a large percentage of sulphur, and therefore it is assumed that the liver is the seat of its formation, but

no more than this is known of its origin.

Xanthine has been found in very rare instances as a constituent of urinary calculi, and has been said to have constituted a urinary deposit. Its identity, however, was not perfectly proved. It is soluble when heated, and dissolves without effervescence in strong nitric acid. When evaporated, a bright yellow deposit is left, which is changed to violet red on the addition of liquor potassæ (Stecker). Its crystals have the shape of pointed ovals resembling those of uric acid.

Leucin and Tyrosin.—The urine of patients suffering from acute yellow atrophy of the liver contains both leucin and tyrosin. The latter is deposited in the form of bunches of acicular crystals. Leucin, however, usually remains in solution, but is occasionally thrown down in spherical crystals.

Phosphates.—Phosphates of lime, magnesia, and ammonia are very frequently deposited from the urine. As a rule, when these salts are precipitated, the urine is alkaline, but two of them, the stellar and the triple phosphates, are occasionally thrown down from urines which are neutral or even faintly acid. Again, an urine which has deposited phosphates will usually give a further precipitate when heated, a reaction due, as Sir William Roberts has shown, to the fact that phosphate of lime is less soluble at high than at low temperatures.

Amorphous Phosphates have the chemical composition of $\text{Ca}_3(\text{PO}_4)_2$, and are invariably deposited when the urine becomes alkaline. They form a white, flocculent precipitate, which is not dissolved by heat, but disappears instantly when acetic acid is added to the urine. Under the microscope it consists of amorphous granules.

Stellar Phosphate has the composition $\text{CaHPO}_4 + 2\text{H}_2\text{O}$ and is of somewhat rarer occurrence. It forms a white deposit, composed of rod-like crystals, arranged in rosettes or stars, whence its name. Other forms, resembling Indian clubs, are also met with. From the observations of Sir William Roberts we know that the occurrence of this body as a deposit is usually a sign of some grave disease. Albeit, the same deposit may occur in the urine of a healthy person, if it be rich in lime and of low acidity.

Triple Phosphate has the composition $\text{MgNH}_4 + 6\text{H}_2\text{O}$, and usually occurs to-

gether with the amorphous phosphate in which has undergone ammoniacal urine decomposition. Under the microscope, the deposit is seen to be composed of large crystals, whose predominant form is a triangular prism with beveled ends, and they are further characterized by their high refracting power.

Magnesium Phosphate, having the composition $\text{Mg}_4(\text{PO}_4)_3$, has been found in a strongly alkaline urine in the form of highly refractile rhomboid plates.

Carbonate of Lime.—This substance does not often form an urinary deposit in man, but does occasionally compose a urinary calculus. It has been found as a rare deposit in sphere-like crystals.

Sulphate of Lime is sometimes found as a deposit, either as crystals which assume the form of long needles, plates, or prisms, or as dumbbells.

Hippuric Acid is a rare urinary deposit, but may be found when a patient is taking benzoic acid or salicylic acid internally. It forms rhombic prisms resembling one of the varieties of uric acid crystals, but distinguished from these by not giving the murexide reaction.

Fat occurs in the urine of chronic Bright's disease and in chylous urine, as small, highly refracting globules.

Fatty Acids.—Von Jaksch has described a deposit which he believed to be composed of the lime and magnesia salts of the fatty acids. It consisted of crystals resembling those of tyrosin, but not giving the chemical reactions of that body.

Cholesterine.—Plates of this substance are sometimes, but rarely, met with as an urinary deposit.

Indigo, as already mentioned, may form in decomposing urines. It may then occur as a deposit, as blue crystals, or amorphous masses.

Organic Deposits.—(1) *Tube-Casts* (see CASTS, URINARY).

(2) *Epithelium*.—In cases of nephritis the epithelial lining of the renal tube is liable to become separated from its attachments, and the individual cells find their way into the urine. They present themselves as a round nucleus, inclosed by a variable amount of granular protoplasm. The whole is irregular in form, but is more or less rounded. The nucleus may sometimes be divided, and the protoplasm also may show degenerative changes, amounting sometimes to atrophy of the cell.

Other epithelial cells which may find

their way into the urine are (*a*) those of the pelvis of the kidney, also of the ureter and bladder; these are irregular in form, many of them "tailed," and the dovetailing of the irregular epithelium characteristic of the mucous membrane of these parts is frequently obvious when patches of cells are discharged. The presence of such cells indicates inflammation of the mucous membrane. (*b*) Urethral cells; these are rounded flat epithelial plates, frequently found adhering in the form of a layer. (*c*) Vaginal epithelium—large flat scales. (*d*) Cells from the mucous membrane of the mouth; these also are large flat scales, which are found in urine when the saliva has been mixed with it.

Pus.—(3) Urine containing pus is usually cloudy when passed from the bladder, and, on standing, deposits a grayish layer at the bottom of the glass. The supernatant urine invariably contains albumin. When the deposit is examined under the microscope it is seen to consist of leucocytes, and when treated with liquor potassæ it becomes thick and ropy. This condition of the pus is assumed spontaneously if the urine has undergone the ammoniacal decomposition. The leucocytes appear as small round granular bodies, which, when treated with dilute acetic acid, become clear and show a horseshoe-shaped or divided nucleus (*see* PYURIA).

(4) *Blood Corpuscles*.—These appear in the urine, either in their usual form as bi-concave disks, or, more frequently, shriveled, crenated, or swollen, from the action upon them of the water and salts of the urine. The chemical reactions of blood have been described above.

(5) *Hemoglobin*.—In cases of hemoglobinuria dark brown granular masses of hemoglobin are found as an urinary deposit.

(6) *Spermatozoa*.—These form a deposit in the urine resembling mucus, but its nature is at once evident on microscopic examination, when the characteristic filaments are seen.

(7) *Mucus*.—Mucus forms a white glairy sediment in the urine, which may be mistaken for pus. Under the microscope, however, it shows merely amorphous granules, threads, or flakes, and is soluble in liquor potassæ.

(8) *Fungi*.—Many forms of the lower vegetable may be found in the urine. Among these may be mentioned varie-

ties of torulæ, which grow in acid urine and will be recognized by their spores and thallus; sarcinæ, distinguished by their characteristic dice-like shape, and bacteria of different kinds. In by far the majority of cases these plants are extraneous additions to the urine after it has been voided, and are associated with its decomposition. This is not always the case. A few instances have been recorded in which organisms, either micrococci or bacilli, were present in the urine as soon as it was passed, and the condition has been named idiopathic bacteruria. Pathogenic germs, too, may be found in the urine. Of these, the more important are tubercle and typhoid bacilli and the micrococci of erysipelas and pyæmia. Most of these germs can easily be detected by straining them with methylene blue and examining with an oil immersion lens and an Abbe's condenser. For the tubercle bacillus a special method is required. A little of the pus or cheesy matter, which is always present in such cases as give rise to a suspicion of the presence of tubercle in the urinary tract, is to be spread upon a cover-slip and allowed to dry in the air. It is advisable, when examining for tubercle bacilli in the urine, to take a somewhat thick layer of pus, not a thin layer, as is the custom in examining sputum. After drying, the cover-slip is drawn through a flame three times in order to fix the albumen. Then the slip is to be floated on a small quantity of Ziehl's fuchsin solution, consisting of 100 parts of water, 5 parts of carbolic acid, 10 parts of alcohol, and 1 part of fuchsin. The solution is to be gently warmed and the cover-glass allowed to remain floating on it for a quarter of an hour. Then it is washed in a twenty-five per cent. solution of nitric acid for a few moments until most of the color seems to have disappeared. It is further washed in water, and stained again by being floated for five minutes on the surface of a saturated watery solution of methylene blue. Again it is washed in water, dried, and mounted in Canada balsam, when the tubercle bacilli will be seen as red rods on a blue ground.

(9) *Animal Parasites*.—The embryos of the filaria sanguinis, hydatid hooklets and cysts, the eggs of bilharzia hematobia, rhabditis genitalis, and ascarides are occasionally found in the urine.

(10) *Portions of Neoplasms*.—Tumors

which ulcerate into the urinary passages will discharge portions of their tissue into the urine. Nevertheless, tumors of the kidney cannot be diagnosed by examination of the urine. The separated cells of a tumor cannot be distinguished from those of the urinary passages. Where, however, not merely separated cells, but actual portions of a tumor, are discharged into the urine, as happens, for instance, in the case of villous tumors of the bladder, important aid to diagnosis is afforded by their recognition.

(11) *Foreign Bodies*.—Lastly, an observer must be prepared for the presence in the urine of various foreign matters, such as hair, the fibers of flax, cotton, and silk wool, feathers, portions of vegetable matter, and muscle fiber.

Dissolved Matters :

(1) **Albumin** (*see* ALBUMINURIA).

(2) **Sugar** (*see* GLYCOSURIA).

(3) **Urea**.—The amount of urea daily excreted in the urine is a measure of the nitrogenous waste of the economy, and is therefore of considerable clinical interest. The average amount excreted by a healthy man in twenty-four hours is about 500 grains, or 32 grams. It is diminished during exercise, increased in the period of rest which follows exercise. It is increased also by nitrogenous food. Generally speaking, it is increased during pyrexia, diminished during convalescence from pyrexia. In organic diseases of the kidneys it is markedly diminished, while in both diabetes mellitus and diabetes insipidus, the daily excretion is increased in amount.

Quantitative Estimation of Urea.—

It is important in estimating the amount of urea in a specimen of urine to perform the analysis before any decomposition has set in, since the urea is readily decomposed, as already stated, into carbonate of ammonia.

The Hypobromite Method.—This is the most ready means of estimating urea for clinical needs. The principle of the method is that urea is decomposed by hypobromite of soda, and its nitrogen is discharged as free gas, which can then be measured in a graduated tube. Dupré's apparatus consists of a small flask closed with a caoutchouc stopper, in which the hypobromite solution is placed, and from this an india-rubber tube leads to a long graduated tube, the mouth of which is under water in a large wide jar. Since solution of sodium hypobromite is quickly

decomposed on standing, it is well to make it fresh for each estimation, by adding 5 c. c. of bromine to 45 c. c. of a forty per cent. solution of caustic soda. Of this solution 25 c. c. are placed in the small flask, and 5 c. c. of urine are poured into a narrow tube, which is then placed in the flask in such a manner that none of the urine is mixed with the hypobromite solution until the flask is inclined. The stopper being now replaced, the graduated tube is lowered until the water in it reaches the zero mark, and by means of the opening at the top of the graduated tube the pressures inside and outside of it are equalized. The small flask is now tilted, and the urine allowed to gradually mix with the hypobromite solution, the mixture being finally shaken to insure due discharge of the nitrogen. After waiting ten minutes, the amount of nitrogen collected in the graduated tube is read off, care being taken that the water inside and outside the tube is at the same level. The graduated tube may be marked merely in divisions of cubic centimeters, when the quantity of urea in the five cubic centimeters of urine taken can be calculated from the fact that 37.3 c. c. of nitrogen correspond to 0.1 gram of urea; or the tube may be graduated in percentages of urea. Uric acid, creatin, and other nitrogenous bodies of the urine also give off nitrogen by this manipulation, while urea only gives off ninety-two per cent. of its nitrogen. Thus about 4.5 per cent. must be subtracted from the total amount of nitrogen produced, to obtain the exact amount discharged by the urea of the urine.

Liebig's Method.—This depends upon the fact that urea is precipitated by a solution of mercurous nitrate. The phosphates and sulphates of the urine are first removed by baryta solution. Then a solution of the mercurous nitrate is added until all the urea is precipitated, which is known by the urine at this point giving a yellow color with a solution of carbonate of soda. But a certain amount of the mercurous nitrate solution has to be added before precipitation of the urea commences. This amount must be noted and subtracted from the total quantity of solution used, since it is the amount necessary to change the chlorides of the urine into bichloride of mercury, and until this is done no urea will be thrown down. From the quantity of mercurous nitrate

solution used, the amount of urea in the quantity of urine taken can be calculated. It is convenient that the mercurous nitrate solution should be of such a strength that 1 cubic centimeter corresponds to 10 milligrams of urea. For greater accuracy it is desirable to first estimate the chlorides present by a solution of nitrate of silver.

(4) **Uric Acid.**—The murexide test for the detection of uric acid has been given. For an estimation of its quantity either gravimetric or volumetric methods may be made use of. Employing the gravimetric method 5 c. c. of hydrochloric acid are added to 100 c. c. of filtered urine, and the mixture allowed to stand for twenty-four hours, when the uric acid will have separated out and can be weighed. Of the volumetric methods that of Haycraft is most employed. It is based on the fact that nitrate of silver forms a urate of silver, when brought into contact with uric acid, and the silver contained in the latter salt can be estimated by trituration.

(5) **Sulphates.**—These occur in the urine as simple sulphates and as salts of the ether-sulphuric acids. The simple sulphates are precipitated by the addition of a solution of barium chloride to the urine slightly acidified with acetic acid; the compound sulphate, not until the urine has been boiled with hydrochloric acid.

(6) **Phosphates.**—Phosphates are estimated in the urine by the uranium process. The solutions required are: (1) Uranium acetate solution having such a strength that 1 c. c. corresponds to 5 milligrams of phosphoric acid. (2) A saturated solution of ferrocyanide of potassium. (3) A solution of sodium acetate containing 100 grams in the liter together with 100 c. c. of acetic acid. The strength of the uranium solution is determined by a standard solution of sodium phosphate.

Fifty c. c. of the urine are mixed with 5 c. c. of the acetate solution and heated to near the boiling point. The uranium solution is then run in until the mixture gives a brown color with a drop or two of the ferrocyanide solution, when the wished-for point of the total precipitation of the phosphates is reached. The quantity of uranium solution then gives the amount of phosphoric acid in the quantity of urine employed.

(7) **Chlorides.**—The chlorides of the urine are precipitated by nitrate of silver in the presence of nitric acid. This can be used as a rough test of their presence or absence by adding only a drop of a nitrate-of-silver solution. The chlorides are estimated by means of a solution of nitrate of silver of such a strength that 1 c. c. corresponds to 10 mgrs. of sodium chloride.

(8) **Acetone.**—Acetone has been found in the urine in a great variety of conditions, of which the most important is diabetes. It has also been found in the urine of patients suffering from fever, inanition, and cerebral disorders. Further, a certain amount of acetone can be detected in healthy urine. For its detection the urine should be distilled, and one of two tests applied to the distillate. These are: (1) *Lieber's Test.*—A few drops of a mixture containing caustic potash, iodine and iodide of potassium are added to a small quantity of the distillate, when, if acetone be present, a precipitate of crystalline iodoform is produced. (2) *Legal's Test.*—To the distillate are added a few drops of a concentrated solution of sodium nitroprusside and also a little solution of caustic potash. A red color is produced which rapidly disappears, and, if acetone be present, gives place, on the addition of acetic acid, to a purple color.

(9) **Diacetic Acid.**—The urine of diabetes often gives, with a solution of perchloride of iron, a burgundy-red color, which was believed to indicate the presence of diacetic acid. Certain precautions, however, must be taken before this test can be accepted. In the first place, the presence of acetone must be ascertained as above, since its reactions always occur when diacetic acid is found. Then a strong solution of perchloride of iron is added to the urine; any phosphates which are precipitated are filtered off and more iron solution is added. When the red color appears, a portion of the mixture is boiled, and, if due to diacetic acid, the color should still remain. To another portion of urine is to be added sulphuric acid and ether. The ethereal extract should give the perchloride reaction after standing twenty-four to forty-eight hours.

For Ehrlich's diazo reaction, see **TYPHOID FEVER.**

ROBERT MAGUIRE.

URINE, RETENTION OF.—

Causes.—Retention of the urine may be due to causes acting on the urethra or on the bladder.

1. Calculus or other foreign bodies impacted in the urethra.

2. Tumors, such as an enlarged and displaced uterus pressing on it from the outside.

3. Alterations in the wall of the urethra, either permanent, as stricture and enlarged prostate, or temporary, as congestion and spasm. This is by far the most common.

It is very rare for one of these to act entirely by itself; an impacted calculus occupies only part of the interior. But the hyperæmia and spasmodic contraction of the tissues around soon close the rest of the canal, and enlarged prostate may exist for years until some accidental congestion causes sufficient swelling of the mucous membrane.

4. The bladder itself may be unable to expel its contents, from various causes: atony of its walls; paralysis; hysteria; diseases of the spinal cord (*e. g.*, locomotor ataxy); peritonitis; exhaustion, as in fevers; belladonna poisoning; alcoholic or other excesses; or shock. In old people very little is needed; merely the passage of a catheter, or a fall on the trochanter. In younger persons, retention of urine is met with chiefly after operations about the rectum, injuries of the pelvis, and railway accidents.

Results.—As the bladder becomes filled, it rises up from the pelvis into the abdomen, and projects above the pubes as a rounded tumor, dull on percussion, and most prominent when the patient is standing. It may reach the umbilicus, or even the ensiform cartilage, so as to be mistaken for ovarian tumor, if its walls are thin and soft; but in old cases of cystitis, where there has been chronic retention for years, where the walls are rigid and hypertrophied, and the cavity is contracted, such distention is impossible, and there may be retention with urgent symptoms without the bladder being perceptible from the exterior.

The bladder itself rarely gives way; its muscular fibers may be so stretched as to lose their power of contracting either for a time or even permanently, so that it is left in a state of atony, unable to empty itself; but, unless some portion of the wall is exceedingly soft from fatty degen-

eration, or some additional compression is applied from the outside, rupture is quite unusual. It is far more common for the softened and ulcerated mucous membrane behind a stricture to tear, and give rise to extravasation. In the majority of instances the congestion and spasm which have, so to speak, been the last straw in closing the urethra, give way before the pressure, and the bladder remaining full, the urine flows away continuously, drop by drop. This is the overflow of urine from a bladder that is too full, and is different in every respect from incontinence, in which the bladder is empty.

The *symptoms* of complete retention depend on its mode of onset, rapid or slow. In the former the pain is intense, and if relief is not soon afforded, constitutional disturbance of a typhoid character sets in, the patient becoming delirious, the tongue dry and brown, and the pulse small and frequent. These symptoms depend probably on the sudden check offered to the secretion in the kidneys, with the exception of the local pain, which is due to the extreme and rapid distention of the bladder, and is even more severe when the cavity is small, and the walls rigid, than when it is of normal size and elasticity.

When retention comes on gradually, as in cases of stricture, the urinary organs have had time to adapt themselves to the altered conditions, and the immediate symptoms are not so urgent. It is even not uncommon to hear a patient suffering from stricture, with his bladder distended far above the pubes, complain of nothing more than the inconvenience caused by the incessant dribbling of urine. In this case there is no sudden check to the secretion of the kidney, but the ultimate result is no less grave, for the ureters dilate, and chronic pyelitis and surgical kidney inevitably follow.

The *treatment* of retention must be guided by a knowledge of the cause, but in all cases it is absolutely necessary to relieve the bladder as soon as possible.

When it is due to *atony* or loss of tone in the walls of the bladder (*see* ATONY), a soft catheter must be passed with the utmost gentleness night and morning, at least, until the muscles have recovered. Or if a *calculus is impacted*, or the uterus is displaced so that it drags on the urethra, suitable means must be at once adopted to

remove the obstruction (*See IMPACTED CALCULUS*). But where the cause is some change in the wall of the urethra, either permanent, as *stricture* and *enlarged prostate*, or merely temporary, as the congestion of gonorrhea or acute prostatitis, it often happens that other expedients must be adopted to meet the exigencies of the moment.

When it is due to *congestion*, retention may come on suddenly, brought on immediately by exposure to cold or by alcoholic excesses, or may give a warning by the rapid diminution in the size of the stream. The bladder soon becomes distended, and, owing to the neck being involved, there is the most intense desire to micturate, with severe constitutional trouble and urgent distress. Relief must be given at once, or serious, perhaps even permanent, atony will result. A catheter should be passed immediately if the symptoms are urgent; but if the patient can wait for half an hour he may be placed in a hot bath (the temperature as high as can be borne, and maintained at that point), and given a full dose of opium, half a dram to forty minims of the tincture. Sometimes, when there is much spasm, this of itself procures relief, or, if not so successful, it makes it easier to pass a catheter afterward, procures sleep and quiet, and tends to prevent the occurrence of rigors and other secondary troubles. The bowels must be thoroughly opened as soon as possible; the urine rendered unirritating by the use of alkaline carbonates and sedatives, such as hyoscyamus; all stimulants forbidden, and the patient confined to his bed, or, at least, his room. This treatment must be kept up for four or five days in a case of gonorrhea, or until the abscess bursts, if the obstruction is due to suppuration in the prostate.

When the cause is *stricture* the immediate symptoms are rarely so severe. The constriction grows tighter and tighter by slow degrees, giving rise to difficulty and causing the bladder to become hypertrophied; but the constriction is not complete, until from some accidental cause, such as exposure to cold or alcoholic excesses, spasm and congestion are set up in addition. The treatment must be conducted on the same principles, only it is as well to be careful in the administration of opium, as the kidneys are frequently diseased. An at-

tempt may be made to give relief at once by means of a catheter, using one of moderate size, unless the state of the stricture is known from previous experience; then smaller and smaller ones may be tried, but always with the utmost gentleness; force of any kind should never be used, and there should not be the slightest stain of blood. The more soft and flexible the instrument is, especially near the point, the more likely it is to be guided by the mucous membrane of the urethra into the orifice of the stricture. Black ones, slightly bulbous at the point, are the most useful, but they are very liable to break at the eyes; small metal ones are exceedingly dangerous. When these fail, a gum elastic or a catgut bougie may sometimes succeed, and the urine will almost certainly follow as it is withdrawn, but it is very questionable whether it is advisable in the majority of cases to persist long in this line of treatment. The way to overcome the obstruction is to irritate it as little as possible. It is better, if a catheter does not pass after a very moderate trial, to place the patient at once in a hot bath and give him a full dose of opium. This nearly always succeeds, and it will generally be found, if he is kept in bed, on light food, without stimulants, if the bowels are kept open freely, and if hot baths are given night and morning, that in a few days the spasm and congestion have disappeared so thoroughly that a catheter passes with ease. The only alternative is to give an anæsthetic, make a further attempt, and then, in case of failure, puncture the bladder. The result, so far as concerns the stricture, is the same, but at the expense of an operation.

When *enlargement of the prostate* is the cause, the circumstances are different. There is little or no spasm; the prostate portion is elongated and perhaps tortuous; its sides, which, like those of the rest of the urethra, are in contact with each other, are not easily (owing to the increase in size and density of the tissues round) forced apart when the stream begins to flow; the bladder loses some of its power, and then, from some accidental cause, congestion sets in, the mucous membrane swells up, and the narrow channel is completely obstructed. Opium and hot baths can do no good, and often are positively dangerous. A catheter must be passed at once; either

silver one, with a long and sweeping curve, a gum elastic, with a stilet in, as already described, or a black one, with the point bent up (*coudée*), so as to ride over the obstruction. Unless a stricture is present as well, the largest catheter that will pass the meatus should be selected, and, owing to the growth of the prostate, it should be of extra length. Violence is never justified, but it is often necessary, when passing a catheter under these conditions, to make use of a certain amount of steady, but firm pressure. The urine is nearly always blood-stained for some days after, owing to the congested condition of the mucous membrane at the neck of the bladder. If this treatment does not succeed, the choice lies between tapping the bladder or forcibly pushing the catheter through the substance of the prostate and tying it there.

C. MANSELL MOULLIN.

In the Female.—May arise from the following conditions:

(1) Retroversion of the gravid uterus, which is mentioned first as being the most common cause of retention sufficiently prolonged to lead to serious ill consequences (*see* PREGNANCY, DISEASES OF).

(2) Retroversion of an uterus enlarged by a fibroid. This is much rarer, but may produce the same results as retroversion of a pregnant uterus.

(3) Impaction of a tumor, either uterine or ovarian, in the pelvis, causing pressure upon the urethra.

(4) Pressure upon the urethra by a pelvic abscess, hematocele, or an extra-uterine gestation cyst. The urethra may either be directly compressed on, or the uterus may be pushed forward against it. The latter is the more common condition.

(5) Hysterical retention of urine. This is the commonest kind of retention in young unmarried girls of a neurotic type.

(6) Atony of the bladder from over-distention.

(7) Stricture of the urethra—rare in women.

(8) Congestion or abscess of the urethro-vaginal septum.

(9) Urethral caruncle; retention being *quasi* voluntary, due to the patient's shrinking from the pain of micturition.

(10) So-called "lupus" of the vulva;

the fibrous overgrowths blocking the urethra.

(11) Cancer involving the urethro-vaginal septum.

(12) In the first few days after delivery retention is common, partly from swelling of the urethra from contusion during labor, partly from the laxity of the abdominal parietes, which renders the patient unable, in the recumbent position, to make the necessary expulsive effort.

(13) Spasmodic stricture of the urethra, from drink, exposure, sexual excess, etc., has been described, but is very rare.

(14) Reflex influences, as from hemorrhoids, or fissure of the anus. Other causes, which occur equally in both sexes, do not need enumeration here.

The obvious *treatment* is to draw off the urine with a catheter. In hysterical retention this should be postponed as long as possible, and should be done by a nurse.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is valuable in retention from cold. *Turpentine*, in suppression from renal congestion; hematuria; catarrh of the bladder; incontinence from atony of bladder. *Nuxvomica* is useful in spasmodic retention. *Cantharis* is often serviceable for frequent or involuntary micturition, especially when coughing, in women, from weakness of sphincter. *Hyoscyamus* is valuable for retention of urine after labor. *Opium*, in paralytic retention. *Camphor*, in sudden spasmodic retention. *Gelsemium*, in hysterical retention.

URINE, SUPPRESSION OF.—By suppression of urine is understood that condition in which no urine reaches the bladder, as opposed to retention of urine where the bladder is full but no urine passes from the urethra. Suppression of urine may arise from total abolition of the secreting power of the kidneys, due directly to some disorder of the organs themselves, or on the other hand, from some obstruction in the pelvis or ureter of both kidneys, which, while at first causing retention of urine in the pelvis and calyces, afterward produces abolition of secretion. The first of these conditions is known as non-obstructive, the second as obstructive, suppression of urine. The symptoms of the two conditions are different and will require separate description.

I. Non-obstructive Suppression.—

This is prone to arise in the course of the specific fevers, and especially in the algide stage of Asiatic cholera. Organic disease of the kidneys of any kind may be the cause of little or no urine being secreted, and this is specially seen in cases of acute nephritis, and in the later stages of chronic Bright's disease. It must be remembered, too, that a dose of opium may cause almost absolute suppression of urine if the kidneys are in a damaged state. Mere exposure to cold and shock of all kinds, but especially that following major operations, acts similarly. Operations on the urethra are specially liable, if the kidneys are diseased, to produce suppression of urine, preceded by rigors and pyrexia. Hysterical patients occasionally suffer not merely from retention, but also from true suppression of urine, which may last for days and yet ultimately be followed by recovery.

The *symptoms* of non-obstructive suppression are those of ordinary uræmia (*see* URÆMIA). Vomiting, dyspnœa, delirium, and convulsions usher in the attack, and the patient usually dies comatose, if the condition be unrelieved. Those cases due to hysteria are, however, characterized by almost entire absence of these distressing symptoms. Such patients suffer from vomiting, and the vomit may contain a certain amount of urea; but for days, until the renal secretion is again established, the patient may remain in an apparently comfortable condition.

The actual *pathology* of non-obstructive suppression is still obscure. The kidney itself has in such cases been found congested. Probably the suppression is brought about through the agency of the nervous system, and in those cases which arise from catheterization presumably the irritation of the urethra exerts a reflex effect upon the sympathetic nerves of the kidney, and thereby abolishes secretion.

Treatment.—The treatment adopted for other forms of uræmia should be made use of here. Hot baths, and especially the blanket baths, are most efficacious. The patient should be encouraged to drink copiously of barley water and other diluents. Perspiration may be induced by subcutaneous injection of pilocarpin, when internal medication is prohibited by the vomiting.

II. Obstructive Suppression.—

The most common cause of obstructive suppression is blocking of the ureter, generally at its entrance into the bladder, by a small calculus formed in the pelvis of the kidney, the opposite kidney having been destroyed at some previous time by this or some other cause, or being congenitally absent. Again, both ureters may be involved in the growth of carcinoma or tubercle of the bladder. Congenital malformations of the renal arteries or of the ureters are among the rarer causes of obstructive suppression.

Symptoms.—In most cases the exciting cause of the suppression acts suddenly. After an attack of renal colic, the painful symptoms gradually subside, but no stone is passed, and the excretion of urine is abolished. Yet other symptoms do not appear rapidly. The patient feels fairly comfortable even for a few days, and it is difficult to persuade either him or his friends of the serious nature of his condition. Yet he is not free from symptoms which are suggestive to the observer. Great weakness and twitching of the muscles gradually develop. The patient becomes restless, and although he is at times drowsy yet he gets little or no real sleep. The urine may be entirely suppressed, but more frequently small quantities are passed at irregular intervals. Such urine is limpid and of low specific gravity, containing sometimes a little albumin. The respirations are panting. The pupils, normal at first, become contracted. Very rarely is there any gastric disturbance or diarrhea; still more rarely, dropsy of any part of the body. There is no odor of ammonia perceptible in the breath. The drowsiness increases, and with it the muscular weakness, yet the mind is normally active when the patient is roused, until near the end of the case, when low muttering delirium, coma, and rarely convulsions may precede death. The longest period known during which life was prolonged without any urine being passed is twenty days, but usually eight or nine days is the limit.

When the obstruction is due to renal calculus a *diagnosis* of its situation can generally be made from the localization of the renal colic which preceded the suppression. Usually, too, the history will indicate a former attack of renal colic on the opposite side, after which no stone was passed.

The *prognosis* is most unfavorable, unless the obstruction in the ureter can be overcome.

Treatment.—Medicinal measures are of no use whatever. All treatment must be directed to a removal of the obstruction. Sir William Roberts has recommended kneading of the abdomen, in the direction of the obstructed ureter, changes of posture and succussion of the patient with a view to displacing the stone. It might be advisable, seeing that the stone is often impacted near the bladder, to attempt its dislodgment by catheterizing the ureter. Should all these measures fail, the ureter must be opened from the loin, above the obstruction, and a permanent urethral fistula established.

ROBERT MAGUIRE.

Symptomatic Indications.—*Aconite* is valuable in suppression from cold; *turpentine*, for suppression from renal congestion; *kali bichrom.* when following Asiatic cholera.

URTICARIA (Nettlerash ; Hives ; Cudiosis).—An acute or chronic affection of the skin, and sometimes of mucous membranes, characterized by the development of wheals of ephemeral existence, accompanied by severe pruritus.

Symptoms.—Wheals (*pomphi*), which are pathognomonic of the disease, vary greatly in their characters; they may be as small as a pea, but usually are about the size of a finger-nail. They form with great rapidity, and seldom last more than a few hours, but they may appear in successive crops extending without interval over months or years. In their most typical form wheals are distinctly raised above the general surface, flat on the top, pale in the center, bright pink at the periphery, and slightly harder than the surrounding skin. In shape they are usually circular, but sometimes oval, irregular, or in streaks; they exhibit no grouping. In tissues which are lax (*e. g.*, eyelids, scrotum) and on mucous membranes the pale center is not present, and vivid patches of erythematous redness are formed by the coalescence of large numbers of them. If the amount of serous effusion into the center of the wheals be excessive vesicles result, but probably most cases of so-called *U. vesicans* are in reality examples of hydroa. Occasionally, too, the rupture of the extremely congested capillaries results in

hemorrhage, constituting *U. hemorrhagica* or *Purpura urticans*. In children there is a special tendency for the migration of leucocytes in addition to the transudation of serum, and on the subsidence of the wheals inflammatory papules are left behind. Various clinical types meriting separate description are recognized, but these merge one into the other.

Acute Urticaria is often febrile; it is preceded by rigors and malaise, and the temperature may rise to 103° or 104° F. before the appearance of the rash. It frequently results from irritating ingesta, and may be accompanied by severe gastric catarrh and vomiting. The rash is usually very copious, and distributed with rough symmetry more or less over the whole body surface; the lesions are not grouped, and on the face they coalesce to form a sheet of vivid redness comparable to an erysipelas, while on the chest they may be mistaken for the rash of scarlatina. Œdema of the eyelids occurs, and the buccal, faucial, pharyngeal, or even the laryngeal mucous membranes are often involved, causing dysphagia and threatening suffocation. In one case of frequently recurring attacks the gastric mucosa appeared to be involved, as large quantities of blood were vomited with each recurrence. Temporary albuminuria has also been noted. The sensation of itching, burning, or tingling, is always intense, and constitutes an important diagnostic feature. Fortunately, the duration of such cases is generally short, extending only over a few days, but occasionally they may be succeeded by a more or less **Chronic Urticaria** which may last for months or years and prove a source of great annoyance, especially by causing sleeplessness, as the crops have a tendency to develop when the patient gets warm in bed. In other cases exposure to cold, even to the most trifling draughts, determines an attack. The outbreaks are not attended with appreciable fever, and the lesions present the ephemeral characters already described.

Papular Urticaria (*U. Papulosa*; *Lichen Urticatus*) is a variety which occurs only in children, and represents the link which connects urticaria with prurigo (*q. v.*). After the subsidence of the wheals, persistent, hard, small,

acuminate, inflammatory papules remain, the tops of which are crowned with blood-crusts as the result of scratching. These lesions are most common and persistent about the outer sides of the legs and thighs, on the buttocks and, generally speaking, on extensor surfaces. They not infrequently become vesicular, pustular, or, on the palms and soles, even bullous, probably as the result of inoculation of pyogenic micrococci. From time to time acute crops of typical urticarial wheals occur, but these become gradually less and less frequent. The disease almost always occurs in the neglected children of the lower classes, and is often in the first instance the result of pediculosis or fleabites. It is very apt to be mistaken for scabies, but a careful study of its distribution, and the absence of burrows generally, render its differential diagnosis easy.

Urticaria Pigmentosa is a much rarer form, the relationships of which are not so manifest. It has been chiefly described by English dermatologists. The affection always begins in early infancy, and its course is very protracted, although it tends to spontaneous recovery at or about puberty. The lesions are permanent and pigmented; they are commonest on the trunk and neck, and consist of large, wheal-like tubercles, at first reddish in color, but soon becoming dull yellow or buff. They are surrounded by a pink areola at first, and develop very rapidly. Small successive crops appear every few days, and ordinary urticarial wheals or factitious urticaria may be present. Occasionally they vesicate or become erythymatous, probably as the result of scratching. The deeply pigmented tubercles persist unchanged for years. Although most cases are accompanied by severe itching, a few are not so, and in them no secondary lesions develop. Their diagnosis from xanthoma may be a matter of difficulty.

Giant Urticaria.—This term has been somewhat inaptly applied to a group of cases characterized by the sudden appearance of large, soft, oedematous swellings of the skin and subcutaneous tissue, which may measure several inches in diameter. They are specially prone to develop on the face about the eyelids, occluding the eyes. They may also attack the trunk and the limbs, especially in the neighborhood of joints. The

skin over them is usually of normal color; there is no itching, and only some sense of tension is generally complained of. When the mucous membrane of the mouth, throat, or larynx is involved—as not infrequently happens—the symptoms are alarming, but they generally subside with rapidity in the course of a few hours or days. The usual exciting causes are exposure to cold and disorders of digestion, but a considerable number of cases are associated with chronic rheumatoid arthritis. The disease may in exceptional cases extend over months or years, relapses occurring with regular frequency.

Ætiology.—The ill-balanced state of the peripheral circulation which predisposes to urticaria is commoner in children than in adults, in women than in men. Many cases result from external irritants applied to the skin; among such may be included those due to rough flannel clothing, coarse aniline dyes, the stings of nettles, the “bites” of all sorts of pediculi, fleas, bugs, gnats, etc., the personal factor entering largely into the production, and determination of the severity of the resulting lesions. Scratching or rubbing of the originally affected parts, acting as a further irritant, produces extension of the mischief, the secondary lesions thus caused generally greatly predominating over the primary. In the same way and for the same reason urticaria usually complicates all forms of itchy eruption, notably eczema, scabies, acute lichen ruber, prurigo, and pruritus. In susceptible individuals, who are generally said to have “an irritable skin,” exposure to cold is a common excitant, and in them wheals may result from poultices, the application of electricity, the pressure of articles of dress, or from passing the finger-nail or any blunt instrument firmly along the skin surface (*U. factitia*). In this manner, elaborate patterns may sometimes be traced on the skin, especially of the back.

The more important cases are, however, generally symptomatic of other conditions, especially of disorders of the gastro-intestinal tract and of the presence of toxic matters in the circulation. Thus many kinds of food are notoriously prone to cause urticaria, chief among which may be mentioned crustaceans and mollusks; occasionally fish of any sort, whether fresh, dried, smoked, or potted, produces the same disagreeable result.

Pork (especially in sausage form), pickled meats, cheese (especially toasted), eggs, pastry, porridge, cucumbers, nuts, mushrooms, and pickles are often noxious, and among fresh fruits, strawberries, grapes, gooseberries, and raspberries are perhaps those which most frequently disagree. The number of articles of diet which may provoke nettlerash, however, is very large, and individual idiosyncrasies manifest themselves in the most remarkable manner. It is a point worthy of note that in many instances the eruption appears to be the result, not of a toxic substance in the blood, but of a true reflex action from the stomach, as it immediately ensues upon the ingestion of the peccant and almost as quickly disappears when the stomach is emptied by an emetic. Sometimes, too, the direct application of the excitant to the skin produces the same immediate effect as its ingestion.

Other conditions, to which nettlerash is apparently sometimes reflex, are: dentition, the presence of intestinal worms (especially in children), the puncture or rupture of hydatid cysts, and the passage of gall-stones; it may also result from pregnancy, parturition, operative procedures on the generative organs, menstrual disorders (especially at the menopause), and violent mental or moral emotions. The gouty diathesis and acid dyspepsia underlie many persistent cases, and attacks of urticaria may alternate with those of asthma, neuralgia, megrim, or ague, and may occur with the periodic regularity and definite course of the latter disease.

Urticaria is also of comparatively frequent occurrence in connection with chronic Bright's disease, jaundice, lithiasis, diabetes, rheumatism, and enteric fever, probably from irritant matters in the blood; and in the same category must be placed those cases which result from the administration of certain drugs—*e. g.*, copaiba, cubebs, opium or its alkaloids, quinine, chloral, turpentine, santalin, salicylic acid, and the salicylates. The fact must be accentuated that neither in the case of *U. ab ingestis* nor in *U. medicamentosa* is the severity of the affection present proportional to the amount of unsuitable food or of the drug taken, but to the personal susceptibility of the patient. A most severe case occurred in a lad suffering from influenza, in which

no other plausible explanation could be found other than that it formed an integral part of that disease. It remains only to be said that in many cases, especially of the more chronic forms, no ætiological factor can be discovered, and the continuance of the affection is attributed to the establishment of "the urticarial habit."

The *treatment* of every case of urticaria must be directed mainly against its cause, if that be ascertainable. It is, however, impossible here to enter into the management of the very extensive list of morbid conditions which may underlie the disease. In an urticaria *ab ingestis* an emetic of ipecacuanha or sulphate of zinc, or a subcutaneous injection of apomorphine, may be administered if the patient be seen soon after taking the noxious substance. This may be followed by a brisk purge of sulphate of magnesia. In more chronic cases the greatest care must be exercised in the selection of food, dyspeptic troubles must be treated on the ordinary lines, alkalies, bismuth, and vegetable bitters being perhaps the most generally useful drugs. Regular and free action of the bowels must be maintained. Alcohol, tea, and coffee are often specially harmful. The most perfect hygienic surroundings must be obtained, and pediculi, fleas, or other causes of external irritation must, of course, be removed. The skin must be kept scrupulously clean, and soft silk or fine linen worn rather than flannel underclothing, which is often rendered extremely irritating by its impregnation with aniline dyes. In many cases a warm bath every night is decidedly beneficial, and sulphide of potassium ($\frac{3}{4}$ ij) or bicarbonate of soda ($\frac{3}{4}$ vj) may advantageously be added to an average bath of thirty gallons.

Lotions containing liquor carbonis detergens (3 j–3 ij ad $\frac{3}{4}$ vj), carbolic acid (3 j ad $\frac{3}{4}$ vj), naphthol (grs. xx–x ad $\frac{3}{4}$ j), or bicarbonate of soda (grs. xx or more ad 3 j) are generally useful, but Crocker points out, with reason, that any "disinfectant" is useful as an antipruritic. In many cases, the ætiology of which is quite obscure, certain drugs appear to act as specifics. Thus, arsenic is often curative, but care must be taken that the digestive functions are in good order. The same precaution is, oddly enough, not necessary for the applicability of ichthyol, which is of great value, espe-

cially in the nettlerash of women at the menopause. Owing to its nauseous taste it must be given in capsules or in sandarach-coated pills, the dose being gradually raised from 10 to 30 grains daily. Belladonna or atropine, pilocarpin, sulphate of quinine, bromide of potassium, and colchicum are all sometimes useful and merit careful trial in obstinate cases.

J. J. PRINGLE.

Symptomatic Indications.—*Urtica urens* is the chief remedy, and will usually cure the ordinary form. *Apis* is valuable in acute form; *antimonium crud.* in chronic form, with gastric disorder. *Arsenicum* is valuable in obstinate cases.

UTERINE CERVIX.—See CERVIX UTERI.

UTERINE OS.—See OS UTERI.

UTERO-VESICAL FISTULA.—See FISTULA, UTERO-VESICAL.

UTERUS, ABSCESS OF.—*Definition.*—Suppuration in the walls of the uterus. A rare sequela of metritis.

Causes.—Change of inflammation to suppuration unknown.

Symptoms.—After those of metritis, those of suppuration, rigors, nocturnal rise of temperature.

Signs.—Bulging of an elastic swelling in the uterine wall.

Diagnosis.—Is difficult; differentiate swelling from that of cyst by the symptoms.

Prognosis.—If accessible, favorable.

Treatment.—Free incision.

HEYWOOD SMITH.

UTERUS, ABSENCE OF.—*Definition.*—Complete, very rare; occasionally rudiments of the organ are to be detected.

Causes.—Congenital.

Symptoms.—Amenorrhea. If ovaries are present, sexual appetite may exist.

Signs.—Examination by touch, by sound in bladder and finger in rectum (or hand if necessary) failing to detect the organ.

Prognosis.—Unfavorable.

Treatment.—None.

HEYWOOD SMITH.

UTERUS, CANCER OF.—Cancer may affect either the cervix or the body

of the uterus. It is much more common in the cervix.

Symptoms.—The main symptoms of cancer of the uterus are hemorrhage, pain, and wasting. Of those, hemorrhage is the earliest and most constant. It is not uncommon for hemorrhage following coitus to be the first symptom noticed. After the hemorrhage there comes leucorrheal discharge in the intervals of hemorrhage, which becomes very profuse as the disease advances. It may be watery or yellowish. Pain is usually later than hemorrhage. Occasionally the disease runs its whole course without pain. Wasting, to a degree which attracts the patient's attention, does not occur till comparatively late in the disease. The symptoms of *Cancer of the Body of the Uterus* are much the same as those of cancer of the cervix. The pain is of a somewhat different character, being more paroxysmal and due to uterine contractions. The discharge, when the cancer has begun to break down, contains fragments of dead and decomposing tissue, and smells offensively. There is nothing in this at all characteristic of cancer, for fetor of discharge may be produced by many causes. As the disease progresses, the hemorrhage may be so great as to directly kill the patient. This is rare. It may produce anæmia, which leads to fatty degeneration of the heart, and this to sudden death. Venous thrombosis, and pulmonary embolism resulting therefrom, may carry off the patient. The cancer may involve the peritoneum, and set up fatal peritonitis. Secondary growths may set up fatal changes in the organs in which they grow. One of the most common ways in which uterine cancer leads to death is by occlusion of the ureters and consequent uræmia.

Diagnosis.—No reliance can be placed upon the symptoms or the history for the purpose of diagnosis, which can only be made by physical examination. In the later stages of cancer of the cervix or vaginal portion the diagnosis is easy; it is based on the presence of new growth enlarging the cervix, invading all tissues, and therefore fixing the uterus, and breaking down in the central part, thus producing excavated ulceration. In the early stages diagnosis is very difficult, and may be impossible without removing a piece of the growth for microscopical

examination. In judging of the characters of such a piece, only the opinion of a microscopist familiar with the examination of uterine structures is of value. The diagnosis of cancer rests upon the discovery of epithelial ingrowths into the uterine tissue. The presence of irregular enlargement of one part only of the cervix, marked off from the rest, or divided into lobes, by fissures which do not run centrifugally, as do lacerations; and of a sharply defined warty growth, ulcerating in the center, are characteristic appearance; but cancer so advanced as to exhibit these features will often be beyond the reach of treatment. An early sign of importance is a peculiar feeling of the cervix, so that its examination suggests that the finger is passing over wet india-rubber. The behavior of the cervix to a tent has been said to be diagnostic: that a cancerous cervix will not dilate, while one not cancerous will. This is certainly not correct.

In cancer of the body of the uterus, on vaginal and bimanual examination, the cervix is found healthy, and the body of the uterus enlarged. The diagnosis can only be made early enough to admit of treatment either by scraping the body of the uterus with the curette, and examining the piece removed microscopically, or by dilating the uterine cervix and examining the cavity with the finger. The diffuse growth will then be felt. In the circumscribed form of uterine cancer it will be necessary to remove the polypus and examine it with the microscope.

Pathology.—Cancers of the cervix are divided into two classes: (1) *Cancer of the vaginal portion*, and (2) *Cancer of the cervix*.—Cancer of the vaginal portion is cancer beginning on the surface which lies between the os uteri externum and the attachment of the vagina. The vaginal portion, defined as above, is covered with squamous epithelium. Cancer of the cervix is cancer beginning in the part which lies between the os uteri internum and the os uteri externum.

(1) *Cancer of the vaginal portion* begins in the epithelium. It may begin at one point, or at several points close together. The appearance of this form of cancer in early stage presents different forms. It may be a papillary or villous growth. This kind grows down into the vagina, and forms the so-called "cauliflower excrescence," a soft, spongy, villous

mass which collapses after removal. It may, on the other hand, present in the earliest stage nothing but an area of lividity, or it may be first visible as a finely granular patch, or as a red tuberculated surface. The essential and important peculiarity of this form of cancer is that it is superficial, and does not involve the substance of the uterus till a comparatively late period of the disease, and the parametric tissue not till later still. It extends superficially, and in so extending does not tend to spread up the cervical canal, but advances outward and downward toward the vagina.

(2) *Cancer of the cervix* begins in the glands of that canal. These glands increase in number and in size, and their ramification becomes more various in shape. Their epithelium proliferates, and with the multiplication of the cells their shape alters, so that the glands instead of being lined by a single layer of columnar epithelium, become filled with cells of various shapes, often with several nuclei. Thus they form tubes, strings, clusters, and nests of cells. The growth may commence either near the surface or in the deeper parts of the glands. It may begin either high up or low down in the cervix. The forms assumed by cancer in this part in its early stages are various. It may be polypoid, hanging from one of the lips of the cervix, or it may be a papillary growth on the surface, or it may begin as a nodule in the substance of the cervix. But whatever its characters in the early stages, its tendency is to quickly involve the whole thickness of the cervix and the cellular tissue around. It often also grows downward, forming an excrescence projecting into the vagina, but it seldom extends upward above the os internum until late. Briefly, cancer of the vaginal portion creeps along the surface toward the vagina; cancer of the cervix grows outward and downward in the substance of the cervix.

Cancer of the body of the uterus may be diffuse or circumscribed. The *diffuse form* is the more common. In it the whole or the greater part of the mucous membrane of the body of the uterus is covered either with villous growths or with wart-like protuberances. The irritation of the new growth causes hypertrophy of the muscular wall, from which cause, combined with the enlargement of

the cavity caused by the new growth, the body of the uterus becomes considerably enlarged. In the *circumscribed form* the cancer projects like a polypus into the uterine cavity. In its growth it extends deeper and deeper into the uterine wall, at the same time that its projection into the cavity increases.

The disease begins in the glands of the endometrium. There are two forms, adenoma and true cancer. In the former, while the glands greatly proliferate, they remain lined by a single layer of columnar epithelium. In the latter, beside the increase in the size and number of the glands, the epithelial cells become heaped up, and of various sizes and shapes. As the interior of the body of the uterus is not accessible to simple inspection, we really know very little of the appearance in the early stages of cancer of the body. Cancer of the body of the uterus seldom extends to the cervix, but not uncommonly to the fallopian tubes.

Cancer of the uterus in its further history presents the same characters as cancer elsewhere. It invades all tissues, and, as its edge advances, its older parts break down and ulcerate. The lumbar glands enlarge and secondary growths appear in other organs. In the case of the uterus they appear later than in cancer affecting most other parts.

Ætiology.—Cancer of the cervix is rare in the virgin, and occurs chiefly in women who have had children. Statistics show that the more labors a woman has passed through the greater is the liability to cancer. It has been attributed to the lacerations of the cervix which occur in almost all women who have had children, but the only scientific investigation which has been made into this question shows that it seldom, if ever, begins in the lacerated part. Therefore the supposed prevention of cancer is no valid reason for doing the operation of trachelorrhaphy. Cancer of the body of the uterus occurs with equal frequency in virgins, the married, and in those who have had children. Beyond these facts nothing more is known as to the ætiology of cancer of the uterus than of that of cancer elsewhere.

Treatment.—The classification of cancer given above is a practical and important one, because it corresponds to important differences in the amount of success which follows treatment.

Cancer of the vaginal portion can be

diagnosed early, because the growth can be well seen, and a bit of it, if necessary, easily removed for examination; and, until it is far advanced, so that it has extensively invaded the vaginal wall, it can be removed. The treatment, so long as the disease is not too extensive, is to amputate the cervix. This part should be removed as high as possible, so as to get quite clear of the disease. The cervix should be pulled down to the vulval orifice by seizing it with a vulsellum. The practicability of so pulling it down is an important guide to the possibility of complete removal, not only because (1) the operation is easier when the cervix is well pulled down, but because (2) if on vaginal examination we do not perceive any very definite induration around the uterus, yet on attempting to pull down the uterus we find that the upper part of the vagina seems rigid, and is not easily inverted so as to let the uterus come down, that is an indication that the cellular tissue is involved. If the disease has spread to a small extent over the vagina, but has not affected the cellular tissue, the vagina will come down with the uterus, and the diseased mucous membrane, with a surrounding zone of healthy mucous membrane at least one-third of an inch wide, should be dissected off and removed with the cervix. The results of this operation are very good, its danger is slight, and patients may go for years after it without relapse.

Cancer of the cervix is less frequently amenable to treatment. As the part in which it begins is not always accessible to sight or touch, it is often not recognized until the time has passed within which successful treatment was possible; and, as its tendency is to grow outward, toward, and into the cellular tissue, it comparatively soon oversteps the limits within which its removal is possible. Still, if we are so fortunate as to meet with a case of cancer of the cervix before the growth has reached the cellular tissue, the proper course is to amputate the cervix. In removing the cervix for this variety of cancer, it is still more important than in cancer of the vaginal portion to cut well above the internal os uteri, so as to be sure that the whole cervix has been removed.

Cancer of the body of the uterus.—The only radical treatment is the removal of the whole uterus. The collect-

ive mortality following this operation has until recently been not far off one in four, but modern improvements in operating (especially the use of pressure forceps) have reduced the mortality, in the hands of skillful operators, to about that of ovariectomy.

If a case of cancer of the uterus be not seen until too far advanced for removal, all that can be done is to relieve symptoms by palliative treatment. Pain can be eased by morphine, and this may be given in doses as liberal as are required. Patients usually soon become tolerant of the nausea produced by it. It is best given in the form of hypodermic injections, for thus the least ill effect is produced. Foul discharges can only be overcome by great cleanliness, frequent douching, and an unlimited supply of clean napkins. When hemorrhage is great, it can be for a time arrested by scraping the surface of the growth with Simon's sharp spoon, so as to remove the part of the growth which is breaking down and get to a part where the cancer is mingled with healthy tissue. In cancer of the body this step often gives marked relief to pain as well as to hemorrhage.

G. E. HERMAN.

Symptomatic Indications.—*Conium* is useful as a palliative, especially for intolerable, lancinating pains. *Arsenicum* is valuable and the principal remedy in open cancer; with burning, agonizing pain; fetid brown or blackish ichor, excessive debility and emaciation. *Arsenicum iod.*, in scirrhus of os and cervix. *Clematis* is useful in softened scirrhus, with lancinating pains, corrosive discharge. *Creosote*, wide open os, its inner surface covered with cauliflower excrescence. *Magnesia mur.* in scirrhus induration of the os. *Silicea*, in malignant sarcoma. *Hamamelis*, *belladonna*, or *sabina* are serviceable for hemorrhage.

G. E. HERMAN.

UTERUS, CORRODING ULCER

OF.—This is a rare disease, consisting in an ulcer which spreads, destroying as it does so all the tissues in its way. In this it resembles cancer. But it differs from cancer in that there is no induration, or evidence of new growth, in its edges or base: that on microscopic examination of its base or edge no evidence of cancer is found, but only the appearances

of simple ulceration; that its progress is slower, and its course longer than that of cancer, some patients living ten years or more, and finally dying of some other disease; that it is not attended with such emaciation as is usual in cancer, nor with such severe pain; and that hemorrhage is less frequent. It seldom occurs before the climacteric. It has been suggested that it may be analogous to lupus or to senile gangrene, but recorded cases are too few to establish its pathology. No successful treatment has yet been carried out.

G. E. HERMAN.

UTERUS, DISPLACEMENTS OF.

—The uterus in healthy women has not always the same position and shape. The organ is not always in the middle line, and, if it originally occupy a nearly central position, it may be dragged toward one side by adhesions.

Much importance has of late been attached by German writers to the effect of perimetric and parametric adhesions in producing uterine displacements. There is no doubt that by adhesions the uterus may be displaced in the most various ways. But such displacements are of little clinical importance; first, because in the great majority of such cases the symptoms produced by the pelvic inflammation are not appreciably modified by the displacement of the uterus; and secondly, because in the rare cases in which the displacement appears to interfere with the uterine functions, it is quite irremediable by any justifiable treatment.

1. Lateriversion.—This term has been applied to the deviation of the uterus from the central position, and mechanical appliances have been recommended for its treatment. It is quite consistent with health and therefore requires no treatment. If it did, there is no means, mechanical or other, by which the position can be altered.

2. Ante flexion.—In the majority of unmarried women and in a large proportion of parous women the uterus is not straight, but is bent forward so as to be concave in front. To this condition many evil consequences were formerly attributed, and instruments devised for its alteration. It is now known that it interferes in no way with the health, comfort, or fertility, and that, even were it necessary, it is not possible to permanently straighten an

anteflexed uterus by any appliance. Childbearing generally makes the uterus more nearly straight than it was before.

3. **Anteversion.**—The position of the uterus varies according to the degree of fullness of the bladder. When the bladder is full, the uterus lies in or behind the axis of the pelvic inlet; when empty, the uterus falls forward, so that often its whole length can be felt through the anterior vaginal wall. This is called anteversion, and, like anteflexion and lateriversion, has been considered a disease, and treated as such. It is a normal state of things, requires no treatment, and cannot be altered by treatment.

4. **Retroflexion.**—In some women the uterus is bent backward, so as to be concave behind. The above term is applied to this condition.

5. **Retroversion.**—The organ is sometimes turned backward without being bent, so that the uterine body can be felt through the vagina. This is called retroversion.

Cases of retroversion and retroflexion may be divided into four classes:

(1) *Without symptoms.*—Retroflexion and retroversion (which are generally combined) may be present without interfering in any way with health or with the uterine functions; they therefore do not always require treatment.

(2) *With symptoms due to other conditions.*—It is obvious that the existence of displacement of the uterus backward does not protect the patient from other diseases, and that therefore, if symptoms referred to the pelvic organs exist along with backward displacement of the uterus, it does not follow that the latter condition is the cause of the symptoms. The displacement must only be blamed when every other morbid condition can be excluded, and the symptoms are such as the displacement is known to cause.

(3) *With symptoms of prolapse only.*—In the early stage of prolapse, as the uterus sinks it often becomes displaced backward. In that case, while the symptoms of prolapse are present, the backward displacement may be the most distinct alteration in the position of the uterus.

The *symptoms* are pain, referred to the lower abdomen, sacral region, and thighs, the pain being of a dragging, bearing-down character; constant, not paroxysmal; aggravated by exertion, relieved

at once, and soon entirely removed, by recumbency. There is irritability of the bladder, constipation is usual, and the straining which accompanies defecation is painful to the patient. To strong, robust women such symptoms are trifles, but these displacements are more common in nervous weakly women, who also suffer from atonic dyspepsia, sleeplessness, neuralgic pains, nervous exhaustion, and hysteria. The train of morbid phenomena forms a vicious circle. Weakness of the nervous system favors the occurrence of functional failure of various kinds, and also makes the nervous system more sensitive to the painful sensations which such failure produces; the presence of local discomfort in its turn reacts upon, and further weakens, the exhausted nervous system.

(4) *With symptoms of prolapse and congestion.*—In some women, the disposition of the peritoneum in the pelvis is such that two firm bands run from the uterus back to the sacrum. With this arrangement of parts, if the body of the uterus gets displaced backward, and pressed down between these bands, the veins which run from the body of the organ outward in the broad ligament are compressed, the return of blood is impeded, and congestion of the body of the uterus is the result. In these cases the pain is more severe, and is not relieved by recumbency until that position has been maintained for some days; the uterus is very tender to the touch; menstruation is often very profuse and prolonged. Pain and hemorrhage in this affection are, as a rule, in inverse proportion to each other, copious hemorrhage relieving congestion and therefore pain. There is not only irritable bladder, but some smarting on micturition, and leucorrhœal discharge.

Backward displacement of the uterus is often, but not always, associated with erosion of the cervix, as vessels run vertically downward from the body into the cervix and are therefore liable to be compressed if the uterus be bent, and with prolapse of the ovaries.

Prognosis.—This depends very much on the amount of prolapse. If this be great, the patient may need either to wear a support, or put up with the inconvenience of prolapse, for an indefinite time. If the descent of the uterus be only slight, it may be that after the uterus has

been kept supported at its proper level for one, two, or three years, the pessary may be left off without return of the symptoms. The correction of the flexion is not of importance for the relief of symptoms; the falling downward and backward of the uterus is the essential condition, not the bending.

The *treatment* of retroversion and retroflexion, when treatment is necessary, is to support the uterus with a pessary. For complete relief it is desirable that the uterus be raised into a position of anteversion. In effecting this the pessary converts the uterus itself into a lever, the body of the uterus being the weight, the fulcrum the anterior attachment of the uterus to the bladder, and the power the traction of the posterior vaginal wall (pushed up by the pessary) on the cervix. This is most perfectly effected by Hodge's pessary, or one of its modifications. This pessary is made of pewter, vulcanite, or celluloid; pewter is more readily molded, but sometimes causes pruritus. There is a useful form made of spring wire, covered with india-rubber, the anterior ends being separated by india-rubber only, so that the ends can be approximated for ease of introduction. Hodge's pessary is sometimes difficult to adjust, and sometimes, especially in cases of acute flexion, will fail to raise the uterus into a position of anteversion. If it fail to do this, and the uterus be congested, the pressure of the pessary will aggravate the pain. In such a case the best pessary is a thick ring made of a watch-spring covered with india rubber. If prolapse of the ovaries be present, this pessary is indicated, as even if it should not antevert the uterus, its thickness and softness prevent the pressure from causing pain. Whatever pessary be used, it should fill the vagina, but not make its walls tense. A good practical guide to the size will be found in this rule: Choose a ring in diameter one inch less than the posterior vaginal wall, measured from the posterior *cul-de-sac* to the vulva.

All india-rubber pessaries are apt to cause vaginitis, with offensive discharge. The patient should therefore be instructed, while wearing one, to syringe the vagina with warm water night and morning. If there be pruritus, some borax may be added to the water. The pessary should be removed, and the parts examined to detect any ill effects that may have been

produced, such as ulceration, at least once in three months.

Before considering prolapse, a condition must be described which accompanies it, and is indeed the first step in the process, viz.:

6. Descent of the pelvic floor.—This condition accompanies all the most pronounced cases of prolapse. But it may occur by itself, without any appreciable change in the relative position of the uterus. There is always in health some change in the pelvic floor. It descends with inspiration and during effort, and ascends with expiration and when effort ceases. The amount of descent in most healthy women does not exceed half an inch. It is greater in women who have borne children. In women in whom the pelvic floor has been weakened by child-bearing, and the muscular tone lowered by debility, the descent may be much greater, and may be attended by symptoms much the same as those of uterine prolapse. These are relieved by a perineal support. They vary with the tone of the patient's nervous system, being a source of distress when the nervous system is depressed, but hardly felt at other times.

7. Prolapse of the uterus.—This term is applied to those cases in which the uterus is distinctly lower than it should be. It is customary to distinguish three degrees of prolapse: the first degree when the uterus has not descended below the vulvar orifice; the second when the cervix has protruded externally, but not the whole uterus; the third degree, or *pro-cidentia*, when the whole organ is outside.

This condition usually begins with descent of the anterior segment of the pelvic floor—*i. e.*, the anterior vaginal wall and bladder. As the anterior vaginal wall sinks downward, it drags the cervix after it. When the cervix is thus dragged down, while the body is held by its peritoneal and other attachments in or near its normal position, the effect is to stretch the part of the cervix above the vaginal insertion; and therefore, in prolapse of the second degree, it is the rule to find the uterine cavity measuring from four to five inches in length. That this elongation is due to stretching, although it is sometimes spoken of as hypertrophy, is shown by the fact that when cases of prolapse of the second degree, with elongation of the cervix, advance to procidentia, as the traction of the cervix from the body which

caused elongation no longer exists, the uterus resumes its normal length. The cervix uteri in descending drags the posterior vaginal wall after it. When the uterus is completely outside, it lies in a bag formed by the inverted vagina, which becomes dry and scaly. In prolapse of the second degree, the cervix being constricted by the vulvar orifice, the part outside becomes much congested and swollen. This change disappears when the case goes on to procidentia. The protruded parts, both cervix and vagina, are liable to ulceration, which is mainly the result of friction. These ulcers heal when the uterus is replaced and maintained in position. There are cases in which the descent of the parts does not take place in this order, but they are quite rare and exceptional.

The *symptoms* of prolapse have been already described. There is a dragging, bearing down pain, relieved by recumbency, and made worse by exertion. The bladder is irritable, and there is smarting pain on micturition. The act of defecation is attended with [discomfort; a leucorrhœal discharge is usually present.

Prolapse is a condition which is met with chiefly in the laboring class.

Treatment.—The best treatment is to keep up the uterus by one of the forms of cup-and-stem pessary. The cup receives the cervix, and the stem has attached to it elastic bands which are tied to a waist-belt. The pessary may be made of gutta-percha, vulcanite, earthenware, or india-rubber; of these earthenware is the cleanest. An instrument three inches long, with a cup two inches wide, is of the size most generally used.

In slight cases one of the forms of Hodge's pessary or a thick ring may be sufficient. But these can only be retained where there is not much dilatation of the vaginal orifice, and they are therefore ineffective in the extreme cases of prolapse.

If a pessary with external straps be objected to, a plastic operation to contract the vaginal orifice may be performed. But this will not do more than make it possible to keep the uterus up with a vaginal pessary.

Alexander's operation, or the shortening of the round ligaments, has been recommended for backward displacements

of the uterus and for prolapse. For prolapse it is useless; because in prolapse there is descent, not only of the uterus, but of the vagina, and this operation only alters the position of the uterus. Cases of backward displacement of the uterus without descent of the vagina, which cause symptoms enough to make the patient an invalid, and yet cannot be relieved by a vaginal pessary, may be completely cured by Alexander's operation. It is not free from risk, but this is less than that attending treatment with an intra-uterine pessary, and, if successful, it cures, which an intra-uterine pessary never does.

It has been recommended to open the abdomen, and stitch the uterus to the abdominal walls. This measure is no doubt for a short time efficient; but knowing how peritoneal adhesions may stretch and even disappear, it is hardly to be expected that the permanence of an adhesion so produced could be relied upon; and no cases have yet been published showing the duration of relief afforded in this way.

8. *Inversion*, or turning inside out, of the uterus, is fortunately rare. It most often occurs after delivery, and is due to contraction of the cervix coinciding with relaxation of the body of the uterus, so that while the latter is pushed or pulled downward through the os uteri, the cervix contracts and prevents its returning. In the unimpregnated state it may occur from the traction of a fibroid, either during its spontaneous expulsion, or as it is being pulled down for removal by the surgeon.

Cases of inversion of the uterus are divided into *acute* and *chronic*. Acute inversion is the form which follows delivery. It may be caused by traction on the cord, either by the medical attendant in attempting to remove the placenta, or by the child in consequence of the cord being too short, or from its being twisted round its body. But it may also occur without any traction, if the uterine body be relaxed, and it is important to bear in mind that it may thus happen without any fault of the medical attendant.

The *symptoms* are collapse and hemorrhage. On examination, a sensitive tumor, the size of the uterus, surrounded at its base by the cervix as by a collar, will be found projecting into

the vagina. On examination of the abdomen the body of the uterus is not to be felt in its proper place. The *treatment* is to push up the inverted uterus with the hand. This is most easily done by pressing somewhat laterally, so as to push up first one side, then the other. The sooner replacement is attempted after the inversion has occurred the easier it is. If long delayed it may be difficult even with chloroform, and the case may require to be treated as one of chronic inversion.

If acute inversion of the uterus be left unreduced, the organ undergoes involution, just as is the case when it has not been inverted. When involution is complete the condition is called *chronic inversion*. The inverted uterus is sensitive to the touch, and bleeds almost continuously, watery or purulent discharge being present in the intervals of hemorrhage.

The *treatment* of chronic inversion is to replace it by continuous elastic pressure. The best repositors are Aveling's. By this instrument reduction can almost always be effected within three days, and generally in a shorter time. No other treatment is at the present time justifiable.

G. E. HERMAN.

Symptomatic Indications.—*Nux vomica* is often useful, with recumbent position, in recent prolapsus. *Aletris*, for displacement from weakness of uterine ligament. *Caulophyllum*, in retroversion, with periodic, spasmodic pains.

UTERUS, FIBROIDS OF (Fibroid Tumors; Fibro-myomata).—These are the commonest tumors which grow in the uterus. They are classified, according to their position, into *submucous*, *interstitial*, and *subserous*. They are all interstitial growths at first, and, as they enlarge, some come to project into the uterine cavity (submucous), and others on the peritoneal surface of the uterus (subserous).

Fibroids are also classified according to their structure; some consist of concentrically arranged fibro-muscular tissue, or of several masses so formed, and appear as round hard nodules distinctly encapsuled. They can easily be shelled out of their capsule, are less vascular than the other kind, and on section are pale in color. These have been called *hard*, *white*, or *nodular*

fibroids. In them fibrous tissue is relatively more abundant; therefore some writers restrict to them the term "fibroma." Others are much softer, more vascular, redder on section, are not formed of concentrically arranged fibers, but of fibers which interlace in all directions; they are not encapsuled, but so closely blended with the surrounding tissue that they cannot be shelled out; and they do not form nodules, but a general enlargement of the uterus concentrically surrounding the uterine cavity. These have been called *soft*, *red*, or *concentric* fibroids, and in them muscular tissue is relatively more abundant; therefore they are by some writers called "myomata."

Symptoms.—Subserous fibroids cause trouble chiefly by their size. They may grow to be as large as any tumors met with in the body, reaching a weight of fifty or sixty pounds, or even more. When they reach this great size they may cause much suffering and danger by their pressure on important parts. By enlarging the abdominal cavity, and so pressing the diaphragm upward, they may cause dyspnoea. By pressing on the stomach they may cause vomiting. Intestinal obstruction may be the result of pressure on the bowel. Pressure on veins may cause oedema of the lower extremities, and pressure on the urethra may give rise to retention of urine and its consequences; or one or both ureters may be occluded by pressure. These tumors may produce the pressure results thus enumerated, not merely by their size when in the abdominal cavity above the pelvis, but, when no larger than a fetal head, they may get locked in the pelvis, and thus exert injurious pressure on parts within that cavity, or they may get so tightly incarcerated as to become gangrenous. The degeneration, softening, and escape of the products of degeneration of these fibroids may cause peritonitis. Such peritonitis may be fatal, but if not fatal it results in the production of adhesions. Such adhesions may enable a tumor to produce effects by its pressure which would not have happened had the tumor been free to move. It may even happen that the tumor comes to receive its blood supply through an adhesion, and that the traction exerted by an adhesion may elongate, perhaps twist, and finally break

off the connection between the fibroid and the uterus. Fibroids which are entirely subserous seldom have much effect upon menstruation.

Submucous Fibroids (with which, for clinical purposes, the soft or "concentric" growths spoken of by some as "myomata," must be classed) are chiefly important because they produce hemorrhage. When of the hard or nodular kind they are generally single, and seldom reach a great size. A submucous fibroid larger than a fetal head is rare. By projecting into the uterine cavity they enlarge it, and the irritation of their presence causes the uterine mucous membrane to undergo thickening and vascularization to such a degree that some have termed the condition endometritis. The vascularity of the mucous membrane and the increase in its area cause profuse, long-continued, and often repeated hemorrhages, with leucorrhœal discharge in the intervals of hemorrhage. There is often dysmenorrhea, often also irritability of the bladder and slight pelvic pain. But the hemorrhage is the important symptom, for through it the patient is made an invalid. Death directly from hemorrhage is rare; more commonly such patients, if not cured, die from some condition the result of the anæmia induced by the hemorrhages.

As already stated, all fibroids are interstitial in the beginning, and, as they grow, bulge either toward the peritoneum or toward the uterine cavity. But they may enlarge in both directions, especially when multi-nodular, and may reach a considerable size while covered on each aspect by a layer of muscular tissue, altering the external shape of the uterus and enlarging and distorting the uterine cavity. In such cases there will be menstrual troubles, such as are produced by submucous growth, and there may be also symptoms resulting from pressure or from peritonitis and subsequent adhesions.

Changes in fibroids.—Fibroids are liable to various changes. They *enlarge* slightly before each menstrual period, and very much during pregnancy, if it take place. They may become very *œdematous*, and the fluid exuded may separate the fibers and lie in interstices of irregular shape between them. Thus is formed the so-called "fibro-cystic" tumor. The term "fibro-cystic" is not

quite appropriate, because in such tumors there are, as a rule, no true cysts, but merely irregular spaces between the fibers containing fluid, but having no epithelial lining. There may be more than œdema—viz., *myxomatous degeneration*. There may be *suppuration*, or, what is more common, *breaking down* of part of the tumor, and conversion into a granular detritus. This often takes place at parts of the tumor, and, by opening of such softened spots and escape of *débris* into the peritoneum, peritonitis may be produced. The writer has known a suppurating fibroid discharge pus copiously into the uterine cavity, but this is rare.

Fibrous tumors may undergo *calcification*—that is, there is a deposit of calcareous salts around the periphery of the tumor, or in streaks through its center, together with shrinking and hardening of the whole mass. This change occurs in the subserous fibroids of old women. *Gangrene* of the whole tumor may occur either from inflammation and suppuration of its capsule, or, in the case of a subserous growth, from twisting of its pedicle, or from a tumor getting wedged and compressed in the pelvis. Disintegration of uterine fibroids is often spoken of as *gangrene*. A natural mode of cure of submucous tumors is by their *expulsion* through the cervix into the vagina, and the slow elongation, thinning, and at last parting of the pedicle and separation.

Disintegration and expulsion of submucous fibroids in the form of loose fibrous *débris* also occurs, though rarely. Such disintegration is not attended with grave symptoms until the disintegrated tissue reaches the lower part of the vagina, when putrefactive germs get access to it, and decomposition of the dead tissue and blood-poisoning from absorption of the products of putrefaction result. If the patient be seen before this has happened, timely treatment with antiseptic injections will prevent it. This form of degeneration is interesting clinically, because the loose fibrous *débris* presenting at the os uteri feels very like placenta, for which it has often been mistaken, thus giving rise to unfounded suspicions.

Lastly, many isolated cases have been published in which tumors diagnosed

by competent observers as uterine fibroids have disappeared, and it has been believed that the tumors have been *absorbed*. In most such cases the absorption has taken place during the lying-in period.

Diagnosis of fibroids.—This is made by physical examination. It is generally easy, but may be difficult, or impossible. The important signs are, first, that the tumor, on bimanual examination, is found to be continuous with the uterus, and to move with it. Next, that subperitoneal, multi-nodular tumors are very hard, and are made up of a number of masses, each having a rounded outline. Should a subperitoneal fibroid have a long pedicle, it may be impossible to distinguish it from a solid ovarian tumor. Submucous fibroids produce uterine enlargements, which it may be difficult to distinguish from pregnancy. The diagnosis will be made from the fact that the enlargement due to a fibroid is seldom quite as regular in shape as that of pregnancy, and also the softening of the cervix and the bluish tint of the genital mucous membrane are absent in the case of the fibroid. Between a small fibroid and cancer of the body the diagnosis may be difficult, and indeed impossible without a digital exploration of the uterine body after dilatation of the cervix. This proceeding will be necessary for treatment as well as diagnosis if there be copious hemorrhage with slight uterine enlargement. A fibroid projecting from the uterus laterally may much resemble the swelling formed by a thickened and dilated fallopian tube. If, in addition, there have been pelvic peritonitis matting the pelvic organs together, the diagnosis will be still more difficult, and may be only possible after abdominal section. The diagnosis (previous to that proceeding) depends mainly on the much more severe pain which accompanies disease of the tubes.

Ætiology.—Nothing is known about the ætiology of fibroids. They occur chiefly in women between thirty-five and forty-five. It is rare to find them before twenty-five, and rare also for their growth to begin after the menopause. They occur alike in the virgin, the married, and the parous.

Treatment.—As the majority of uterine fibroids (taking all classes together)

produce no serious symptoms, they require no treatment. Subserous fibroids of such size as to cause grave pressure symptoms can only be effectively treated by removal. If locked in the pelvis, they should be pushed up either manually or by hydrostatic pressure.

Submucous fibroids are spontaneously cured in two ways. First, by their disintegration and piecemeal expulsion. This is rare; and attempts to bring it about artificially, such as have been advocated, are attended with more probability of harm than good. Secondly, by their gradual expulsion from the uterus, first into the cervical canal, then into the vagina. In this process the attachment of the tumor to the uterus gradually becomes thinner and longer, and it may be spontaneously severed, and thus the cure completed. This process may, however, take years to accomplish, but the most satisfactory treatment of submucous fibroids is the acceleration by art of this natural process.

Fibrous polypus.—A fibroid tumor lying in the cervix or vagina, attached to the body of the uterus by a thin stalk, is thus termed. If it be found *in the vagina* the treatment is to cut through its stalk either with scissors or the *écraseur*. If the attachment of the tumor to the uterus be extensive and close, it may be that, instead of the neck of the tumor elongating and a polypus being formed, the tumor drags down the body of the uterus, and thus inversion of the uterus is produced. In the case of a seeming polypus, if it be about the size of the fundus uteri, it should be remembered that, to the vaginal touch, an inverted uterus and a polypus about the same size feel very much alike. In both there is a rounded swelling projecting into the vagina and surrounded at its base by the cervix uteri. The diagnosis is to be made either by bimanual rectal examination, by which, if the tumor be a polypus, the body of the uterus will be felt in its natural place above the cervix; or by the sound, which, in the case of a polypus, will pass $2\frac{1}{2}$ inches or more beyond the os externum, but in an inverted uterus will not pass more than about one-half inch.

In the case of a tumor *in the cervical canal*, the lower part of the cervix being stretched over it and the external os dilated—if the tumor be small, that is,

not larger than a walnut, it may be seized, pulled down, and twisted off. If the os be not large enough to allow this, it may be enlarged by incision, or by waiting a few days and giving full doses of ergot, which will produce further dilatation of the cervix, but which has the disadvantage of being accompanied by further hemorrhage. If the tumor be larger than the size of a Tangerine orange, and within the cervix, it should be removed by enucleation. It has been said that there is a secret in the enucleation of fibroids. The secret is to select cases in which the cervix is expanded and the os externum dilated to the size of a fifty-cent piece or larger, to use antiseptic precautions, and not to try to drag by force a large tumor through an undilated cervix, but to cut the tumor up into small pieces, removing a piece at a time, and dragging down a fresh piece as room is gained by removal of its predecessor. In this way the writer has enucleated a tumor weighing $2\frac{1}{2}$ lbs.

Submucous fibroids *not expanding the cervical canal* and causing hemorrhage can generally be effectively treated by ergot, which, by making the uterus contract and contracting the arterioles, reduces the hemorrhage to limits consistent with health, and often diminishes the size of the tumor. The ergot should be given in $\frac{1}{2}$ -dram doses of the liquid extract, three times daily, continuously for at least three months, unless something else be needed before that time has expired. It has been given by hypodermic injection; but the advantages of this method are so slight as not to counterbalance the disadvantages. The beneficial results mentioned follow the use of ergot in three-fourths of the cases. If benefit accrue, the ergot may be continued without intermission for twelve months or more. If the uterine contractions from the ergot should be very painful, they may be obviated by the addition of grs. x of antipyrin to each dose. In some cases ergot fails to do good, and in a few it appears to increase the hemorrhage. This latter result is sometimes due to the uterine contractions forcing down the tumor and rupturing veins running in its capsule. Fatal hemorrhage has been known to occur from rupture of such veins. There is no drug besides ergot which has any

definite effect upon uterine fibroids or the hemorrhage they cause.

Lately, a method of treatment by *electricity* has been introduced. This consists essentially in passing a very strong continuous current (100-300 milliamperes) through the tumor; one electrode being placed in the uterus, the other on the abdomen. Injury to the abdominal wall from so strong a current is prevented by using as an electrode a large poultice-like sheet of potter's clay. The intra-uterine electrode exerts a cauterizing effect on the mucous membrane, and so checks hemorrhage. It is said also that the current exerts what is called an "electrolytic" action on the tissue of the tumor through which it passes, and diminishes its size. No proof of this has yet been adduced. There is some danger attending this treatment, for it has been followed by death, but the sources of danger have not yet been defined. The published results show that this treatment is not so effective as that by ergot, and, in addition, it is less safe. But in cases in which ergot fails and operative treatment is unadvisable, electrical treatment may properly be tried.

If hemorrhage be considerable enough to affect health, and ergot fail to lessen it, *removal of the uterine appendages* should next be considered. If the tumor be small and movable and the patient's health not much affected, this is, in competent hands, an easy and safe operation. If the tumor be large, the ovaries are often displaced and the folds of the broad ligament are spread out, so that the uterine appendages cannot easily be pulled up and ligatured; if it be immovable, the appendages may be found imbedded in firm adhesions; and if the patient be extremely anæmic, there is danger from thrombosis after the operation; these conditions, therefore, much increase its danger. If the appendages are successfully removed, cessation of hemorrhage and shrinking of the tumor follow in the great majority of cases.

If these methods fail, nothing remains but hysterectomy. But cases are exceedingly rare in which this is required.

G. E. HERMAN.

Symptomatic Indications.—*Mercurus corr.* is valuable where there is profuse muco-purulent excoriating leucor-

rhœa; *mercurius biniod.*, for fibroids of stony hardness without much excoriation. *Trillin* for metrorrhagia due to fibroid.

UTERUS, HYPERTROPHY OF.—

Increase in size of the body of the uterus sometimes remains after child-bearing; the condition has been called *hypertrophy*, but it is usually termed *subinvolution*, and is described under that name. The body of the uterus becomes increased in size and thickness whenever new growths are contained in its walls or cavity. This hypertrophy is secondary to the growths, and is in itself unimportant.

Hypertrophy of the cervix uteri.—

There are three kinds of enlargement of the *cervix* to which the term hypertrophy has been applied. (1) Chronic inflammation of the cervix producing general thickening. When this thickening is great, good may come from amputation of the cervix. (2) In prolapse the traction on the cervix by the procident vagina elongates that part of the cervix which is above the insertion of the vagina. By some this has been called hypertrophy; by others, elongation; by others again, *hypertrophic elongation*. Reasons for thinking that it is lengthening of the cervix by stretching rather than overgrowth are given in the section on PROLAPSE. But, although usually so produced, it may be due to overgrowth. A specimen in the Hunterian Museum shows hypertrophy of the infra-vaginal part of the cervix in the anterior lip; of the supra-vaginal portion of the cervix, in the posterior lip. Here the supra-vaginal hypertrophy cannot have been due to stretching, and is not accompanied with thinning. (3) Hypertrophy of the vaginal portion of the cervix may be a congenital malformation. If slight descent of the uterus take place the hypertrophied cervix protrudes at the vulva, and the condition stimulates the second degree of prolapse. The hypertrophy appears to favor the occurrence of prolapse. This form of hypertrophy is recognized on endeavoring to replace the apparent prolapse, when it is found that, when the uterus is pushed as high as possible, the distance between the vaginal insertion and the os externum is not diminished.

The *treatment* is to cut off the infra-

vaginal portion of the cervix, either with knife or scissors, the mucous membrane of the cervical canal being sutured to that of the external surface of the cervix, or the galvano-cautery wire may be used.

G. E. HERMAN.

UTERUS, INFLAMMATION OF (Metritis).—

Acute Metritis occurs in the puerperal state as a result of septic infection (*see* PUERPERAL FEVER). In the non-puerperal woman it is sometimes seen as a result of rough treatment of the uterus, as in the removal of tumors from the use of tents without proper precautions, or from the wearing of intra-uterine pessaries. It is generally believed that it may result from suppression of menstruation, or from sexual excesses, but from such causes it is at least rare. It is associated with endometritis, and quickly leads to peritonitis.

The *symptoms* are that, in addition to the hemorrhage or discharge which endometritis produces, the uterus is swollen and tender.

Treatment consists in absolute rest in bed, the administration of laxatives, leeches to the inguinal regions if the patient be full-blooded; counter-irritation to the abdomen in the form of poultices of linseed mixed with mustard or sprinkled with turpentine, potassium bromide if there be much reflex excitability; the removal of any pessary or tent, and discontinuance of any interference with the uterus.

Chronic Metritis is one of the most common, and yet ill-understood, diseases that occur in women.

Symptoms.—The affection is assumed to be present when the uterus is large and tender, and the patient, without any other morbid condition being present to account for it, suffers from chronic pelvic pain. The pain is not very severe, but lowers the tone of the nervous system by its continuance, and is increased at the menstrual period. It is generally stated that in the beginning of the disease the menstrual flow is increased in quantity, while later on it is diminished; but, if this be the rule, exceptions are numerous. There is usually some leucorrhœa, from accompanying vaginal catarrh and cervical endometritis. There is often irritability of the bladder and slight scalding in micturition. Dyspareunia is usual. The pelvic symptoms

are usually accompanied by those of atonic dyspepsia—capricious appetite, fullness after meals, flatulence, constipation—and by such symptoms of nervous exhaustion as loss of energy, depression of spirits, muscular weakness, disturbed sleep, inability to sustain thought, frequent headaches, vertigo, and hysterical seizures. This train of symptoms is generally of long standing, and is often dated back to a labor which was followed by a convalescence slower than usual or interrupted by illness. A similar group of morbid phenomena is sometimes seen in women who are sterile, or comes on during a period of sterility following a period of fertility, and in some at least of such cases is due to efforts to prevent conception. It has been attributed to laceration of the cervix, but without the slightest evidence, and there is abundant proof to the contrary. It may be produced by too much local treatment of the uterus. From the circumstances of its origin, its persistence and chronicity, and the kind of treatment that is found effectual, the increased size and tenderness of the uterus is believed to be due to chronic congestion and inflammation. It is suggested that in the earlier stage it is congested (hence the increased menstrual flow), and that later the inflammatory exudation has become organized into fibrous tissue which thickens and hardens the uterus, compressing and even obliterating vessels, and hence making menstruation scanty. Some who think the evidence of inflammation insufficient, but nevertheless accept as a fact the presence of an excess of fibrous tissue in the uterus, call the disease “chronic areolar hyperplasia.” But the morbid changes, whatever they may be, have never yet been demonstrated. Those that have been pointed out are not peculiar to this disease. There is no evidence that there is any more fibrous tissue in these large tender uteri than there is in uteri which although large, are not tender. The strongest argument in favor of the disease being really due to congestion is the benefit that follows treatment which depletes the pelvic vessels.

The success of treatment depends upon the stage at which the opportunity for it occurs. Recent cases can be quickly cured, but in those of long standing treatment is not followed by good results.

Treatment.—Rest is most important, but it may be difficult to induce the patient to keep her bed for a malady which does not seem to require it, but if she can be induced to do so the effects of treatment will be greatly helped. If the patient be florid and menstruation scanty, four or six leeches should be applied to the cervix uteri, when aggravation of pain indicates the approach of menstruation. A hot vaginal douche should be used night and morning. After the douche, a plug of cotton-wool saturated with glycerin, and tied to a piece of string to facilitate removal, or, better, a pessary of glycerin and gelatin (gelatin ℥j, glycerin ad 3 ij), should be inserted. To the latter, if there be much soreness and irritation, grs. xx of boric acid may be added. Alcohol should be forbidden. The bowels should be regulated, it being better that they should be loose than confined. Disorders of digestion must be treated in appropriate ways, and tonics given, with draughts of ammonium bromide (3 ss) if there be sleeplessness. If the patient can be induced to keep her bed, and the case be recent, a month or two of this treatment will probably remove the symptoms. It has been proposed, and practiced in intractable cases, to remove the ovaries; but in the cases which have come to the knowledge of the writer this has not proved beneficial. Treatment is likely to be more efficient if the patient can be taken from her home, and in some cases, but by no means in all, this is essential.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is the principal remedy, when attended with febrile symptoms; burning, stinging pains; purulent discharge. *Belladonna* when from menstrual suppression, or after labor; also in hyperæmic condition of the uterus; general congestive condition. *Nux vomica* is often valuable after parturition. *Sabina* is sometimes useful, especially when attended with irritation of the bladder and rectum. *Aurum* is useful in chronic cases of long standing; the uterus sags down in the pelvis, and is indurated; patient melancholy and depressed. *Ergot* is the principal remedy for subinvolution, both for ordinary cases with atonic condition and severe cases where gangrene threatens, with general adynamic condition of the system; uterine hemorrhage, worse from the least motion;

black, fluid, fetid discharge. *Sepia* in venous congestion of the uterus, with severe bearing down pains; chronic, indurated condition of the uterus, cervix, and os. *Calcarea carb.*, in chronic metritis; subinvolution; menses too early, too long, too profuse; profuse perspiration from least exertion.

UTERUS, MALIGNANT ADENOMA OF.—A rare disease, consisting in a fungous overgrowth of the mucous membrane of the uterus.

Symptoms.—Quite in the beginning it may be difficult or impossible to distinguish this disease from fungous endometritis, for detached portions of the overgrown mucous membrane, when examined microscopically, only show overgrowth of the regular gland-tissue of the uterus, and not any malignant structures.

In course of time the case is distinguished from endometritis by the rapidity and extent of the growth, which may come to form great masses spreading down into the vagina and filling it.

The symptoms and course of the disease when advanced are practically identical with those of cancer of the body of the uterus, from which it differs only in the histological characters.

The *treatment* is the same as that of cancer of the uterine body.

G. E. HERMAN.

UTERUS, POLYPUS OF.—The term "polypus" means a stalked growth. It has been applied to at least four different uterine products.

(1) *Fibroid Polypus*, a submucous fibroid which has been expelled into the uterine cavity or beyond it, and has thus acquired a stalk.

(2) *Mucous Polypus*.—The simplest form of mucous polypus is that caused by an occluded cervical gland, which, being enlarged from retention of its secretion, first projects from the surface of the mucous membrane and then hangs down by a stalk. Such tumors have been called *Ovula Nabothi*. Sometimes several of these are aggregated together and form a larger tumor. Other mucous polypi are simply overgrowths of the mucous membrane, and consist chiefly of connective tissue. Polypi of these kinds seldom reach a size larger than a hazel nut. They only cause leucorrhœa, and perhaps hemorrhage when touched. They are

easily cured by seizing them with a pair of forceps and twisting them off. There is another kind of polypus, commonly classed under "mucous" polypi—viz., *follicular hypertrophy of the cervix*. This is formed of an overgrowth of all the cervical tissues, muscular tissue, vessels, and glands, the overgrowth of the glands being the most conspicuous change. These have been called "channeled" polypi. They, and the polypi formed by blocked glands, are by some called "adenoma." Such a polypus causes leucorrhœa, backache, and, it may be, slight hemorrhage. The *treatment* is to twist it off, or, if the pedicle be thick, to remove it with an *écraseur*.

(3) *Placental Polypus*.—This is a retained portion of placenta with entangled clot, which still has some vascular connection with the uterus. For *treatment*, etc., see ABORTION.

(4) *Fibrinous Polypus*.—A clot retained in the uterine cavity and having some attachment to the uterine wall. *Treatment*, as for placental polypus.

Cancer sometimes forms a polypoid tumor.

G. E. HERMAN.

UTERUS, SARCOMA OF.—Sarcomata of the uterus—i. e., tumors composed of embryonic connective tissue—are rare. Before this name had been given to these growths they were described under the title of "recurrent fibroids." They are usually of the rounded type, less often of the spindle-celled kind, sometimes of mixed types. They more often grow in the body of the uterus than in the cervix. They are met with in two forms—circumscribed and diffuse. When *circumscribed*, they form rounded tumors growing in the uterine wall, to the touch very much like uterine fibroids, but softer. Fibroids sometimes degenerate into sarcoma. At this stage they can be distinguished from fibroids only by microscopical examination. In the *diffuse* form, assumed when the growth begins in the mucous membrane, the interior of the uterus presents an irregular ulcerated surface with ragged fungous outgrowths, its walls being infiltrated with new growth. The circumscribed growths are often multiple; they may break down and ulcerate, and thus the transition can be traced between the circumscribed and the diffuse forms.

The diffuse form can only be distinguished from cancer by the microscope. Late in the course of the disease secondary growths occur in other organs, although less often than in cancer.

The *symptoms* are much the same as in cancer—pain; hemorrhage; watery, offensive discharge in the intervals of hemorrhage; cachexia. Its course seems to be slower than that of cancer.

Nothing is known about the *ætiology* of sarcoma. Unlike cancer of the cervix, its occurrence does not seem to be favored by child-bearing.

The *treatment* is the same as that for cancer.

G. E. HERMAN.

UTERUS, SUBINVOLUTION OF.

—When, after delivery, the uterus does not return to the size it had before pregnancy, it is said to be in a condition of subinvolution. It is very common; so much so that, in anatomical works, it is usually laid down that the uterus in women who have borne children is larger than in the virgin. The uterus does sometimes, after child-bearing, return to its former dimensions, so that the mere size of the organ affords no ground for giving an opinion as to whether there has been pregnancy or not.

Symptoms.—Subinvolution does not *per se* give rise to any symptoms, even though the uterus be of considerable size. But just as all damaged or degenerated parts are more liable to inflammatory and other morbid changes than healthy parts, so a uterus which has not undergone perfect involution is more liable to become the subject of chronic metritis or endometitis and to menstrual irregularities than a well-involuted uterus. After the lying-in period has passed, the size of the uterus cannot be appreciably diminished by treatment. This effect has been claimed for many kinds of treatment, but the claim has never been supported by the evidence of cases so observed as to show that the observer was aware of the fallacies which make it difficult to draw conclusions on the point.

Ætiology.—The main causes of subinvolution are the following: (1) Deficient contraction of the uterus in the puerperal period. (2) Retention of placenta, membranes, or clot *in utero* during the early days of the puerperium. (3) Febrile conditions during the lying-in period.

Treatment.—Subinvolution is to be prevented by the use of antiseptics during labor and the lying-in; by proper management of the third stage of labor, so that the placenta and membranes may be completely separated and expelled; and, if uterine contractions be imperfect (indicated by after-pains, passage of clots and hemorrhage), by the administration of ergot during the lying-in period.

G. E. HERMAN.

Symptomatic Indications.—*Aurum, iodine, sepia, ergot.* See UTERUS, INFLAMMATION OF.

UTERUS, SUPER-INVOLUTION, OR PUERPERAL ATROPHY OF.—

This condition is produced when the puerperal involution of the uterus goes further than to restore it to the size that it had before delivery, the organ again becoming infantile in size, but it is rare. Nothing is known about its causation. It is not necessarily accompanied by any symptoms, except amenorrhea, or, to use a more comprehensive term, premature menopause. The vasomotor disturbances which often accompany the menopause, such as flushes, perspirations, headaches, etc., may be present with this condition. No serious impairment of health is produced by super-involution. There is no treatment which can restore the uterus to its former size. Intra-uterine stems, cauterization, galvanism, have been advised to stimulate, or rather irritate, the uterus. It is possible with them to make the uterus bleed, but this is not restoration of function, nor is it beneficial to the patient. Such treatment is, moreover, attended with risk. Super-involution is of course attended with sterility.

G. E. HERMAN.

UVULA, DISEASES OF.—The uvula is the conical-shaped body depending from the center of the free border of the soft palate. In its structure it resembles the soft palate, but it is especially rich in glands.

From its position the uvula naturally suffers when the soft palate and fauces are affected; hence it is liable to inflammatory conditions, and to be the seat of the local manifestations of measles, scarlet fever, diphtheria, syphilis, etc. Occasionally the uvula is the starting-point of the inflammation, and very rarely the mischief is confined to the uvula,

the term **Uvulitis** being applied to this condition. In some cases the engorgement of the uvula may proceed to such a degree that it attains the size of the thumb, and causes an irritating cough, or even obstructs the passage of air.

Treatment.—When the uvula is acutely inflamed the application of a twenty per cent. solution of cocaine by the spray or laryngeal brush, will often give relief, and pellets of ice in the mouth will assist. Should the swelling increase, scarification or amputation may be required.

Elongation of the Uvula.—By repeated inflammatory attacks, particularly in persons of lax fiber, the uvula may become permanently elongated. In one instance the uvula was so long that the patient could take it between his teeth; and, on removal, it was found to be four inches in length, its lower extremity being terminated with a knob. Elongation of the uvula generally gives rise to an irritating cough, especially when the patient is in the recumbent position; this fact should be borne in mind in investigating cases of nocturnal coughing. Schech states that an elongated uvula may cause spasm of the larynx, and quite recently A. Mantle has described a case of laryngismus, in a child, cured by removal of the uvula. The elongated uvula may also give rise to the sensation of a foreign body in the throat or cause an inclination to vomit.

Treatment.—It is necessary, in the first place, to improve the general health. If there be constipation, a mixture containing the sulphates of iron and magnesium will usually diminish the relaxed condition of the uvula. Local astringents may then be tried. A combination of the extract of krameria and cocaine, made up into a pastile, is often very effectual. Or astringent gargles, such as alum or tannic acid, may be ordered. The application of nitrate of silver, fused on an aluminium probe, usually gives at least temporary relief. Should these measures fail, the elongated organ must be amputated. This is best effected after the application of a twenty per cent. solution of cocaine to the part; see MOUTH, DISEASES OF. The indications for this operation are as follows: "(1) Elongation to such a degree that the uvula, especially during sleep, is sucked

into the larynx and produces attacks of suffocation. (2) The coexistence of a long thick uvula, with a persistent feeling of irritation in the throat, and a constant tickling cough. It must be distinctly understood that this indication is only valid after careful examination of the pharynx, larynx, and thorax, and after exclusion of all other possible causes. (3) The hindrance offered by a very long uvula to the performance of delicate endo-laryngeal operations. (4) Malignant disease starting from the uvula." There can be no doubt that the uvula is frequently removed unnecessarily, as the reasons for its removal are but rarely met with. It should be borne in mind that the pain on swallowing which sometimes follows the operation is severe and persistent, and occasionally the hemorrhage is excessive. In one or two cases the hemorrhage, which was very trifling at the time of the operation, recurred with great violence some hours later. The most effectual way to arrest the hemorrhage is to slip slowly a mixture of tannic and gallic acids, 360 grains of the former and 120 of the latter in an ounce of water as recommended by Mackenzie.

Abnormalities and Growths of the Uvula.—The uvula may be cleft, giving rise to a bifid uvula, or there may be two uvulas.

Apparent absence of the uvula is generally to be accounted for by destruction of this body through tertiary syphilitic ulceration.

Growths such as mucous polypus, papilloma, cavernous angioma, epithelioma, etc., occasionally take their origin from the uvula.

F. DE HAVILLAND HALL.

Symptomatic Indications.—Inflammation of the uvula when acute will require *aconite*; congestion and engorgement, *belladonna*; great engorgement, with low grade of inflammation, *mercurius*. For elongation the principal remedy is *pulsatilla*, although *hyoscyamus* is sometimes useful.

VACCINATION.—The inoculation of a human being with the contagium of vaccinia or cowpox, with the object of protecting the person thus inoculated against smallpox—or, at least, against a severe or fatal attack of that disease.

The immediate effects of vaccination

are chiefly local; they vary in character according as the person affected has, or has not, already been successfully vaccinated or undergone an attack of inoculation of smallpox.

Primary vaccination denotes the successful vaccination of a person previously unprotected; *secondary vaccination* is synonymous with *revaccination*.

I. Primary vaccination. — Regular course.—When vaccine lymph of proper quality has been applied to the abraded skin of a previously unprotected person, or has been inoculated by a subcutaneous puncture, a couple of days pass without any observable result. In successful cases the order of subsequent events is as follows:

End of second or beginning of third day, a small, hard, red *papule* appears at the site of inoculation; by the *fifth or sixth day*, the papule has become a distinct pearly *vesicle*, oval or circular in outline, with raised margin and depressed center.

Eighth day, the vesicle is fully developed; it is plump and rounded, distended with clear lymph; its margin is firm and prominent, and the central depression distinct. In the course of this day—sometimes by the evening of the seventh day—the vesicle begins to be surrounded by a circular rosy *areola* of inflammation.

Ninth and tenth days, both vesicle and areola continue to extend, with increased swelling and hardness of the subjacent subcutaneous tissue, which is generally somewhat painful. After the tenth day the areola begins to fade, and in another three or four days has usually quite disappeared, together with all swelling and hardness. With the fading of the areola the vesicle begins to dry in the center, its contained lymph becomes opaque, contracts, and consolidates, so that by the

Fourteenth or fifteenth day the vesicle is converted into a hard brown scab, which gradually dries and blackens; and on about the

Twenty-first day—or, from the twentieth to the twenty-fifth day—the scab separates, leaving a *cicatrix*, which is circular, depressed, pitted, sometimes radiated, and generally permanent through after-life.

These events form a tri-weekly record, which may thus be summarized: the

first week is occupied by the formation and maturation of the *vesicle*; the *second week* witnesses the formation and decline of the *areola* and the drying of the vesicle into a *scab*; the end of the *third week* sees the separation of the scab with the discovery of the *cicatrix*.

The manner in which the lymph was inoculated—whether into one large abraded surface, or by several punctures, and these some distance apart, or set close together—will determine the development of one large vesicle, of several separate vesicles (one for each successful puncture or abrasion) or of one or more confluent vesicles, together with variations in the shape and extent of the resulting cicatrix or cicatrices.

The *constitutional symptoms* which attend these local phenomena are usually slight; they comprise slight rise of temperature; beginning about the fourth day, more marked during the areolar stage, and often all that time attended with disorder of the bowels and stomach, but declining as the areola fades. At this period also, the axillary glands sometimes become greatly enlarged and painful, and occasionally—chiefly in hot weather—there develops in young children an eruption of *vaccine roseola* (chiefly confined to the limbs), or of the papules of *vaccine lichen*, or even of vesicles—which differ from true vaccine vesicles in possessing no central depression. These eruptions, when they do occur, generally disappear within a week.

Irregular course.—The order of events related is in most cases followed exactly. Sometimes, however, the development of the vesicle is either retarded by two or three days or slightly accelerated, but this variation from the normal course of events does not impair the protective value of the result, provided that the phenomena be in all other respects regular and typical.

It is however, important to recognize a non-protecting and spurious form of vaccination distinguished by irregularity in the characters and course of the vesicle itself. Thus, papules, or even small vesicles, may appear early, and, beginning to decline about the fifth or sixth day, are marked only by a slight crust or scale by the end of the first week; or vesicles develop early after the inoculation, attended with much local itching (which is hardly ever noticed in a true

vaccination), become conoid or acuminate, instead of flattened with a central cup-shaped depression, contain a straw-colored opaque fluid in place of clear lymph, and soon develop an irregularly shaped areola, which rapidly fades after the sixth day.

Complicated course.—Friction or other injury and want of cleanliness may sometimes cause the vesicles to develop into ulcerating sores, more especially in strumous subjects.

Similarly, swollen axillary glands may suppurate, and erysipelas may supervene on vaccination. Such unfortunate accidents are rare in proportion as scrupulous care is taken in the selection and use of fresh lymph taken from a healthy vaccinator, and strict attention paid to cleanliness as regards the instruments used and the place of vaccination, and provided that the healthiness and continued personal cleanliness of the person vaccinated be insured.

II. Secondary vaccination (Revaccination).—Most persons can be revaccinated at least once during their lives; sometimes repeatedly, and at comparatively short intervals. Occasionally, the resulting phenomena are exactly those of a regular primary vaccination, or differ only in the development of a smaller and more transient areola and the formation of a fainter cicatrix. More usually the result is only a *spurious vaccination* with the production of a small papule or acuminate vesicle, attended with great itching and irritation, surrounded by an early and irregular areola which is at its height by the fifth or sixth day, and scabbing by the eighth day; but the general constitutional symptoms are often quite disproportionately severe. In some persons all attempts at revaccination are without effect.

Performance of vaccination.—Since it is undertaken as a protection against smallpox, which spares no age and is especially fatal to infants, vaccination should be performed as early in life as possible. If the child be healthy and well nourished, the age of from four to six weeks is appropriate; if the child be delicate, the operation may be postponed for another month or six weeks. If smallpox be epidemic in the immediate vicinity or have attacked other members of the household, the infant should be vaccinated at once, whatever its age and

whatever its condition, acute and serious illness being the only exception to this rule. Under other and ordinary circumstances the existence of certain forms of ill-health or of disease in the child will render its vaccination inadvisable so long as this continues. Thus, a child suffering from any acute febrile disease, from diarrhea, from disorders of dentition, from any cutaneous malady, and particularly from any form of herpes, eczema, or intertrigo (in view of which the scalp, and the skin-folds in the groins, the neck, and behind the ears should always be carefully examined)—one that has been lately exposed to the infection of measles or of scarlatina, or in whose neighborhood erysipelas prevails at the time—should not be vaccinated so long as any one of these conditions persists.

The lymph employed for the purpose may be either “bovine” or “humanized;” in either case it must be taken from an animal which is both young (calf or infant), and in sound health and of healthy parentage, so as to avoid the possibility of transmitting other acquired disease as well. Since bovine lymph is apt to induce rather more severe local effects, humanized lymph should be preferred for the vaccination of delicate children.

The lymph should be used as fresh as possible; whenever practicable, it is best transferred directly from one subject to the other, as in “arm-to-arm vaccination;” but it may be stored for a reasonable time on clean flat “points” of ivory or bone, between glass plates, or in glass tubes of narrow bore, which are partly filled by capillary attraction with lymph exuding from a punctured vesicle, and then sealed by melting first one end and then the other in the flame of a spirit lamp.

The lymph must be taken only from a perfectly formed, sound, uninjured vesicle, which has developed after the “regular” type and which has not yet developed any areola. Though lymph may exist in a regular vesicle as early as the fifth day, it is obtained more abundantly and more conveniently by the early part of the eighth day (*i. e.*, the day-week following the vaccination. Each vesicle is multicellular, and should be opened by delicately scratching or puncturing its surface, great caution being used not to draw blood, which must on no account be mixed with any lymph intended for vac-

cination. The lymph rapidly exudes from the punctures and collects on the surface of the vesicle, whence it may be collected for storage as above, or from which it may be taken on the point of a clean lancet or other instrument suitable for the performance of arm-to-arm vaccination.

The arm of the child that is to be vaccinated should be bared above the shoulders, and the skin of the deltoid region washed with warm water and rubbed dry with a clean cloth; this cleanses the skin, at the same time rendering it somewhat hyperæmic and more prone to absorption. The arm being then grasped, so as to steady it and slightly stretch the skin, the lancet (charged with the fresh or stored lymph) is made to slightly puncture, scarify, or tattoo the skin over one or more surfaces, whose total or combined areas should equal about half a square inch. The procedure may be varied by first scratching the skin with a clean lancet and then rubbing lymph into the abraded surfaces. Where "points" are used, the dried lymph which they bear must be softened by holding them in the steam of hot water before inserting them into the punctures or firmly wiping them over the scarifications.

The lymph thus applied, together with any blood which may have appeared, should be allowed to dry before the child's clothing is readjusted. It is well to instruct the nurse not to wash the vaccinated spot for the first two or three days, and then to protect the surface by one or two loose folds of fine scorched linen. If, as the vesicles mature, local irritation become excessive, the frequent application of soft rags saturated with lead lotion affords much relief, and a mild mercurial alterative may be given internally. All unguents and greasy applications should be interdicted, and the part must be kept clean and protected from friction.

The child should be seen again on the day-week (eighth day) following the vaccination. If the development of the vesicle be then found to be retarded, it should be again inspected in another two or three days' time. Should the local condition still appear abnormal, the case must be carefully watched day by day to its termination. Only that vaccination in which the development and char-

acter of the vesicles conform to the normal type can be certified as successful and regarded as protective.

All instruments used for vaccination purposes should not only be kept scrupulously clean and bright, but should be thoroughly cleansed after each time of using, if employed for more than one vaccination at a time.

Revaccination is performed with the same precautions as regards the infancy of the vaccinifer and the selection of the lymph employed. The resulting constitutional symptoms are apt to be more severe; and it is well to support the vaccinated arm in a sling, and to enjoin abstinence from its active use, so as to minimize the troublesome enlargement and irritation of the axillary glands. In the case of men and boys (in whom the position of the cicatrix is comparatively immaterial) it is useful to revaccinate on the inner and upper aspect of the left *forearm*; the vesicles are here less exposed to friction from the clothes, the movements of the shoulders are less hampered, and dressing and undressing become less painful.

Vaccination does not, in all cases, confer absolute immunity against smallpox; it does so, however, for the great majority of the successfully vaccinated; and such a person, if attacked with smallpox, suffers only the much milder "modified" form of the disease; while the probability of a fatal issue is even less than if the individual had undergone a prophylactic inoculation or a previous attack of smallpox itself. The necessity for revaccination depends upon the fact that in only a comparatively small number of persons does the effect of a successful primary vaccination in infancy persist throughout life; in other words, most people become susceptible to vaccination (and, presumably, to the infection of smallpox) after the lapse of a period which differs in length in different cases. The immunity so commonly afforded by a successful primary vaccination seems to be more rapidly exhausted during the actively metabolic period of youth and adolescence; hence most individuals can be revaccinated successfully before the period of puberty, and very commonly at least once again—sometimes at comparatively frequent intervals—during adolescence or in later adult life. Certain diseases also—and enteric fever in particular—seem directly to impair or to neutralize the effects of vac-

cination. On the other hand, successful revaccination appears, equally with successful primary vaccination, to afford immunity against smallpox, or, at all events, against its more serious effects; and this, in each case, for a period which varies probably with the "physiological equation" of the individual operated on. Statistics show that smallpox is extremely rare, and a fatal result almost unknown, among adults who have undergone a successful revaccination.

Hence, if susceptibility to revaccination be coincident with susceptibility to smallpox and if successful vaccination afford, in most cases and for some time at least, protection against smallpox (which the vast and increasing experience of all civilized communities affirms); then it is reasonable to urge the revaccination of all children at about the age of from ten to twelve years, and to advise a second revaccination by the time that adolescence is completed, as well as after recovery from certain diseases, such as enteric fever in particular. Persons who are found to be thus again susceptible to the vaccine virus would do well to submit to another revaccination after a further lapse of years; and in any case, to be revaccinated whenever they were likely to be exposed to the infection of smallpox, and during an epidemic of that malady.

C. E. SHELLY.

Symptomatic Indications.—When the appearance of the papule is attended by fever; inflammatory condition of the site of inoculation; restlessness and anxiety, *aconite* is useful. For acute swelling; erysipelatous skin with high fever; parts inflamed and very sensitive; delirium with nervous excitation, *belladonna* is very valuable. For an erysipelatous condition of the site of inoculation, with pain and much swelling, pale, waxy, transparent, or dark blue color of the skin, burning stinging pains with much œdema, *apis* is serviceable. For intolerable itching of the skin: erysipelatous inflammation; induration and thickening of the skin; pain and soreness of limbs, *rhus tox* is the remedy.

VACCINO-SYPHILIS (Vaccination Syphilis).—A term used to indicate the conditions—local and constitutional—which result from the introduction into the system of syphilitic infection along

with the vaccine at the time of vaccination. It does not include that quite distinct class of cases in which the syphilitic poison has been subsequently inoculated on the site of abraded vaccine vesicles, nor those other cases in which symptoms of hereditary syphilis develop in the course of, or shortly after, vaccination; although an accurate distinction between these three groups may sometimes present very considerable difficulty. The syphilitic virus may be inoculated during vaccination by means of contaminated lymph, or by the contact of tainted instruments, with the freshly made punctures or scarifications.

In true vaccino-syphilis there is a double and contemporaneous inoculation of two distinct infections—the virus of vaccinia, and that of syphilis—but the incubation-period and the developmental phenomena of the latter overlap, without, as a rule, interfering with those of the former; so that in such cases the vaccination vesicles generally pursue their usual course and obtain their normal development (*see* VACCINATION), and it is not until after they have healed, and four or five weeks have elapsed since the date of the vaccination, that the local inflammation which constitutes a chancre begins. This is attended by the usual glandular enlargement (axillary bubo), and is followed, in due course, by the recognized secondary symptoms of constitutional infection. The occurrence of vaccino-syphilis—although, fortunately, of extreme rarity—is the most lamentable accident by which carelessness or misfortune can prejudice the performance of vaccination, and it is important by reason, first, of the care which is requisite for its prevention; and secondly, by reason of the necessity for discriminating between it and some other conditions which simulate it, and with which it is apt to be confounded.

Vaccination syphilis is to be avoided by the invariable and conscientious exercise of the following precautions: Great care in the selection of a healthy vaccinifer; scrupulous cleanliness of all instruments, etc., used in obtaining lymph from the vaccinifer and in transferring it to the subject of the vaccination, together with effectual cleaning and drying of the instruments immediately after the performance of each separate operation; carefully avoiding to draw blood

when opening vaccine vesicles for the purpose of obtaining lymph from them for vaccination, and the rejection of any lymph with which blood may have become mixed; and the refusal to take lymph for vaccination from any vesicles which are surrounded by an areola.

The various pathological conditions which are apt to be confounded with

vaccino-syphilis, and from which it may have to be discriminated, include *Vaccinal Ulcers* (ulceration or gangrene at the site of the vaccination vesicles); and—if the concomitant symptoms suggest evidence of general infection—*Vaccination Rashes* and *Hereditary Syphilis*. The principal points which differentiate these various groups are exhibited in the annexed tables:

Vaccino-Syphilis.

Chancre developed on the site of usually one or two only of the vaccination-punctures.

Inflammation is slight.

Loss of substance superficial only.

Suppuration scanty or absent; scabs or crusts formed.

Border of chancre smooth, slightly elevated, gradually merging into floor.

Surface of floor smooth.

Induration "parchment-like" and specific, not merely inflammatory.

Inflammatory areola very slight.

Gland swelling constant, indolent (syphilitic bubo).

Complications rare.

Chancre never developed before the fifteenth day after vaccination; usually not until after three to five weeks: still in its earliest stage twenty days after vaccination.

Secondary Syphilitic Eruption due to true Vaccino-Syphilis.

Appears at the earliest, nine or ten weeks after vaccination.

Requires, in every case, the pre-existence of a specific ulcer (chancre) at the site of vaccination.

Exhibits the character of a true specific eruption.

Fever often slight.

Lasts for a long time.

Usually accompanied by specific appearances on mucous membranes.

Vaccino-Syphilis.

Begins with a local infection, chancre, and indolent bubo.

Typical development in four stages, viz.: Incubation, chancre, second incubation, generalization (secondary eruptions, etc.).

Never appears earlier than the ninth or tenth week after vaccination.

Vaccination Ulcers.

Ulceration affects all the punctures as a rule.

Inflammation and ulceration severe.

Ulcer deeply excavated.

Much suppuration.

Margin of ulcer irregular, as in "soft chancre."

Floor of ulcer uneven, suppurating.

Induration inflammatory only.

Areola inflammatory, and erysipelatous in character.

Gland swelling often absent; if present, merely inflammatory.

Complications—sloughing, erysipelas, etc.—often present.

Ulceration is present twelve or fifteen days after vaccination, and is fully developed by the twentieth day after vaccination.

Vaccination Rashes—(including roseola vaccinalis, miliaria vaccinalis, vaccina bullosa, vaccina hemorrhagica) also accidental eruptions—rubeola, scarlatina, lichen, urticaria, etc.

A true vaccinal rash appears between the ninth and fifteenth day after vaccination.

Absence of inoculation chancre.

Eruption does not exhibit specific characters.

Fever always present.

Evanescent.

Hereditary Syphilis showing itself about the time of vaccination.

No chancre; begins with general phenomena.

Has no typical development in connection with vaccination.

Time of development quite independent of vaccination.

Is attended by the characteristic syphilitic bodily aspect.

Other manifestations of hereditary syphilis may be present.

The history may indicate syphilis.

In considering this subject it must be admitted that there are some few individuals and some constitutions in which the inoculation of vaccine virus—however pure the lymph—may evoke local and general phenomena strictly comparable with those erratic forms of blood-poisoning which occasionally appear as the sequelæ of other specific fevers;

compare—*e. g.*, the cancrum oris and noma of measles; hemorrhagic and gangrenous varicella; the otitis of scarlatina; the necrotic periostitis of smallpox and enteric fever; and, moreover, that all of these conditions may appear to be benefited by the exhibition of mercurials, although they have nothing to do with syphilis.

The *prognosis* of vaccination-syphilis is, with appropriate treatment, at least as good as that of severe cases of vaccinal (non-syphilitic) ulceration.

The *treatment* is essentially that of syphilis.

C. E. SHELLY.

VAGINA, DISEASES OF.—Malformations.—The vagina may be occluded by a transverse septum. Such septa are more common at its lower part, but may occur at any part. There may be more than a mere membranous septum. The vagina may be absent altogether or be obliterated for part of its length.

The consequences and treatment of malformations of this kind are described in the article on AMENORRHŒA (*q. v.*).

The vagina may be *double*, a condition usually associated with duplicity of the uterus. This malformation gives rise *per se* to no inconvenience, and is usually discovered only when some other condition calls for local examination.

Unilateral Hemato- or Pyo-colpos.—One-half of a double vagina may be imperforate, and in that case blood or pus may be retained in it. Such a disturbed half-vagina forms a tumor on one side of and partly in front of the pervious half. The tumor is elastic, and fixed, not displaceable; fluctuation may be obtained, although with difficulty.

The *diagnosis* will be finally made by puncture. Before opening such a tumor, and sometimes even after a free incision has been made, it is difficult to tell how far the fluid-containing cavity is formed by the vagina, and how far by the cervix uteri.

Treatment.—A piece of the septum should be cut out, so as to lay the two canals permanently into one.

Inflammation.—*Puerperal vaginitis* is the commonest form. Some degree of vaginitis during the involution of the uterus and vagina is very common, and this may last for months or years after, thus producing chronic leucorrhœa. If treated early, it is easily cured. The most acute form of vaginitis is *gonorrheal* (see GONORRHEA IN THE FEMALE). *Senile vaginitis* is not uncommon, especially in fat, constipated women with gouty tendencies, and in such is often associated with eczema or erythema of the labia.

Vaginitis may also be due to the irritation of pessaries, bits of sponge or wool left in the vagina, etc., and it may also be due to irritating discharges from the uterus. *Granular* or *papular vaginitis* is a form met with along with pregnancy and gonorrhea. Usually both these conditions are present, but there may be one without the other. This form is characterized by the presence in the vagina of hard papules, feeling like shot imbedded in the mucous membrane. The probability is that these papules are inflamed and enlarged glands; but this has not yet been proved. Very rarely, instead of papules there are *pustules*. Another rare form has been observed in Germany, the *emphysematous*, in which there are vesicles containing gas. No such case has been observed in England, but one case of a similar condition affecting the cervix uteri has been published in this country. There is a form which may be described as *painful vaginitis*, in which the discharge is slight, but there is much heat and swelling of the mucous membrane. In this form pain and difficulty in sexual intercourse are prominent symptoms, and are described as varying in degree and at different times. Another rare form is *dry vaginitis*, in which there is no discharge, but the mucous membrane is deep red and tender. The writer has observed two cases of vaginitis lasting for months, and peculiar in the profuse discharge of pus which was present, the quantity being in excess of that in gonorrhea, but there being neither pain nor tenderness and the affection not disappearing after a course of a few weeks, as in gonorrhea. Vaginitis is sometimes produced by the disease known as *lupus* of the vulva, or esthiomène. Lastly, just as by a chill, nasal catarrh may be produced, so vaginal catarrh may own a similar origin.

In slight forms of vaginitis the only symptom is a mucous or purulent discharge. In severer forms there may be pain, and there may be also soreness or pruritus. Pain in micturition, from extension of the inflammation to the urethra, is frequent.

Treatment.—If rapid recovery be wished for, the patient should be kept in bed. The secretion should be washed away by a hot douche, as frequently as the patient can be got to use it, and after

the douche—a mild astringent lotion should be used. Mild astringents frequently repeated are more efficient than the occasional use of strong lotions. Tannic acid (grs. vj ad $\frac{3}{4}$ j), or zinc sulphate (grs. ij ad $\frac{3}{4}$ j) may be used. If there be pain or soreness, a saturated solution of borax or boric acid is best. In a chronic case in which treatment of this kind has been much used, some strong carbolic acid may be poured into a Fergusson's speculum, and then the vagina bathed with it. Care must be taken that it be mopped up before withdrawing the speculum, so that none may go into the vulva. Laxatives should be given, and alcohol forbidden. If vaginitis be slight and of long duration, its inconveniences are so trivial, and the cure so difficult, that it is better to let it alone.

Cancer.—The vagina is very seldom the seat of primary cancer, although it is common for uterine cancer, as it extends, to involve the vagina. Primary cancer forms a warty growth on the mucous membrane.

Treatment.—If seen while it is yet movable, it should be excised, about one-fourth inch of healthy mucous membrane round it being removed with it. After it has extended to the submucous tissue only palliative treatment is practicable.

Sarcoma of the vagina is rare. It may form rounded nodules, very much like fibroids, but softer, and unlike fibroids they have no connective tissue capsule. They can in their early stage only be distinguished from fibroids by microscopic examination. After they have begun to break down and ulcerate they clinically resemble cancer.

The only *treatment* is early removal when possible.

Fibroids of the vagina are rare. They seldom reach a great size. They commonly attract notice by the mechanical inconvenience which they cause, leading to a protrusion, or blocking of the canal. They are encapsuled, so that their removal is usually easy, and is the only treatment.

Prolapse of the anterior vaginal wall with the bladder is called *cystocele*; of the posterior wall with the rectum *rectocele* (q. v.).

Cysts are sometimes seen in the vagina. They are rare, and their mode of origin is disputed. They only cause mechanical inconvenience by their presence if they

reach some size. They are seldom larger than a hen's egg.

The *treatment* is to cut away as much of the cyst wall as possible.

G. E. HERMAN.

Symptomatic Indications.—*Aconite* is the most useful remedy in simple vaginitis, from cold; *mercurius*, in catarrhal form, with purulent secretion. *Cantharis* or *sepia* for gonorrheal vaginitis. *Grindelia robusta* is often useful, soothing violent itching and burning, particularly when parts are red and raw.

VAGINISMUS.—A nervous disease which consists in hyperæsthesia of the mucous membrane of the vulva.

Symptoms.—In this affection the slightest contact with the mucous membrane provokes cries of pain and uncontrollable movements having for their object to withdraw the part from contact; and this, although the patient is quite willing to be examined. The tenderness is not limited to one spot, and examination under anæsthesia fails to detect any disease of the vulva. Contact in some cases provokes not only pain, but spasmodic contraction of the levator ani muscle and narrowing the vagina.

Certain *morbid conditions* of the vulva may cause symptoms like those of vaginismus. Urethral caruncle, fissures of the fourchette, follicular vulvitis, a peculiar disease in which very tender patches of a deep red or purple color are seen on the mucous membrane of the nymphæ and around the meatus urinarius, lupus of the vulva, abscess in Bartholin's gland, painful vaginitis. These will be distinguished from vaginismus by ascertaining, by physical examination, the local cause of the trouble. These conditions—both vaginismus and the local conditions subsequently mentioned—although often discovered on marriage, may come on for the first time after years of married life, and after child-bearing.

Treatment.—Vaginismus is a nervous disease which cannot be cured. Even childbirth fails to remove it, but with time it may diminish in severity. It can, however, be greatly relieved, and, for the time, removed, by the local use of cocaine in the form of an ointment, applied to the vulva (grs. xx ad vaseline $\frac{3}{4}$ j). Or as a pessary (cocaine hyd. grs. v, gelatin grs.

xx, glycerin ad 3 ij). Cutting operations have been devised, but are quite useless.

G. E. HERMAN.

Symptomatic Indications.—*Belladonna* is one of the most important remedies for this condition, particularly when the vagina is hot and congested; *gelsemium* for purely nervous vaginismus. *Nux vomica* is sometimes useful.

VAGINA, FOREIGN BODIES IN.

—Generally pessaries or sponges may cause a false diagnosis of metritis, leucorrhœa, or even cancer, patient forgetting their presence. Sometimes they have to be removed piecemeal. Pessaries have for years remained unsuspected in the vagina, causing foul discharges, etc.

C. B. KEETLEY.

VAGINA, LACERATIONS OF.—

Usually the result of parturition, occasionally caused by broken chamber utensils, or by assaults, etc.; in rare instances, even by bridal intercourse.

Treatment.—Trivial cases require only rest, silver nitrate, etc.; medium cases require sutures, and, if neglected at first, eventually operation for recto- or vesico-vaginal fistula. Severe cases may cause collapse and rapid death. Complete circular rupture of vagina, with expulsion of uterus, has been known during parturition. And this, also, without violent instrumental interference.

C. B. KEETLEY.

VAGINA, POLYPUS OF THE.

—*Definition.*—Rare. A small tumor which may be fibrous or of connective tissue, sessile, or pediculated, from the vaginal wall.

Causes.—Unknown; probably irritation.

Symptoms.—Sometimes dull, aching pain, and inconvenience from obstruction.

Signs.—The tumor is felt movable in the vaginal wall, and of a denser consistency than a cyst.

Diagnosis.—As above.

Prognosis.—Favorable.

Treatment.—Removable by dissection or the *écraseur*.

HEYWOOD SMITH.

VAGINA, RUPTURE OF.—*Definition.*—A tear through the vaginal wall into the cavity of the peritoneum. It usually takes place at one side or the other of the

cervix uteri, near its junction with the vagina.

Causes.—Spontaneous, through a severe pain after considerable pressure of the head, or owing to the act of turning, or though unskillful use of instruments.

Symptoms.—Severe pain, collapse, hemorrhage.

Signs.—The rent can be felt on examination, and not unfrequently the intestines protrude through the rupture.

Diagnosis.—On examination the finger can be passed through the rent and the intestines felt, and also the peritoneal surface of the uterus.

Prognosis.—Unfavorable.

Treatment.—Keep the patient for at least forty-eight hours on that side on which the rent is, so that the weight of the uterus may keep the sides of the wound in apposition; full doses of opium.

HEYWOOD SMITH.

VARICOSE VEINS.—A permanent pathological dilatation of a vein is called a *varix*, and a vein so affected is said to be *varicose*. The disease is most common in the veins of the lower extremity, but is also frequently met with in the spermatic cord (varicocele), and around the anus (hemorrhoids), less often in the neck, upper limbs, and trunk. It is chiefly observed as a disease of the subcutaneous veins, but dissection shows that it affects very often also the intermuscular and intramuscular veins, but the main veins of the limbs, with the exception of the posterior tibial vein, are remarkably exempt from it. The disease may be limited to one or more of the main superficial veins, as either saphena, or even to a limited portion of it; or leaving these veins free, it may involve only some one or more branches opening into them, or some of the small venous radicles only, and then again, in other cases, all the subcutaneous veins of a part are found to be varicose. It is believed that a superficial varix often commences at the point where a deep vein communicates with a superficial vessel, and that the dilatation of a varicose vein is apt to be most marked at such situations. The coats of varicose veins are notably thickened, so that, when cut, they gape like arteries. The intima is thickened and shows longitudinal striæ; sometimes it is atheromatous or even calcified. In the middle coat there is an increase of

both the muscular and the fibrous elements; the outer coat is also thickened to a less degree; but firm bands of fibrous tissue bind together the convolutions of a tortuous vein, and also fix it to the skin over it. The valves of varicose veins are not enlarged in a compensatory manner, but, on the contrary, may be found shrunken, or present in the form of cords, adherent sometimes by one end only, or they may be entirely wanting.

Ætiology.—The usual view is that varix results from a disturbance in the normal relation between the intravenous pressure and the resistance of the vein wall; this may be either an increase in the blood pressure or a diminution in the tone of the vessel. The diminished power of resistance of a vein may be an inherited condition, or the result of some occult error in development; or it may result from absorption of surrounding structures depriving the vessel of its wonted support; or from inflammatory changes in the outer coat of a vein leading to its softening. Increased intravenous pressure is generally considered to be a more powerful factor. This may result from the action of gravity obstructing the venous outflow, or from an increased supply of blood to the part. The pressure of a pregnant uterus upon the iliac veins is believed to be a common cause of varicose veins of the leg; the pressure of a tight garter or of an ill-fitting truss, and the obstructive diseases of the heart and lungs, are other conditions which may have the same effect. Although the column of blood in the veins of the lower limb is supported by that in the arteries, yet the pressure of the blood upon the vessels is increased by gravity, and is greatest at the lower end of the column. The valves are of use in breaking up the veins into segments, each of which is to some extent relieved from the weight of the column of blood above it. But should a valve be rendered useless by overdilatation of the vein or any other circumstance, the segment below is not thus relieved, and is liable to yield under the extra strain thrown upon it. The hyperæmia attending inflammation, chronic ulceration, or prolonged muscular contraction increases intravenous pressure. Certain ætiological factors must be still further considered.

(a) *Age.*—Varicose veins most often develop between twenty and thirty-five

years of age; they may increase or diminish at later periods.

(b) *Sex.*—The disease is more common in men than in women, probably because, with the exception of pregnancy, they are more exposed to the exciting causes of varix.

(c) *Occupation.*—All occupations which entail prolonged standing or walking predispose to the disease; this is partly due to the effect of gravity, partly to the compression of the deep veins by the contracted muscles, and partly to the active hyperæmia attending prolonged muscular action.

Effects.—It is commonly held that the dilatation of veins impedes the return of blood from a part; this leads to chronic congestion and œdema, with ulceration, eczema, and induration of the tissues as results. The frequent association of these latter conditions with varicose veins is a fact, but that they are related as cause and effect is highly improbable. Certain is it that, even in cases of extreme varix, no one of these phenomena may be observed, while they are often met with apart from varix. Possibly they may be common results of one set of causes. The dilatation of a vein is sometimes attended with a thickening and pigmentation of the skin over it; more often, however, the skin is thinned by the constant pressure; and when, as may happen, this is combined with a thinning of the coats of the vein, the vessel may burst externally, either spontaneously, or as a result of strain or some local injury. The thinning of a vein chiefly occurs at the seat of saccular dilatations of its walls. The altered state of the vein walls, and the slowing of the circulation within them, together with their prominence exposing them to contusion, render varicose veins specially liable to thrombosis.

Symptoms.—An extreme degree of varix may exist without giving rise to any symptom. More usually the patient complains of an aching pain, or a sense of fullness in the part on standing, or after long walking. Deep varix may cause cramp-like pain. The enlarged veins are readily recognized; often their blue color is visible. In the skin, dilated veins show as blue lines; they are often arranged in a stellate manner. Great thinning of a vein gives it a dark purple color, and its rupture leads to free hemorrhage, for, owing to the inefficiency of

the valves, the venous blood flows both from above and from below.

Treatment.—*Palliative treatment* consists in obviating the increased intravenous pressure caused by position, strain, muscular action, etc., in affording external support to the vessels by well-fitting elastic stockings, or a carefully applied bandage, and in improving the patient's general condition by astringent tonics or digitalis, where these are indicated.

The curative treatment consists in obliterating or removing the diseased vessels. It is indicated in only a minority of cases; the multiplicity of varices, and the simultaneous affection of deep veins, frequently render operations performed upon superficial veins disappointing. Where, however, a single limited varix exists; or one particular varix is a source of constant pain, unrelieved by palliative treatment, and disabling the patient; or where an enlarged vein leads directly up from a chronic ulcer, which resists other measures, operative treatment of the varix is called for. Many modes of radical cure have been proposed, but only three require notice.

1. *Acupressure.*—By passing a hare-lip pin beneath the vein, placing a piece of gum bougie over the vessel, and then throwing a silk thread in a figure of 8 over the ends of the pin, the walls of the vessel can be held in apposition, and a certain amount of traumatic phlebitis be excited, which may lead to the occlusion of the vessel. One or many pins may be employed, as may be required; they should be withdrawn in about a week, unless marked irritation be excited earlier, and they may be left longer if the local irritation be very trivial. Care should be taken not to pierce the vein, as it is liable to excite more acute phlebitis. The operation often fails to obliterate the vein. Two pins may be introduced close together, and the vein then be divided subcutaneously; this renders the results more certain.

2. *Ligature.*—Through an incision, about half an inch long, down to the vein, a ligature may be passed around it and tied. Silk, soaked in carbolic acid solution (five per cent.), is the best material for the ligature; chromic catgut may be used.

3. *Excision.*—By making an incision along a varix the vein may be exposed and dissected out; a double ligature

should be tied around each branch of the vessel before it is divided. All these plans of treatment should be performed with antiseptic precautions, lest spreading phlebitis be excited. Intravenous injections of perchloride of iron, or carbolic acid, or the application of the actual cautery, or hot iron, are not to be recommended. Where a single bunch of varicose veins demands treatment, excision is the best operation; where it is desired to cure a number of varices, or one of considerable length, the multiple antiseptic ligature is to be employed, or if the surgeon prefers it, acupressure.

Angeiomata.—Angeiomata are tumors composed mainly or exclusively of blood vessels; some of these vessels are newly formed, others are pre-existing ones, dilated more or less extensively. The vessels may be arteries, capillaries, or veins. Arterial angeioma is more often known as *cirsoid aneurism*; capillary and venous angeiomata are commonly called *nævi*, or "mother's marks." Cases are sometimes met with in which two or more of these varieties of angeioma are combined together; they are classified in accordance with the predominant character of the tumor.

Symptomatic Indications.—*Arsenicum* is useful when the veins are of a livid color, and attended with severe burning pains; *belladonna*, when an erysipelatous inflammation surrounds the varices; *pulsatilla*, when there is much inflammation, excessive pain and swelling, and the limb assumes a livid hue; *arnica*, when the varices are the result of wounds or blows.

VEINS, DISEASES OF.—Inflammation of the coats of a vein is called *phlebitis*; this, when it affects the intima, always causes clotting of the blood in the vessel (*thrombosis*). It was at one time held that the presence of a clot in a vein was evidence of inflammation of its coats, and, therefore, every instance of venous thrombosis was classed under one or other division of phlebitis. It is now known that a thrombus may form in a vein independently of inflammation of its walls, and subsequently excite phlebitis.

Plastic phlebitis is an inflammation of the coats of a vein, attended with effusion of plastic lymph, terminating in resolution or obliteration of the lumen of the vessel.

Causes.—Injuries ; the formation of a simple non-infective thrombus ; the extension of plastic inflammation of the tissues around a vein ; gout, and certain other unknown conditions which occasion so-called "idiopathic phlebitis."

Pathology.—The coats of an inflamed vein are swelled and softened by a cellular exudation infiltrating the media and adventitia. The disturbance in the nutrition of the intima always leads to thrombosis when that is not the primary change. Generally the vessel then undergoes the same changes as occur in the permanent closure of a wounded artery ; but in some cases the inflammation subsides, and the vein is again restored to its former state. Traumatic plastic phlebitis is limited in extent to the injured part of the vein, and has no tendency to spread ; and the same is true of the inflammation excited by the presence of a simple thrombus. Gouty phlebitis is usually symmetrical, often subsides in one vein to light up in another, and has a tendency to recur in the same vessel. Phlebitis may attack any vein, but it is most common in those of the lower limb, and especially in the saphena veins.

Symptoms.—The symptoms are local œdema ; there is a firm knotty cord in the position of a vein. The part is painful and tender, the skin over an inflamed superficial vein is reddened, and pits on pressure. The distended vein is bulged opposite each valve. The part feels stiff, and movement is painful.

Treatment.—The part should be kept at rest, and raised so as to favor the venous return from it. Heat relieves the pain and favors resolution, and a good local application is belladonna and glycerine thickly smeared over the parts, and then a hot fomentation. The bowels should be unloaded by a saline purge, and the diet restricted to fluids, bread, and fish ; when the inflammation has subsided, if œdema persists, a bandage should be worn. In gouty phlebitis, alkalies and colchicum should be exhibited.

Suppurative phlebitis.—*Causes.*—The cause of suppurative phlebitis is probably in all cases infection with putrefactive organisms. Hence, if the thrombus in a wounded vein becomes infected with septic micrococci from the discharges in the wound, or the coats of a vein are bathed in putrid fluid, or when the tissues around a vein or returning blood to a vein are at-

tacked with septic inflammation, this form of infective or suppurative phlebitis is set up. It occurs in connection with septic wounds, diffuse cellulitis, and "acute necrosis," and it plays an important part in many cases of septicæmia and pyæmia.

Pathology.—The changes in the coats of the vein are those common to suppurative inflammation. The changes in the thrombus are those described as "yellow softening," and the products eventually blend with those of the disintegrated vessel itself. Septic micrococci are always found both in the softened thrombus and in the disintegrated vein wall. The disintegration of the clot is commonly attended with the escape of septic embolisms into the general blood stream, and septic phlebitis is commonly a link in the chain of processes ending in septicæmia and pyæmia. The infective nature of this form of phlebitis imparts to it one of its chief peculiarities, its tendency to spread, which is so marked that it is often known as "spreading phlebitis."

Symptoms.—In many cases suppurative phlebitis gives rise to no symptoms by which it can be recognized, but the occurrence of septicæmia or pyæmia in connection with a wound or ulcer is the first indication of such a lesion. Abscesses occurring in the course of septic inflammations are in many cases the result of suppurative phlebitis, and the secondary abscesses of pyæmia are believed to be in some cases of the same nature. When the disease attacks a superficial vein it can be more readily recognized. In such a case the vein is converted into a firm cord with projecting "knots" opposite each pair of valves ; the outline of the vein is quickly lost owing to surrounding œdema, and the skin over the part reddens ; then, at one or more spots (often at the valves), the swelling notably increases and becomes fluctuating ; meanwhile the disease involves more and more of the vein.

Treatment.—The only successful treatment of this condition is preventive : rarely are remedial measures successful in saving life. Abscesses formed in the course of the affection should be opened early, and the cavity cleaned with carbolic acid or corrosive sublimate in solution. Where the disease is recognized early, and before there are signs of general blood poisoning, the part should, if possible, be amputated well above the plugged

vein; but it is only rarely that such a case presents itself to the surgeon. The preventive treatment is the efficient application of the methods of aseptic surgery to wounds of all kinds. In "acute necrosis," abscess should be opened early, and with antiseptic precautions, but even this may fail to prevent infection of a vein. The constitutional treatment is that of septicæmia.

Symptomatic Indications.—In the early stage of the disease *aconite* is generally useful, particularly if the febrile symptoms predominate, with a quick, full pulse; dry, furred tongue. If the brain should appear to be affected *belladonna* may be substituted for the *aconite*; following *aconite* and *belladonna*, *pulsatilla* is useful in promoting a cure. When the tongue becomes dry, brown, and cracked, or the patient is much prostrated, with burning thirst, and hot, dry skin, *arsenicum* is very valuable. If suppuration threatens, or has occurred, and the amount of purulent secretion is large, *calcium sulphide* or *silicea* will be found useful. For the chronic form of the disease *pulsatilla* or *hamamelis* are most valuable.

VEINS, INJURIES OF.—Contusions of veins arise under similar conditions to the contusions of other parts. When quite slight they may not give rise to any consequences which will enable them to be recognized; if more severe, they lead to coagulation of the blood in the vein. When the contusion is more severe still, it leads to the death of all the coats of the vein and to the coagulation of the blood within it; this occurs in severe crushes of parts, such as are followed by local death.

Lacerations of veins occur where limbs or parts of limbs are violently torn off from the body, as in the reduction of dislocations, especially when these are of old standing. Laceration may completely occlude a vein as an artery, but owing to the smaller amount of elastic and muscular tissue in its walls, a torn vein may continue to bleed when its companion artery is completely closed. Thus it happens that very extensive and even fatal hemorrhage may occur from a subcutaneous laceration of a vein.

Wounds of veins are of very common occurrence. They heal in the same way as a wounded artery; but obliteration of

the vessel is much less frequent. Where a vein is quite severed the channel is never restored; but a considerable wound may be made across a vein without the vessel being obstructed.

Entrance of air into veins.—This is one of the rarer accidents attending a wound of a vein; but its effects may be so disastrous, and it occurs so suddenly, without warning, that it is necessary to be well acquainted with its phenomena. Experiments on animals have shown that a small quantity of air can be injected into a vein without serious consequences; and that, if the injection is made very slowly and gradually, a large quantity of air may be introduced without causing the alarming or fatal effects which follow the sudden introduction of a smaller quantity.

Causes.—During inspiration, and especially during a labored effort to fill the lungs, the blood in the great veins converging upon the heart is sucked in, while during expiration an opposite effect is produced. This effect of respiration upon the flow of blood is only seen in the veins about the root of the neck, for beyond that the walls of the vein collapse under the influence of suction; if, however, this collapse is prevented, either by thickening of their coats or by their being held in a state of tension, or by their adhesion to unyielding structures, the aspiration of the chest may influence veins at some distance, such as the facial and subscapular. The spontaneous entrance of air into a vein only occurs when an opening is made into a vein which is affected by the aspiration of the chest. These conditions, which prevent the collapsing of a vein, have been called by the French the "canalization" of veins; and, adopting this phrase, we may say that air enters the circulation only when the aspiration of the chest sucks it in through a wound in a canalized vein. The deeper the inspiratory effort, the greater the amount of air introduced, and hence the heavy breathing of patients under the influence of ether to some extent increases the liability to this accident.

The effects of the entrance of considerable quantities of air into the venous circulation have been studied in animals. The right auricle and ventricle, and the pulmonary artery and its branches, are found filled with frothy blood, while the left side of the heart is empty. The right

ventricle is unable to force this mixture of blood and air through the lungs; the left ventricle is therefore unable to send blood to the brain, and the patient dies of syncope. When only a small quantity of air is introduced into the circulation, it gradually becomes dissolved in the blood, and possibly some of it escapes into the air vesicles of the lungs; in this way the cases of recovery are explained.

Symptoms.—These may be described as local and general. At the moment of air being sucked into a wounded vein, a peculiar sucking or hissing sound is heard, and frothy blood is then seen to issue from the vessel. The general symptoms vary much in intensity. The patient suddenly becomes pale, his pupils dilate, his pulse is flickering or imperceptible, while at the same time exaggerated respiratory efforts are made, and the heart's action is powerful and turbulent, and a peculiar churning sound is to be heard on listening over the præcordia. These alarming symptoms may gradually subside, and the patient recover; or they may terminate in death, which may or may not be preceded by convulsions. When the accident is fatal, death usually occurs in a few minutes; but if successive quantities of air are sucked in, the fatal issue may be longer delayed. In more than one recorded case death has occurred after some days from bronchitis or pneumonia.

Treatment.—The first thing to do, on hearing the peculiar sucking sound or seeing the frothy blood in the wound, is to compress the opened vessel with the finger, and in that way to prevent both further hemorrhage and the entrance of more air into the vein. As soon as possible the vein should be accurately secured, either by forceps or a ligature, and the surgeon's hand set free. In the mildest cases this may suffice.

Treves advises that time should not be spent in looking for the wounded vein, but that the further entrance of air should be prevented by filling the wound with water. By this measure, also, the air in the right auricle can be, to some extent, got rid of, especially in children, by compressing the chest wall during expiration. The water in the wound will allow the air to escape, while it will prevent more from entering. Treves also points out the evil effects produced by attempting artificial respiration in these cases.

Where there is syncope and distressed

respiration, the surgeon should endeavor to keep up the heart's action until the obstruction in the lungs is overcome by the gradual solution of the air or its escape into the air cells; at the same time efforts should be made to keep the brain as well supplied with blood as possible. The patient should be placed in a horizontal position, and if the heart's action grows weak it should be stimulated by hypodermic injections of ether, brandy injected into the rectum, a sinapism over the præcordia, and ammonia held to the nostrils, one or more of these means being used as they may be at hand or required. By compressing the axillary and femoral arteries, a large proportion of the blood which succeeds in passing through the lungs will be sent to the brain, and in that way fatal syncope may be warded off.

VENESECTION.—Abstraction of blood from the living body by incision of a superficial vein—a mode of general blood-letting or bleeding.

Although nowadays much less generally resorted to, venesection still deserves confidence as a remedial measure of extreme value in certain diseased conditions; for example, in the early stage of inflammation, such as acute pleuritis, and pneumonia, occurring in the plethoric and robust, and when followed by remedies which maintain its immediately sedative effect on the circulation; in acute congestion of the lungs—as when this condition follows exposure during chronic bronchitis or emphysema; in some forms of cerebral congestion; in sunstroke; and in certain varieties of eclampsia; generally when there exists great venous congestion with overdistention and consequent enfeeblement of the right heart, as in poisoning by carbon dioxide; and, perhaps, in those cases where it is intended to abstract from the circulation a certain bulk of poisoned blood in order to substitute for this an equivalent of pure blood or of saline solution by intravenous injection. Small bleedings, repeated as required, are also practiced to reduce excessive cardiac action and to relieve pain and dyspnoea in some cases of aneurism; in particular, thoracic. The chief general indications for venesection, as afforded by the conditions of the circulation, are turgid veins, a small, tense pulse, and a laboring heart. It is not

a measure suitable to childhood, old age, or in debilitated conditions of the system.

The operation may be performed, if necessary, upon any superficial vein—as on the dorsum of the foot or hand—but is most readily carried out on one of the veins at the bend of the elbow, preferably on the median cephalic: or, if this cannot be found, on the median basilic (which lies close over the brachial artery).

The patient being, as a rule, seated, a broad bandage is first fastened round the arm above the elbow, so tightly as to compress the superficial veins without stopping the arterial current in the limb. The vein selected is then steadied by the thumb and partly laid open by an oblique, transverse incision, care being taken to make the skin wound larger than that in the vein. The thumb is removed, and the escaping blood is caught and measured in a suitable vessel, none being allowed to fall on the dress or bedclothes of the patient. When a sufficient amount has been drawn, the operator places his thumb over the incision, removes the compressing fillet from above the elbow, and finally seals the wound with a small pledget of lint, which is retained in its place by a few turns of a narrow figure-of-eight bandage, the arm being then placed in a sling for a day or two.

If the jugular vein be opened, the incision should be made from above downward and inward, so as to cross the fibers of the platysma, but this form of the operation should be avoided in view of the risks of air entering the circulation, and of other serious complications.

The lancet or scalpel used must be sharp and perfectly clean. The limb should not be moved while the blood is flowing, lest the skin slide over the opening in the vein and thus induce hemorrhage into the cellular tissue. Nervous patients, and those whose veins are small or ill-filled, should be made to grasp a book or walking-stick before and during the operation.

It is worth bearing in mind that in the case of acute inflammatory conditions of the abdominal organs, a moderate bleeding from the arm is more effective than the abstraction of a much greater volume of blood from the veins of the abdominal wall, as by leeching; and that, similarly, acute prostatitis is better, more promptly, and more effectually treated by opening

two or three veins in the wall of the rectum, by means of a narrow, sharp bistoury, and encouraging subsequent bleeding by tepid injections, than by the application of leeches to the anus.

C. E. SHELLY.

VERTIGO (Giddiness; Dizziness).

—“A feeling of uncertainty of our position in space relative to surrounding objects . . . constantly associated with impaired equilibration.”

The equilibrium of the body is believed to be controlled by a center situated in the cerebellum, which is greatly under the influence of the impressions received by the senses of hearing and sight. The semicircular canals and labyrinth certainly play a most important part in maintaining the equilibrium of the body, and it is probable that the vertigo met with in dyspepsia is due to disturbance of their functions, as the centers for the auditory and vagus nerves are in close proximity in the medulla. Vertigo is often associated with other disorders of sensation—*e.g.*, nausea, deafness, tinnitus aurium, dimness of sight, faintness, palpitations, hallucinations, and even loss of consciousness.

Symptoms.—An attack of vertigo may supervene quite suddenly while the patient is standing, sitting still, lying down, or walking; not infrequently it occurs during stooping, and it may be transient, persistent, or recurrent. Some people complain of giddiness after looking fixedly at an object for some time, or when the eyes are closed. The patient either has a sense that objects are moving round him or that the objects are stationary while he is in motion; the direction of the movements being horizontal, vertical, lateral, rotatory, or there may be a sensation of sinking downward, or the impressions are confused, and the patient feels as if impelled in several directions. The outward result is some degree of reeling, and, if no support be at hand, he may fall down.

Ætiology.—The causes of vertigo are many and various. It may accompany almost any disease of the central nervous system, but is most constant in disease of the cerebellum or its peduncles, in which case it is direct and independent of any ocular trouble; in disease of the pons, crura cerebri, corpora quadrigemina or cortex it is also met with, and may occur

independently of any ocular lesion. Paralysis of one ocular muscle, notably the external rectus, is a frequent cause, and vertigo may also result from mere weakness of one of the muscles (muscular asthenopia), as when the eyes are over-tried in myopia. In disseminated sclerosis and locomotor ataxia it is often present, and is due chiefly, if not entirely, to the strabismus. In epilepsy and migraine it is sometimes complained of, also in cases of exhaustion of the nervous system from over-study, mental anxiety, sexual excesses, or from too great indulgence in alcohol or tobacco. In miners' nystagmus vertigo is present, but not in the nystagmus which is congenital or comes on soon after birth, as the patient is then presumably accustomed to and disregards the contradictory impressions he receives. There are, however, other sources of visual giddiness besides strabismus and nystagmus; looking down from a great height causes it in a great many people, while some cannot be in a building with a lofty roof without feeling giddy, and in others a strong light will produce it (*see AGORAPHOBIA*). In certain forms of disease of the ear giddiness is the prominent symptom (*see MENIÈRE'S DISEASE*). Giddiness from waltzing is probably due to the disturbance produced in the semi-circular canals by the rotation; giddiness from swinging is partly due to this cause and partly to the peculiar sensation caused by the body apparently descending faster than the viscera. In seasickness the impressions from the eye, the labyrinth, and the muscular sense are all contradictory and combine to produce the vertigo. General anæmia and heart disease, especially aortic valvular disease, are among the causes. But in no inconsiderable proportion of cases, the stomach (and probably the liver also) is at fault, and *vertigo a stomacho læso* is a well-recognized condition. There may or may not be organic disease of the stomach, and the attacks vary much in severity; they may come on at any interval after a meal, and sometimes no connection can be traced between the ingestion of food and the onset of an attack, and indeed it may be induced by fasting.

As regards the *diagnosis* it is obvious that a great many of the causes above enumerated will be self-evident if present. The cases that remain would be due

either to brain disease, to ear disease, or to dyspepsia. It must be remembered that the last named is far the most likely cause, and that vomiting, even when persistent and accompanied by headache, is no proof of the existence of brain disease. The presence of tremor would be strongly suggestive of this, however, while optic neuritis would be almost conclusive of it. So, too, deafness does not by any means exclude the possibility of the symptoms being due to dyspepsia. Even when no signs of dyspepsia can be elicited, the results of treatment will sometimes furnish proof that the stomach was after all the peccant organ.

Treatment.—Careful attention to diet and moderate exercise are the most important points; the bowels should from time to time be acted upon by aloes or an occasional dose of blue pill, and small doses of alkali with gentian, calumba, or quassia administered, when the vertigo, if due to gastric disorder, will soon disappear. The treatment of the other forms will depend upon their causation.

JOHN ABERCROMBIE.

Symptomatic Indications. — *Belladonna* is valuable in both acute and chronic form; staggering, reeling; hyperæmia of the brain; *cinchona* in vertigo from anæmia. *Gelsemium*, vertigo from general depression of the system; intoxication; confusion; dimness of sight. *Phosphorus* is valuable in many forms, particularly in cases associated with chronic lung or heart disease. *Digitalis* is the chief remedy in essential vertigo from anæmia of the brain, from weakness of the heart. *Argentum nit.* is useful for vertigo from the least mental or bodily exertion.

VICARIOUS MENSTRUATION

means that the menstrual flow does not take place from the uterus, but *vicariously*, hemorrhage from some other part replacing that from the uterus. This may now be described as an exploded superstition. No such thing has ever been accurately observed or described.

Cases recorded as examples of it fall into three groups: (1) Cases in which the only evidence is a vague statement from a patient, unaccompanied by dates. Every case in which a patient making such a statement has been asked to keep a diary, has failed to show a coincidence between the supposed vicarious hemor-

rhage and the menstrual period. (2) Cases in which patients lose blood from some diseased part—*e. g.*, lungs or stomach, and in consequence become anæmic and do not menstruate, and think the bleeding is the consequence of the amenorrhœa, instead of its cause. (3) Cases in which, as in purpura, the general vascular tension accompanying menstruation causes hemorrhage from other parts beside the uterus; that is, menstruation is accompanied by hemorrhage from other parts, not replaced by it.

Cases in which the menstrual flow is replaced by a flow from some other part do not exist.

G. E. HERMAN.

VISION, IMPAIRED.—See REFRACTION.

VITILIGO is a term used by many at the present day as synonymous with leucoderma; but Dr. Tilbury Fox has seen such a disease as Bateman describes under this term, and believes it to be an atrophous condition in scattered spots, of very rare occurrence.

VOMITING (Emesis).—Forcible expulsion of the contents of the stomach through the esophagus.

The act of vomiting is produced by the dilatation of the cardiac end of the stomach, immediately followed by a violent expiratory effort. The former is accomplished by the contraction of the longitudinal fibers of the stomach, which by the same means is drawn over toward the diaphragm. The pyloric orifice is at the same time contracted so that the food is expelled only from the cardiac end. In bilious vomiting the contents of the gall-bladder are driven into the duodenum, and find their way through the pylorus, which must be then imperfectly closed. The respiratory effort is performed by the contraction of the diaphragm and abdominal muscles, and is of itself powerless to cause vomiting, but produces only distressing retching when the cardiac end of the stomach is still unopened. On the other hand vomiting becomes impossible when the respiratory muscles are paralyzed. Thus there are two necessary factors for the performance of vomiting—dilatation of the cardiac end of the stomach, and forcible contraction

of the diaphragm and abdominal muscles. The co-ordinated action of these muscles is regulated by a center, situated in the floor of the fourth ventricle, and closely related to the respiratory center. Efferent impulses proceed by the vagi to the longitudinal muscular fibers of the stomach, the phrenics to the diaphragm, and by the intercostals to the abdominal muscles. The center may be excited by afferent impulses from almost any part of the body, but especially by those originating in the abdominal viscera. It may also be stimulated in a quasi-reflex manner by certain emotional states, and directly by the action of such drugs as tartar emetic and apomorphine.

Most infants, and some adults, vomit with the greatest ease and on very slight provocation, but in others the act of vomiting is generally preceded by symptoms of nausea—*e. g.*, giddiness, pallor of the face, and feelings of faintness, coldness of the extremities, and a weak pulse. Ineffectual attempts to expel the food may then be made on the part of the respiratory muscles, and they add considerably to the patient's discomfort, which is, however, as a rule, immediately relieved by the occurrence of vomiting.

Clinical Indications.—The irritation of faucial and pharyngeal inflammations sometimes induces vomiting, especially in children, and all kinds of gastric disorders are occasionally attended with the same result. Vomiting frequently occurs in acute catarrhal conditions of the stomach, and is then associated with a considerable degree of nausea. It generally follows immediately upon the ingestion of food in cases of cancer of the middle of the stomach, but after the space of three or four hours, when the disease is situated at the pylorus. In the latter case the ejected material is usually streaked with blood in different stages of decomposition. The pain caused by the presence of food in cases of gastric ulcer is often relieved by the occurrence of vomiting, which, as a rule, however, only takes place when the pain has reached a certain intensity. The vomit of dilatation of the stomach is characterized by its great abundance, consisting perhaps of three or four meals, and by the presence in it of the torula cerevisiæ and sarcina ventriculi. Vomiting sometimes happens from compression of the

stomach, which may be the result of tight-lacing, the pressure of a tumor, or the frequent application of tools against the epigastrium in certain trades. All cases of strangulated hernia and intestinal obstruction are attended at one time or another with vomiting, which is the more severe and persistent as the disease is more acute. At first merely matters from the stomach are rejected, but very soon these are mixed with bile from the duodenum, and at last the contents of the intestines themselves are regurgitated, from as far down as the seat of obstruction, if this be in the jejunum or ileum. The vomit has then a distinctly fecal odor, and is called "stercoraceous." The occurrence of fecal vomiting was supposed to depend upon a reversal of the normal peristaltic wave, but Dr. Brinton has suggested that the usual peristaltic motion would in cases of obstruction naturally set up two currents within the intestine, an outer one downward and an inner one upward, so that the fæces would at length mix with the bile in the duodenum, and ultimately even with the food in the stomach.

Nausea and vomiting are some of the earliest symptoms of peritonitis, and are common in cases of hepatitis, biliary and renal colic. They are rarely absent in the course of Addison's disease. Combined with diarrhea, vomiting is a common result of acute and chronic uræmia, or vomiting may alone be present, occurring at first perhaps only in the morning, but afterward whenever food is taken. It is liable in these cases to prove very persistent and intractable. The ejected matters generally contain some urea, which, when they are alkaline, is partially decomposed into carbonate of ammonia. The conjunction of these two symptoms, diarrhea and vomiting, although common enough in infants, should in adults always raise the suspicion of irritant poisoning, when the presence of uræmia has been negatived. It is important to remember that the cough of early phthisis is sometimes attended with vomiting, which may also occur in cases of right-sided pleurisy. The latter has been ascribed to congestive changes in the liver secondary to the inflammation of the diaphragmatic pleura. Occurring in the early morning, vomiting is one of the commonest symp-

toms of pregnancy, but it occasionally happens in women without any very apparent reason. It is also one of the frequent symptoms of chronic alcoholism.

Vomiting often occurs in the course of certain fevers. It may be a premonitory symptoms of scarlatina or variola, and may also occur in the course of typhus and the cold stage of ague. The well-known black vomit of yellow fever owes its color to the presence of masses of decomposed blood corpuscles, but is only met with in the most severe cases. Choleraic vomiting is often sudden and coincident with or following upon the discharge of the rice-water evacuations, to which the ejected matters are very similar. Sudden pain, such as that resulting from a blow on the testicles, a severe sprain or dislocation, usually causes a feeling of faintness, sometimes followed by vomiting.

Cerebral vomiting.—As a symptom of brain disease, vomiting is of the greatest importance. It occurs in cases of tumor, meningitis, abscess, increased intracranial pressure, at the onset of apoplexy, and more especially when the cerebellum is the seat of the lesion. There are no associated symptoms of gastric derangement, and usually no preceding sensations of nausea, though these are in rare cases severe. As a rule the food is rejected soon after it has been taken, and it is decidedly uncommon for cerebral vomiting to occur on an empty stomach. It is an early symptom of tumor and meningitis, and, combined with headache, may anticipate by a considerable time the development of further symptoms. Paroxysms of vomiting (gastric crises) sometimes occur in the course of tabes dorsalis. They are generally accompanied with severe pain in the epigastrium and sometimes with nausea. The vomiting may be incessant, lasting for an hour or two or for two or three days. Recurrences are usually frequent and at irregular intervals, but in the interim there are no gastric symptoms whatever. Vomiting is a frequent result of vertiginous sensations, whether they result from Menière's disease or an injudicious meal; and to the same cause the writer would ascribe the symptoms of seasickness. Paroxysms of migraine are sometimes relieved by the occurrence of vomiting, which frequently also follows attacks of convul-

sions in children. Cases of habitual vomiting, lasting for years, are sometimes met with, in which no efficient cause can be discovered. Food may inevitably be rejected a few minutes after it has been taken, and yet no decided emaciation may be apparent. Such a condition usually occurs in young women in whom there is some evidence of an hysterical tendency and menstrual irregularity. Vomiting frequently occurs during the administration of chloroform, especially when the stomach is full, but it may also take place afterward, and sometimes proves extremely intractable and alarming.

Treatment.—Vomiting is a symptom rather than a substantive disease, and its treatment is therefore first directed toward relieving the causal affection. This generally consists of some gastric disorder. The vomiting is then amenable to treatment, and the end is attained by the exhibition of remedies which act locally upon the *prima via*. But it is possible to depress the excitability of the vomiting center by means of such drugs as opium, morphine, bromide of potassium, chloral, and probably hydrocyanic acid and strychnine; most of these exercise also a sedative influence upon the stomach, and should consequently be given by the mouth, when possible. In cases, however, in which the stomach is so irritable as to reject everything swallowed, recourse must be made to hypodermic injection and rectal medication. The diet will have to be carefully regulated, and it will be often found in severe cases that milk will be tolerated, when administered frequently and in small doses of a tea- to a table-spoonful. Sometimes even this is rejected, and it becomes necessary to give the stomach a complete rest for two or three weeks by the employment of nutrient enemata. The sucking of ice often proves soothing to the patient, and milk and other nutritious fluids are best retained when cool. Counter-irritation or the application of leeches over the epigastrium is sometimes of value. When the stomach becomes more tolerant, the internal administration of subnitrate of bismuth and bicarbonate of soda, combined perhaps with hydrochlorate of morphine or hydrocyanic acid, tends to diminish the irritability. The action of the bowels should in every case be attended to, and carbonate of lime may be added to the

bismuth mixture if the motions are loose, and magnesia if there is a tendency to constipation. When the vomiting is accompanied with much flatulence, foul breath, and other evidence of putrefactive fermentation, antiseptics are indicated and best administered in the form of creosote or sulpho-carbolate of soda. Pepsin, by reason of its digestive power, is a valuable adjunct in some cases, and acids, alkalies, or bitters are all serviceable at times. Minute doses of tinct. iodi, or ipecacuanha occasionally succeed where other means have failed; and cocaine would probably prove useful sometimes.

The vomiting so frequently occurring in infants generally responds to a rectification of the diet, which is commonly at fault, and the administration of bismuth with soda. If the child is not at breast, the milk should be boiled during the hot summer months and mixed with lime water. The gastro-enteritis of infants is generally attended with such irritability of the stomach that everything swallowed is rejected. These cases are extremely difficult to deal with, but should be treated on the general lines mentioned above; especially is it important to give milk in very small quantities, frequently repeated. The vomiting of organic cerebral disease is little amenable to treatment, but any stomachic trouble should be remedied, as it may tend to stimulate an overexcitable center. Counter-irritation to the nape of the neck, or ice applied to the same region, sometimes relieves not only the vomiting, but also the headache of cerebral tumor. Several modes of treatment will have to be tried in those protracted cases of vomiting occurring in hysterical women, but the shower bath, valerian, and other antispasmodics seem to afford the best means of success. The vomiting of peritonitis, strangulated hernia, intestinal obstruction, renal, and hepatic colic must be treated with opium, but in these cases the treatment of the cause is of much more importance than that of a mere symptom. The vomiting of pregnancy usually occurs only in the early morning and is of little importance, but occasionally it is so severe as to seriously endanger the life of the patient. In severe cases a careful vaginal examination is necessary, and an endeavor should be made to rectify any flexion of the uterus that may happen to be present. The local application of nitrate of silver

has been recommended when the cervix is inflamed and covered with granular erosions. Besides the ordinary medicinal methods of treatment, oxalate of cérium may be tried, and Chapman's spinal ice-bag is sometimes of decided value. Stimulants may be urgently called for and none is so good as iced champagne, which is also easily tolerated by the stomach. In certain very rare cases, the induction of abortion becomes necessary, and this expedient is generally followed by an almost immediate relief to the symptoms. Uræmic vomiting must be treated by means of diuretics and sudorifics. The treatment of vomiting dependent upon the action of irritant poisons will be found discussed in the article upon that subject. Vomiting arising from other causes demands no special line of treatment, and must be conducted on general principles.

WM. GAY.

Symptomatic Indications.—*Ipecacuanha* is the principal remedy for gastric vomiting; yellow or white tongue; very valuable in vomiting of pregnancy from irritability of the stomach. *Arsenicum* is useful in many forms of stomach vomiting, especially that of alcoholism and chronic ulcer; vomiting after eating and drinking; great weakness and prostration; burning pains; persistent vomiting of pregnancy. *Nuxvomica* is next in value to arsenicum; useful in vomiting from atony of the stomach, also in irritable condition of the stomach, with constipation. In vomiting of pregnancy one of the most important remedies, diminishing the reflex excitability of the stomach. *Iris vers.* is useful in many forms, particularly in "bilious vomiting," blinding right supra-orbital pain; liver deranged; vomiting of bile. *Veratrum alb.* in vomiting and purging of summer diarrhea; prostration and cold sweats, does excellent service; *antimonium tart.*, much nausea and vomiting, with much straining, sweat on forehead; prostration; *antimonium crudum*, vomiting from overloading the stomach; violent nausea and vomiting; foul white tongue; aversion to food. *Sepia* is useful in vomiting of pregnancy when uterus has been unhealthy; *aletris*, in the early months of pregnancy, excessive nausea; faintness; giddiness; pain in hypogastrium.

VULVA DISEASES OF.—**Vulvitis** is common in children from gonorrhea and from diabetes (*see* LEUCORRHŒA). *Follicular Vulvitis* consists in inflammation of the mucous follicles which are scattered over the vestibule around the urethra, and on the inner surface of the nymphæ. The symptoms are soreness and itching of the parts. On inspection, the inflamed follicles are seen as dark red spots the size of pins' heads, dotting the mucous membrane. It is not common. Nothing is known of its ætiology.

The *treatment* consists in cleanliness and sedative applications, such as ointments of lead (ung. plumbi subacet.co.), bisinuth (3j ad ʒj), calomel (P. B.). Under treatment, especially in young subjects, it gets well; but we do not yet know enough of its clinical history to assign any definite period as that within which improvement may be expected. Sometimes it is very obstinate. Alcohol should be forbidden, and laxatives prescribed.

Gangrene of the vulva, that is, rapid sloughing of the external genitals, is rare, but sometimes occurs. The gangrene is usually symmetrical. It differs from noma, in that it is not a progressive process preceded by induration. There is death of a portion of the skin and subcutaneous tissues, and this dead part is cast off. It is different also from the creeping molecular disintegration which takes place in phagedena or hospital gangrene, or the terribly rapid spreading inflammation of gangrenous erysipelas. The causes of this rare event are quite unknown. It may, although it is not usual, appear inclined to spread, and if so, the slough should be separated, and the surface freely cauterized with nitric acid or the actual cautery.

The *treatment* otherwise consists in supporting the patient's strength, relieving pain, and applying poultices till the slough has separated; afterward zinc ointment may be used.

Tender red patches are sometimes seen on the mucous membrane of the vulva. Their usual situation is just round the anterior half of the vaginal orifice. They vary in color from a pale brick red to a deep purple. They are extremely tender, and are sometimes, especially in women past the climacteric, accompanied by some contraction of the vaginal orifice, or at least what ap-

appears to the patient to be such. The morbid change seems to be closely allied to urethral caruncle, and to the red patches, associated with pain on micturition that are sometimes seen extending along the urethra. It is important on account of the pain and difficulty, amounting sometimes to impossibility, attending sexual intercourse; and is one of those conditions which are sometimes included under the term vaginismus. In young women it sometimes gets well without treatment. In women past the climacteric it is very obstinate. Nothing is known about its ætiology.

Treatment.—The best treatment is the application of iodoform to the spots.

Various **skin diseases**, lichen, eczema, erythema, acne, syphilides, may affect the skin of the labia. They present no essential differences either as to character or treatment from similar changes in the skin of other parts.

Warts are common on the vulva. They do not occur in clean and chaste women, but they may occur without unchastity in those who are not careful as to cleanliness. From their condition of origin, they often are seen with gonorrhea. Attempts to communicate them by inoculation have failed. Warts of this kind are acuminate, broadest at the base, pointed at the free surface. They produce discharge and itching of the parts. If quite small, dusting the parts with a powder of equal parts of calomel and oxide of zinc will make them dry up. If a little larger they may be rubbed with nitrate of silver. If too large to be thus destroyed, they must be cut off with scissors, or if associated with pregnancy, or of such a size that cutting them is likely to cause grave hemorrhage, the Paquelin cautery knife may be used.

Syphilitic condylomata are flat, not acuminate, and the free surface often slightly overhangs the base. These should be dusted with calomel, and mercury given internally.

G. E. HERMAN.

Symptomatic Indications.—*Arsenicum* is the most useful remedy in vulvitis, burning pains; profuse, thick, corrosive leucorrhœa. *Helonias* is frequently useful, especially for intense itching; vulva hot, swollen, and burning; debility; *mercurius*, in chronic vulvitis; rawness and smarting of vulva, with excoriated spots; corroding leucorrhœa. *Thuya*, *sepia*,

in chronic follicular vulvitis. For condylomata the best remedy is *thuya*.

VULVA, LUPUS OF (*Esthiomene*).

—Two opinions are held as to the nature of this disease—one, that it is lupus vulgaris, modified by local conditions of warmth, moisture, and vascularity under which it develops. The other, that it is a form of tertiary syphilis. The latter view is supported by the facts that in many cases there is a history of syphilis, and that antisyphilitic treatment is admitted to be the most effective in this disease. Against it is urged that often no history of syphilis can be obtained, and that with it there is seldom if ever found tertiary syphilitic disease of other parts, or of the bones and periosteum underlying the diseased tissues, and that it sometimes coexists with lupus vulgaris. As there is this difference of opinion as to the pathology of the disease, it would be better if the French term *Esthiomène*, which implies no theory, were adopted. But "lupus," being more generally used, is employed here.

Symptoms.—The disease begins mostly during the years of menstrual life, between twenty and forty. It is a form of ulceration accompanied by the production of fibrous outgrowths of the surrounding and adjacent tissues. It is very chronic, and, while in progress at one part it heals at another, producing hard, thick cicatricial tissues. The presence of healing and the absence of wasting of the body, and, as a rule, of glandular enlargement, mark the essential difference from cancer. It attacks the labia, clitoris, hymen, vestibule, vagina, uterus, groins, perineum, anus, and adjacent inner side of the thighs.

It progresses by imperceptible disintegration of tissue, not by sloughing. The tissues may be deeply excavated. Ulceration and hypertrophy are not invariably combined; slight degrees of one may occur without the other, but, when either morbid change is extensive, the other is found also. The hypertrophies are hard, fibrous overgrowths; and they may surround a canal so as to form strictures; stricture of the rectum, of the urethra, and of the vagina, may be thus produced. Of these the first is the most common, the last the least so. The disease renders the mucous membrane adjacent also to the disease, but not affected by it, liable to inflammation; and this inflammation, the

character of which is marked by its persistence and tendency to recur, may precede the ulceration and the overgrowths. The disease may cause death by hemorrhage from vessels opened by the ulceration, but this is quite rare. It may also cause death by perforation; thus, when affecting the uterus, it may eat through into the peritoneum; or vaginal lupus may perforate the bladder. These are also rare events. Stricture of the rectum, by the incidents secondary to it, may also cause death.

The *treatment* is to cut off the hypertrophic masses with Paquelin's cautery, and to apply black wash or iodoform to the ulcerations. This is usually followed by improvement, and in slight cases may lead to cure. But in cases of long standing, where the disease is extensive, cure is seldom attained; treatment ameliorates the condition, the advance toward recovery goes a certain distance and then comes to a standstill. This is partly because, from the chronic nature of the disease, patients do not persevere with treatment.

G. E. HERMAN.

VULVA, PRURITUS.—See PRURITUS.

VULVA, ULCER OF.—*Definition.*—Simple strumous ulcer of vulva, or gangrenous ulcer.

Causes.—Of the former, the strumous diathesis; of the latter, epidemic puerperal mischief, scarlet fever, etc.

Symptoms.—Of the former, irritation, soreness, not much pain; of the latter, severe cachexia, a fetid discharge.

Signs.—Of the former, a simple ulcer; of the latter, a swollen, purplish state of the part; then an ashy-gray patch, which soon ulcerates and spreads rapidly. Discharge ichorous and very fetid.

Diagnosis.—From symptoms and signs as above; from cancer; from syphilis.

Prognosis.—Of the simple form, favorable; of gangrene of the vulva, unfavorable.

Treatment.—Of the strumous ulcer, stimulating applications, as nitrate of silver, "red" wash, tonics, fresh air, etc.; of the gangrenous ulcer, stimulating food, alcohol, iron, and quinine; to the ulcer a powerful caustic, the actual cautery, or nitric acid, followed by charcoal poultices.

HEYWOOD SMITH.

Symptomatic Indications.—Calcium sulphide; silicea. See ULCERS.

VULVA, VARICOSE VEIN OF.—

Definitions.—A varicose condition of the labia majora and minora, extending at times into the vagina.

Causes.—Pregnancy, or pressure from some pelvic tumor.

Symptoms.—Pain and fullness of the parts, and discomfort on sitting.

Signs.—Full, knotty, irregular swelling of the parts, with dark discoloration.

Diagnosis.—When examined, not to be confounded with any other morbid condition. If ruptured during parturition, it is often difficult at once to discover the source of the hemorrhage; but when the uterus is excluded as the source, the vulva and vagina should be carefully inspected in order to discover it.

Prognosis.—If unarrested, unfavorable.

Treatment.—Cold application and pressure by a pad and T bandage. If ruptured, pressure, or the application of some styptic.

HEYWOOD SMITH.

WART (Verruca).—Warts are excrescences on the skin formed by circumscribed hypertrophy of its papillary layer covered by thickened epidermis. They vary in size from a pin's head to a large bean, and are always acquired, so-called congenital warts being, indeed, nævi. Warts are flat, rounded or pointed, sessile or pedunculated, colored like the normal skin or deeply pigmented; they may be smooth on the surface or rough, or split up in a digitate, brush-like manner. They may be solitary, but are generally multiple, and sometimes very numerous. They develop chiefly on the fingers and hands in children, on the scalp or about the genitals in adults. Occasionally they arise from the mucous membrane of the mouth or anus, and may extend a considerable distance up the rectum. There is some reason to believe that all forms are more or less contagious, venereal warts being conspicuously so, but individual susceptibility to wart development varies within very wide limits. (*See also Papillomata, under TUMORS.*)

Various clinical types are recognized, of which **V. Vulgaris** is by far the commonest, the usual subjects being children, and the seat the hands. They are certainly predisposed to, and aggravated by,

personal uncleanness. At first they consist of a small, smooth, hard lump in the skin, the surface of which is unbroken and semi-translucent; soon they become rounded, button-like prominences. As the papillæ continue to hypertrophy, the cuticle ultimately yields, the surface of the wart becomes rough, irregular, villous, and dark in color, mainly owing to the closely adherent atmospheric impurities. Frequently, warts of this class disappear with an altogether inexplicable suddenness, leaving perfectly normal skin. As a rule, they are more obstinate, tending to disappear spontaneously about puberty, but they do not by any means always do so.

V. Digitata is the commoner form in adults. The essential characters are the same as those of *V. vulgaris*, but they usually attack the scalp, especially of women, where they cause great annoyance, as they "catch" the comb, and, being very vascular, often bleed freely. They are usually numerous, soft, and very ragged at the extremity.

V. Senilis, Plana vel Sebacea, represents the type usually met with in old age, especially in persons of seborrheic tendency and uncleanly habits. They are commonest over the scalp, back, and chest, then on the arms and face, in which latter situation they may closely resemble freckles. They are flat and greasy, always pigmented, and often markedly so, their tint varying from a pale yellow to dark greenish-brown; they are easily detached with the finger-nail, leaving a slight superficial erosion. The papillary hypertrophy is not nearly so marked as in *V. vulgaris* and *V. digitata*. Senile warts, although they give rise to no subjective symptoms, may prove the starting-point of malignant epitheliomatous growths.

V. Acuminata is the form usually found about the genitals. They develop with great rapidity, and, if uninterfered with, persist indefinitely. They are not syphilitic manifestations, although often associated with them, but result from gonorrheal, leucorrhœal, or other irritating discharges, which accumulate as the consequence of neglect of cleanly precautions. In the male they are generally on or under the prepuce; in the female they are commonest on the inner side of the labia, but usually spread to surrounding regions (clitoris, vagina, perineum, anus).

They are at first soft, bright red in color, long, and pointed; they may be present in very great numbers and attain immense dimensions, becoming cauliflower-like excrescences, which secrete a copious, thin, very offensive, acrid, highly infective, muco-purulent fluid.

Treatment.—Warts in children often disappear rapidly when sulphate of magnesia is given in doses sufficiently large to cause three or four copious motions daily. If the treatment does not prove efficacious in the course of a few days, it may be discontinued, as being useless. Salicylic acid is the most useful local application, and dissolved in collodion or alcohol (3 ss–3 j ad $\frac{3}{4}$ j), applied night and morning, is generally successful for common senile and digitate warts. In obstinate cases the acid nitrate of mercury, caustic potash, or glacial acetic acid may be applied with caution. Very pointed warts may be destroyed by electrolysis, which obviates the risk of bleeding, or by the galvano-cautery. Warts about the genitals are best treated by rigid cleanliness, constant washing with disinfectant lotions of carbolic acid, alum, or tannin, followed by dusting powders of borax, salicylic acid, talc, or calomel. When very large they should be snipped off, the base being cauterized so as to prevent all danger of bleeding.

J. J. PRINGLE.

WEED.—See PUERPERAL EPHEMERA; SEPTICÆMIA.

WHITE LEG.—See PHLEGMASIA DOLENS.

WHITLOW.—See ONYCHIA.

WHOOPIING COUGH (Pertussis).—

A contagious disease due to the presence of a specific poison, which is probably contained in the mucous discharges from the respiratory tract.

Symptoms.—The period of incubation is usually rather prolonged, lasting about two weeks, but in some instances it has seemed much shorter than this.

The disease may be divided into two stages: The catarrhal or prodromal stage, in which it may be difficult to recognize anything specific or different from a mere "feverish cold," and a paroxysmal stage.

The Catarrhal or Prodromal Stage.—The first period is usually of about seven to ten days' duration, but may be much

longer, and sometimes lasts only a day or two.

The chief phenomena observed are: languor or irritability, seldom drowsiness, a temperature not usually rising above 101° , a dry, hacking, clanging, or aphonic cough, with a little thickness of the voice. These symptoms are usually worse toward night-time, and even thus early the cough may be more frequent and more spasmodic than the cough of a simple catarrh, and also more liable to be most troublesome in the night-time, waking the patient, especially in the early hours of the morning. The physical signs are simply those of catarrh of the respiratory tract: râles and rhonchi. At the end of a week, in well marked cases, the face presents some puffiness, especially about the eyelids, but the urine is very seldom albuminous, and the facial fullness is doubtless the effect of simple congestion from the suffocative character of the cough. At this period also ulcers, of which the base is often covered with a white exudation, may sometimes be seen on or near the frænum, though usually they only appear after the establishment of the paroxysmal stage. These ulcers are of very frequent occurrence, but their correspondence with any projecting tooth and the time of their appearance go to prove that their association with the disease is accidental—not ætiological.

Sometimes the cough is the only sign of the catarrh, but in other cases there may be running from the nose and sneezing. In a typical case the fever subsides in about a week, but not so the cough, which becomes more explosive and more liable to run together into paroxysms, the daily number of which may be very numerous in severe cases.

Paroxysmal Stage.—As these fits of coughing become more pronounced, the mental distress accompanying them increases. The long-drawn inspiration, which always succeeds and occasionally precedes the series of spasmodic expiratory efforts which make up the paroxysm of coughing, becomes audible as the “whooping” or “crowing” sound, from which the disease takes its name. During the early part of the paroxysmal stage, the total duration of which may be four or more weeks, hemorrhages may arise from the nose and mouth, from the ears, and, more commonly, into the subconjunctival tissues. A peculiarity of the

paroxysm is the ejection of a large quantity of pearly-looking mucus at the end of the fit of coughing; this is expectorated as far as the pharynx, but the quantity is sometimes so large, that even infants, without vomiting, eject the discharge on to the floor. Vomiting is more prone to occur from a whooping paroxysm than from any other species of acute cough. Facts go to prove, not only that hemorrhages may occur as the result of the paroxysms of coughing, but also that widespread or intense explosions of nervous energy may take place. Convulsions of serious import—squinting, loss of sight, the passage of water and fæces, curious chilly sensations, and sensations of tingling—may attend or follow the fits. The rapid development of a drowsy state is almost as much to be feared as the convulsions. Besides coma and convulsions, sudden collapse may occur, in which the pulse and heart may resemble that found in the algid stage of cholera, but this is rare. That some of these symptoms are due to hemorrhages into the nervous tissues cannot be doubted; the occurrence of hemiplegia and monoplegia has been recorded. The mental state after the convulsions is variable, even in the same case; instead of listlessness there may rarely be unwonted gayety, recalling that occasionally noted after true epilepsy.

The face may become much swollen and have a slight mulberry tint; the conjunctivæ may be dingy and suffused, and cutaneous petechiæ may be noted. A whoop by no means always follows each paroxysm, and sometimes only a few whoops may occur throughout the long course of an undoubted case. All children who “whoop” are not suffering from pertussis, as some nervous subjects whoop on the least occasion, as on waking from sleep, in beginning to cry, or during crying. If the lung mischief be marked—*e. g.*, broncho-pneumonia—the whoop may be in abeyance. The precise set of conditions on which whooping depends is not always present; probably a certain force of inspiration and a certain degree of openness of the laryngeal aperture are necessary for its production.

Hemoptysis is frequent; hemorrhage from the bowels and emaciation are among the other symptoms in severe cases. Sometimes there is marked wasting from an early period and independently of the occurrence of vomiting.

Other *complications* chiefly concern the lungs and pleura. Broncho-pneumonia and pleurisy are very common; pericarditis and laryngitis occur rarely.

The broncho-pneumonia is generally of the disseminated variety, and post-mortem examinations show that it probably originates in collapse. The consolidation has a tendency to persist and pass into fibrotic and caseous conditions, but even after lasting some weeks it may pass away.

Whooping cough often leaves behind it a tendency to the development of the peculiar paroxysmal and whooping character in a subsequent cough, even if due to an ordinary catarrh. It appears certain that this is not a genuine relapse. This habit of body is most easily established in members of neurotic families. Probably, long after the pertussis has subsided, the whooping paroxysm may remain as a non-contagious habit.

Diagnosis.—In the first days this may not be possible, as influenza, measles, and other catarrhal affections may present identical symptoms; occasionally it appears as though the pertussis were engrafted on an ordinary cold. Mediastinal tumors, including cheesy bronchial glands and pent-up empyemata, may produce a paroxysmal cough indistinguishable from that of whooping cough.

Prognosis depends on so many factors that each case must be considered on its merits. All are agreed that infants only a few months old are bad subjects for the disease. Convulsions and stupor are of grave omen; broncho-pneumonia adds to the seriousness of the case, and so does rickets. In very severe cases the voice, whoop, and cough may be almost suppressed, as in laryngeal diphtheria, and these signs are of exceedingly grave significance, being often followed by death from asphyxial convulsions. The season of the year exercises considerable influence, the winter being the most unfavorable period, then the spring; but this is chiefly noted in the children of the poor, and arises from the accompanying defective hygiene—vitiated atmosphere and want of warmth.

Pathology and Morbid Anatomy.—In fatal cases collapse and broncho-pneumonia are commonly present. In the latter event the parts about the root of the lung and the middle lobe of the right lung will generally be found to be most

severely affected. There may be collapse of the greater part of a lobe, or the lesion may occur in scattered patches; emphysema being present elsewhere. Subcutaneous and mediastinal emphysema are also observed in some cases. Besides atelectasis of the lungs, bronchiectasis sometimes occurs, and these two conditions are sometimes associated. The glands about the trachea and roots of the lungs may enlarge and become cheesy and tubercular, the latter affection being a not uncommon sequel of pertussis. Sometimes, though less frequently than after measles, the mucosa of the intestines suffers from catarrh, the abdominal glands swell, and tabes mesenterica may result.

Ætiology.—Although fungi and bacteria have been found in the sputa none have yet been proved to be pathogenic. The disease is especially common during the first four years of life, and is much less frequent after the seventh year, but it may occur at any period, the aged not being completely exempt. Female children are much more often attacked than male. A second attack is rare. Although, as a rule, the virus does not travel far, it may probably be conveyed by the clothes of persons not themselves suffering from the disease, although this is doubted by some observers and is certainly a rare occurrence. A child should not mix with others until at least six weeks from the commencement of the whooping, and not then unless the paroxysmal cough has ceased.

Treatment.—Cases presenting a noticeable degree of bronchitis must be kept in bed in a warm room (temp. 60° F.), ventilated without draughts. The treatment of the catarrhal stage is simply that of an ordinary catarrh, modified by the degree of lung complication, which, however, is seldom severe during the prodromal stage. The fresh air in autumn, or at any other season, is better than close confinement, if the child is strong and there are no pulmonary complications. Woollen clothing next the skin is most desirable. During the simple catarrhal stage the chest should be rubbed—front and back and under the arms—with turpentine liniment, night and morning, and a mixture containing carbonate of ammonia and ipecacuanha with some nitrate of potash may be given three or four times a day. A steam spray of carbolic acid ap-

pears to be useful in diminishing the frequency of the cough. On the theory that the disease is due to an organism which first settles on the nasal mucous membrane, various germicide preparations have been used to that part and to the naso-pharynx. A one per cent. solution of resorcin may be applied by means of a brush to all parts of the nose and throat every two hours during the day, and even at night if possible, for the first ten days of the case. After this period it would be useless, and other antiseptics should be tried. Finely powdered boric acid, sulphate of quinine, powdered benzoic acid, salicylic acid and iodoform may be used separately or combined in equal parts, diluted, if necessary, with fine starch powder; a few grains being used every two or three hours as an insufflation.

During the paroxysmal stage, or after it has passed its first period, there can be but little use in persevering with germicide medicaments. What remains is the nervous element of the disease. *Belladonna*, prussic acid, and bromides are the best nervine restorers or sedatives; small doses should be first prescribed, and the dose gradually increased; each remedy should be tried separately; but sometimes the following combination is most successful: \mathcal{R} Tinct. belladonna, m. x; potassii cyanidi, gr. $\frac{1}{16}$; ammonii bromidi, grs. iiij; spt. amm. arom., m. v; syr. simpl., m. xv; aq. ad. 3 ij; t. d. s.; for a child three years old.

Mopping the pharynx and adjacent parts of the larynx with a ten per cent. solution of hydrochlorate of cocain, care being used not to overcharge the brush, is sometimes useful. And the fumes from niter paper and those produced by burning the compound lobelia powder or Himrod's powder appear to diminish the tendency to the paroxysmal attacks. A blister to the back of the neck may be sometimes applied with good effect. Arsenic and change of air are also valuable measures during convalescence.

ANGEL MONEY.

Symptomatic Indications.—*Aconite* is useful at the commencement when there is marked febrile symptoms; dry, hard, wheezing cough; burning pains, or dry tickling in the larynx. *Ipecacuanha* is valuable for bronchitis and pneumonic complications; gastric symptoms; vomiting of mucus; much rattling of phlegm,

but little is expectorated. *Belladonna* is useful in febrile stage, especially with children during dentition, relieving the congestion of the air passages and hyperæmia of the brain. *Drosera* is valuable when spasmodic stage is well marked; severe paroxysms of hoarse cough, sometimes with hemorrhage or vomiting. *Cuprum*, for crouplike cough with convulsive movements, or convulsions; threatened death from collapses of air cells of the lungs. *Phosphorus* is very valuable when pneumonia threatens, or if bronchitis or broncho-pneumonia supervenes. *Ammonium brom.*, for deep cough causing pain in stomach; cough at short intervals; expectoration tough and stringy. *Pulsatilla* is often useful in later stage after subsidence of acute symptoms to complete cure.

WOUNDS.—*Classification:* A wound may be defined as "a solution of continuity in any part of the body." Wounds may be divided into two classes: *subcutaneous*, without division of the skin, and *open*, with division of the skin.

Open wounds are further subdivided in two ways. 1. As regards the manner in which they are inflicted, as *incised*, *lacerated*, *contused*, or *punctured*. 2. With reference to their method of healing, as open wounds (a) *with loss of substance*, and (b) *without loss of substance*.

Of the **subcutaneous wound**, when there has been no division of the epidermis, and consequently no exposure to the air, little need be said. As examples we have what is known as a *contusion*, or bruise, when occurring in the soft parts, and a *simple fracture* when occurring in bone. (See CONTUSIONS and FRACTURES.)

As regards the process of healing, it may be noted that it may be one of simple absorption, as in a black eye. In other cases, if the clot be not too large, and not irritated, it will, with proper treatment, pass through the changes described in REPAIR.

This class does not include such wounds as that made in tenotomy, where there is merely a small opening in the skin, and which are sometimes termed subcutaneous.

The open wound with loss of substance.—Here there is necessarily a certain amount of exposure to the air.

Take a simple case, as, *e. g.*, where a small piece has been cut off from a finger, and suppose that the exposure has been short, so that putrefaction is prevented. Any simple dressing, such as a rag rolled round the part to keep it at rest, and to act as a receptacle for the coagulating blood, and prevent access of air, will do. If the rag be removed too soon (it may be to see if the bleeding has stopped) the clot that has formed will probably break down. Leave the part at rest, and what occurs? A clot forms, and its surface, drying, forms a scab, which protects the clot underneath. Vascularization of the clot occurs, and in that part in connection with fibrous tissue, fibrous tissue is formed, while in that part lying next to the epithelial tissue of the edges of the surrounding skin, epithelium is formed, and grows inward until the whole wound is covered over by dry epithelial tissue. The scab, not being retained in its place, then falls off. Should there be any tension under the scab, *i. e.*, should the effusion be in excess of the absorption, the process of cicatrization, as it is called, does not go on so satisfactorily, but the clot breaks down, and suppuration takes place under the scab.

If we next take the case of a shallow wound, where the exposure has been longer, and putrefaction has occurred, then the clot breaks down, liquefies, and a gap is left with no clot in it. If this exposed surface is watched, it is seen to become moist. From the dilated vessels there is poured out on it the liquor sanguinis, and the white blood corpuscles migrating, we have all the conditions necessary for the formation of the colorless clot, which now forms as a grayish film on the surface. In the words of the older writers, the surface becomes glazed. The next change to be observed is the appearance in the grayish film of little red points here and there. These increase in number, and, coalescing, extend so as to cover the whole surface. The little red projections are vessels, and are termed "*granulation*." The whole surface has become vascular. So long as the granulations persist, there is an exudation from the wound of pus; but the granulation tissue is simply vascular lymph, and we have seen that, in the process of repair, such lymph tends to become like the tissue in which it lies. Accordingly, in the deeper parts of the wound, fibrous

tissue forms and contracts, and *deep cicatrization* occurs; while at the edges epithelium grows in and covers the surface, and *superficial cicatrization* takes place. In simple language, a *scar* is formed. This method of healing is termed healing by "*granulation*," or by "*second intention*." The formation of the fibrous tissue and its contraction must proceed *pari passu* with the ingrowth of the epithelium if a good result is to be obtained. Otherwise we have a depressed scar or a weak one respectively, as the deep or the superficial cicatrization is the more rapid.

If the wound be not shallow, but a deeper trenchlike wound, it heals by the growing together of the granulations at its deeper parts, and the process gradually extends toward the surface, until the wound becomes superficial, when superficial cicatrization occurs. The dangers which the surgeon has to contend with in such a case are the growing together of the granulations near the surface of the wound, and the union of the skin edges before the deeper parts of the wound are firmly united. To prevent this, the superficial part of the wound must be kept open to allow of gradual healing from below upward. To this method of healing by granulation, the special term of "*coaptation*" may be applied.

The open wound without loss of substance, or more accurately without *appreciable* loss of substance, as *e. g.*, in the case of a clean cut or incised wound. Here, if the surfaces be brought at once into gentle contact and kept there, there is formed between them a thin layer of colored clot, which passes through the changes already described, and forms the bond of union between the two surfaces. To this the name of healing by *first intention* has been given. There can be no doubt that, in every incised wound, the injury to the tissues is sufficient to lead to the formation of a layer, however thin, of clot between the two surfaces, and that healing by Macartney's immediate union never takes place.

If the surfaces be *not* brought at once into contact; if, for example, hemorrhage occurs a few hours after an amputation, and the surgeon, having opened up the wound and stopped the bleeding, does not bring the flaps together again until after the surfaces have become glazed,

what happens? The two layers of colorless clot undergo the same changes as the layer in the incised wound, with this difference, that while the surfaces were becoming glazed the colored corpuscles were got rid of, and union takes place with greater ease. This method is termed healing by *apposition*, and is really a most excellent form of healing by first intention. Healing by apposition differs from healing by coaptation in this: that in healing by apposition the surfaces are brought together *before*, while in healing by coaptation they are brought together *after* the colorless clot covering them has become vascular.

Open wounds may also be divided into *incised, lacerated, contused, and punctured*.

1. An incised wound is a clean cut, such as that made with a sharp instrument. An apparently clean cut may, however, be made by a blunt instrument, as in the case of a kick with a heavy boot. This is especially apt to occur over bones, and if the line of impact be linear. The symptoms are: hemorrhage, gaping of the wound, and pain, frequently severe. In incised wounds the aim of the surgeon is to procure union by first intention. He will fail, however, to do so if the wound be exposed to any fresh source of irritation, of whatever nature.

2. A lacerated wound is, as the name implies, one in which there is more or less tearing of the tissues, and consequent irregularity of the sides and edges of the wound. Such wounds present an infinite variety of form, depending on the way in which they are inflicted. A lacerated wound does not gape so much as an incised one. The strain on the tissues in its production is much greater than in a clean cut. Hence, there is always more or less "ecchymosis" or *hemorrhage in the surrounding tissues*. Their vitality, too, suffers a greater amount of depression, and there is great tendency to sloughing. Owing to the tearing across of the vessels, the natural arrest of hemorrhage occurs more readily, and the bleeding from the wound is slight. Lacerated wounds are very frequently also contused.

3. A contused wound is one where the edges are bruised, and their vitality destroyed. It is always associated with a certain amount of ecchymosis.

The pain in a lacerated or in a contused wound is generally of a dull, aching character. The method of healing in these wounds is that by "granulation" or "second intention." The dead tissue is absorbed, or separates as a slough, leaving an area of granulation tissue, which undergoes the changes already described.

4. A puncture wound is one made by a pointed instrument. Its depth is much greater than its breadth. On account of its depth it is one of the most dangerous forms of wounds. While the aim here is to obtain union by "first intention" if possible; owing to the variety in the contractility of the tissues through which it passes, the consequent difficulty in keeping the surfaces in accurate contact, and the tendency, therefore, to accumulation of fluid and tension, on the one hand, and the difficulty of drainage on account of the depth of the wound and its small external opening on the other hand, union almost always takes place by "second intention." The great point to attend to in the treatment is free drainage. At one time this was done by enlarging the wound. It is now done by the use of a drainage tube.

Defects in the healing process.—Their causes are constitutional and local. Those due to a *constitutional* cause show themselves in the form of a want of the power of repair giving rise to slow or to partial healing, or even to absolute want of union. The *local* defects are those due to the causes of inflammation. In the case of union by "second intention," the granulating wound is practically an ulcer. See ULCERS.

Treatment of wounds.—In the treatment of any wound the surgeon endeavors to prevent inflammation, and to get as early and as painless a union as possible. The great principle on which the treatment must be based is *rest*, local and general. The main indications of treatment on this principle are:

1. Arrest of hemorrhage.—See HEMORRHAGE.

2. Removal of foreign bodies.—This may most effectually be done by washing out the wound with water to which some antiseptic solution should have been added. By this means dirt, portions of coagulated blood, etc., are got rid of. Bodies firmly imbedded in the tissues must be removed by *clean* forceps.

3. *Apposition of edges and surfaces.*—This may be done in many ways.

With reference to the *edges*. Some surgeons use adhesive plaster of some kind. This method is often of service in small wounds. In larger wounds its chief disadvantages are that, unless very carefully applied, it is apt to cause inversion of the lips of the wound. It is not easy to keep it aseptic. It is difficult of application unless the parts are thoroughly dry; and it is apt to cause tension.

A preferable way is to use some form of stitch or *suture*. Sutures vary in their form, and in the materials used in making them.

The principal materials are *silk*, *silver wire*, *catgut*, and *horsehair*. Silk is open to the objection that it is flexible and yields, whereas the object is to keep the part quiet; and if the silk stitch be made sufficiently rigid by drawing it tight, tension is apt to occur in the wound. Silver wire meets all these objections; but there is difficulty in removing it without causing pain. Catgut makes a good stitch so long as it remains rigid, but as it is gradually absorbed, and is apt to be softened more quickly than is sometimes expected, it, like silk, also yields. Horsehair has all the advantages of a good stitch. By using it double, all the required strength may be generally obtained, and its resiliency is an advantage, as it permits of a certain amount of giving, and consequent relief if tension occurs. It forms, so to speak, a little rigid yet elastic circle, and it can be easily removed.

Apart from the material used, a suture may be applied in various ways. The chief are the "*continuous*," or "*uninterrupted*" suture, when the stitches are made with one unbroken thread, and which is useful where very accurate apposition of the edges is required, as, *e. g.*, in wounds of the intestine. The *interrupted* suture, the commonest method, where the edges are brought together by a series of separate single stitches. When the edges can only be brought together by being stretched, *e. g.*, when a portion of diseased skin has been removed, and where, in other words, there would be tension of the edges of the wound, this can be lessened by passing the knife under the skin and round the wound, thus rendering the flaps looser and capable of

more easy approximation; and by "*superficial button sutures*," sometimes termed "*stitches of relaxation*." Two small thin sheets of lead are used, each with a hole in the center. One is threaded with silver wire, which is passed through the skin at some distance from the edge of one flap, and is brought out at a corresponding point on the side of the opposite flap. The other button is then fixed on, and so the edges are brought more closely together.

The *surfaces* of the wound, however, must also be brought into contact and kept there. The importance of this cannot be too highly estimated. If, for example, after the operation for excision of the female mamma, the edges of the wound alone are brought together, what happens, if reactionary hemorrhage comes on? The blood collects between the skin and the pectoral muscle, and all the more so if the edges are in accurate contact. And apart from any hemorrhage, there is always more or less effusion, which, accumulating, will give rise to tension. It may be said that efficient drainage will correct all this, but the primary use of a drainage tube is prevention rather than cure, at all events in a recent wound. The best way of securing adaptation of the surfaces, and of supporting them in that position, is to apply sufficient and accurate pressure. In the case taken as an example, pads must be applied on either side of the wound, and the arm bandaged to the side. The pads should be made of some semi-elastic material such as wadding, and the bandage should also be semi-elastic, *e. g.*, a domette bandage, to secure constant, though not too, great pressure. "*Deep button sutures*" are, also, of great service here. They differ from superficial button sutures only in the fact that the silver wire passes deeply into the tissues.

4. *Free drainage.*—The importance of free drainage is evident when the consequence of its neglect (tension, suppuration, etc.) are remembered. The need for drains to conduct away discharges from a wound is lessened the more accurately the surfaces are brought in contact. Drainage may be secured by using tubes of india rubber, or of decalcified bone, or skeins of catgut or of horsehair; but whatever form of drain be used, care must be taken that the outer end of the drain may be in as dependent a position as

possible. If a tube be employed, its outer end should be practically on a level with the edges of the wound, and the tube must be prevented from passing back into the wound. This end may be attained by transfixing the outer end of tube with a piece of silver wire. As the wound heals, the tube requires to be shortened, and a wound on this account may require to be dressed more frequently than would otherwise have been necessary. The time that the tube remains in varies with the size of the wound, with the rapidity of the healing, and with the amount of discharge. The sooner the tube is out the better; but care must be taken not to remove it too soon, as there is danger of tension occurring in the deeper parts of the wound. Tubes are more reliable than catgut in large wounds, because the catgut is capable of being absorbed by the tissues, and may be absorbed too soon, or may otherwise prove insufficient. Catgut is especially useful if the discharge be serous in character; not if it be purulent, for catgut cannot convey pus. If catgut be used, it is stitched to the deeper parts of the wound, or the ends of catgut ligatures used in the wound may be brought out at the end of the wound, and act as a drain. The catgut must not be allowed to get dry, or its capillary action is lost. Free drainage may be further obtained by leaving the wound open, or by placing some absorbent material outside it, which sucks up the discharge as it reaches the surface, and prevents accumulation in the deeper parts.

5. The part must be *steadied* by some form of splint, using "splint" in its general signification. This may be done by means of pads, bandaging, ordinary wooden or metal splints, or by appending a suitable weight. A sheet of lead, adapted to the under surfaces of the limb, is often of great use in amputations in steadying the part.

6. *Putrefaction* must be avoided. See SEPTICÆMIA.

The various Forms of Dressing applied to Wounds, including the Antiseptic Treatment:

1. *The occlusion* method consists in applying some adhesive material over the wound, to close it after its surfaces and edges have been adjusted. The disadvantages of this method have been discussed in connection with the use of

sticking plaster in the treatment of wounds.

2. *The open* method consists in leaving the wound free from any form of dressing whatever. This method permits of all the indications for the proper treatment of a wound being fulfilled, except one, the avoidance of putrefaction. The wound being open, *ceteris paribus*, drainage is provided for, while exposure to the dry air assists in drying the wound, and so in lessening the chances of decomposition in the discharges from the wound. But should the drainage be imperfect, should any of the secretions collect in any little pocket in the wound, no provision is made under this method for their protection from septic influences.

3. *Simple water dressing* consists in the application to the wound of a piece of wet lint, which is covered with a piece of oiled silk to prevent evaporation. This method was used by Liston with great success, even large wounds often healing with very little or almost no supuration. The secret of success here is that free drainage is allowed, but this method, too, is open to the objection that even "pure water" is surgically more or less unclean, and its use may give rise to the implanting of the causes of putrefaction in the wound.

4. *The dry dressing* is on this account preferable to the wet dressing. It consists of a pad of dry lint placed on either side of the wound, so as to secure thorough apposition without interfering with drainage. Some more dry lint is placed over these, and the whole is surrounded by a bandage. Cotton wool is sometimes substituted for lint. This dressing is useful in small wounds, union by "scabbing" generally taking place. In large wounds it is permissible only after free drainage has been provided for; and even then is not advisable on account of the liability to the occurrence of putrefaction.

5. *The antiseptic treatment*.—We have seen, therefore, that while each of the above methods of dressing fulfills many of the indications for the proper treatment of a wound, none of them makes any attempt to provide against the entrance into the wound of the causes of putrefaction. Free drainage, cleanliness, and rest are certainly important factors in the prevention of putrefaction, but they cannot prevent the entrance of bacteria into a wound. This can only be at-

tempted by the use of antiseptics. The word antiseptic must now be taken as having a much wider meaning than it used to have. It cannot be limited to its strictly etymological signification, much of what was formerly ascribed in general to sepsis or putrefaction being now known to be of quite different origin, and to be, in relation to the organism, distinct from those of ordinary putrefaction. As the action of micro-organisms on the tissues is apparently through a process of fermentation, antiseptic must now be held as synonymous with antifermentative. A perfect antiseptic should be sufficiently strong, volatile, and non-irritant. Such a substance has not yet been discovered. The two antiseptics in most general use in surgery are carbolic acid, which is used in the strength of 1 part of absolute phenol to 20 or 40 parts of water, and perchloride of mercury, used in the strength of 1 to 2000 or 1000 of water. There are many other preparations of these substances. Carbolic acid is irritant and volatile; perchloride of mercury is non-irritant, but has the disadvantage of being non-volatile.

The materials used as dressings are :

1. *Carbolic gauze*, which was the original form of dressing used by Lister. It is made by charging unbleached muslin with a mixture consisting of crystallized carbolic acid, 1 part, common resin and solid paraffin, each 4 parts.

2. *Eucalyptic gauze*, where eucalyptus oil is substituted for carbolic acid.

3. *Salicylic cotton-wool, salicylic silk, corrosive wood wool, sublimated wool, i. e.*, some form of absorbent wool impregnated with some antiseptic.

4. *Protective*, or oiled silk coated on either side with a thin layer of copal varnish, so as to render it impervious to the carbolic lotion. Over this again a fine layer of carbolized dextrin is laid, which allows the 1-40 lotion, into which the protective is dipped immediately before use, to wet and so thoroughly purify the surface. Its use is to protect the edges of the wound from the irritating carbolic acid, and to prevent the sticking of the dressing to the wound.

5. *Mackintosh*, or thin cotton cloth covered on one side with india rubber.

Methods.—1. In a wound made by accident, and which has been exposed for some time to the air before the surgeon sees it, the first step, after arresting the

hemorrhage, is to thoroughly purify the wound by washing it out with some antiseptic solution, *e. g.*, 1-40 or 1-20 carbolic lotion, the strength of the lotion used varying with the length of exposure of the wound. The skin round the wound must also be purified. Then a drain, if required, is inserted, and the edges and surfaces of the wound adjusted and secured by some form of suture, *e. g.*, carbolized horsehair. A piece of protective is placed over the wound, and, if a catgut drain be used, also over the ends of the catgut to prevent it from becoming dry, and so losing its action by capillarity. If a tube be used, the protective must be cut so as to leave the end of the tube open. A layer of wet carbolic gauze is placed over the protective (wet gauze, because dry carbolic gauze, unless it be warm, is not antiseptic). This finishes the deep dressing. Then follow, according to the ideas of the surgeon, pads of dry carbolic gauze, or of some absorbent antiseptic wool, above which is placed the large superficial dressing, consisting of eight layers of gauze, with or without a sheet of mackintosh beneath the outermost layer. The superficial dressing is not wet. As it becomes warm with the heat of the body, the volatile carbolic acid with which it is impregnated is set free. The object of the mackintosh is to distribute the discharge when it reaches it, and so prevent it from soaking too quickly through the gauze, and from consequent exposure to the air. Though it is of service when there is a great amount of discharge, it has the disadvantage of preventing free evaporation, and thus of rendering the parts sodden. A gauze bandage fixes the dressing in position, and, when further support is required, an elastic or a domette bandage may be used.

2. In the case of an operation, the first consideration is the thorough purifying and keeping clean of the hands of the surgeon and of his assistants, of the part about to be operated upon, and of the instruments, sponges, ligatures, etc., to be used. Round the part are laid towels soaked in some antiseptic solution. On these the instruments, sponges, etc., which are thoroughly soaked in 1-40 carbolic lotion, may be laid with safety during the operation. Mere washing with carbolic lotion is not sufficient to thoroughly cleanse the skin. The part

should be soaked for some hours before the operation, and thus the carbolic acid is able to permeate the follicles of the skin and destroy any causes of putrefaction that may already exist there. Ether, iodoform, and turpentine are also used for the preliminary purification of the skin, but the skin and wound must be kept pure. This is aimed at in different ways. The two chief methods are *irrigation* and the carbolic *spray*. By many the spray is regarded as the one essential of the antiseptic treatment. It is not so. It is only one, though one of the best of ways, in which the principles of the antiseptic treatment are carried out. Both in irrigation and in the use of the spray, the aim is to keep the clean surfaces covered with some antiseptic material, and thus to prevent them from becoming surgically unclean. In *irrigation* this is generally done by using a mixture of glycerine and carbolic acid, or a solution of corrosive sublimate. Irrigation was formerly used by Lister, and was displaced by the spray, which he found more effective. The tendency now seems to be a return to irrigation, the reason probably being the difficulty of using a spray in general practice. The advantages claimed for the spray are, that it is the best irrigator, and that it forms an antiseptic atmosphere, so to speak, in the immediate vicinity of the wound. If the spray be used, it is turned on immediately after the cleansing of the skin and before the incision is made, and it is kept on till the superficial dressing is applied. The dressings have been already described. It should be added, however, that if the mackintosh be used, care must be taken not to let it be perforated in any way, *e. g.*, with a pin, or its aim will be defeated. The principles of the antiseptic treatment, and some of the more salient points of its detail, have here been briefly indicated.

Complication of wounds and their treatment.—1. *Hemorrhage*.—See HEMORRHAGE.

2. *Severe pain*.—This may be relieved by the use of sedatives. Opium, and especially the subcutaneous injection of morphia, are the best. Relief must also be sought by treating the local cause of the pain.

3. *Starting of the muscles*, in consequence of their being stimulated reflexly by the severe pain. This is to be rem-

edied by opium, by placing the limb in such a position as to relax the affected muscles, or by applying a weight so as to steady the limb.

4. *Foreign bodies*, aseptic or septic. These must be removed if possible. A good general rule is, "only attempt to remove a foreign body if you can feel it."

5. *Shock*.—See SHOCK.

Cicatrices.—A cicatrix may be defined in general terms as the result of the process of repair in a wound. The term cicatrix or scar, however, is not generally used in connection with the healing of true subcutaneous wounds, whether of the soft or of the hard tissues of the body. It is usually applied with reference to wounds associated with a gap or breach in the continuity of the surface of the body; the term surface being taken in its widest sense as any part exposed to the air.

The process of cicatrization is that which finally seals the wound, whatever be the method of healing, whether it be by first or by second intention. The resulting scar consists of a deeper or fibrous tissue portion, and a superficial or epithelial portion. It is nature's best substitute for the original tissue, but it is not exactly the same. The deeper portion contains no lymphatics, and owing to the absence of yellow elastic fibers, and to its being denser than ordinary fibrous tissue, it is of a more or less rigid unyielding character. In the superficial portion there are no sweat glands, and as the papillæ and hair follicles are absent, the scar feels smoother than the surrounding skin. A recent scar is redder than normal, owing to its abundant vascular supply; but as it grows older the blood vessel becomes obliterated, and the scar becomes white and opaque. There is also a tendency for the induration to become less with age, and for the scar to become more like the tissue in which it lies. A scar usually contains but few nerves, and often none at all.

Morbid cicatrices.—When the cut end of a nerve, which is frequently bulbous in form, is involved in a cicatrix, the result is a very *painful* one, owing to the pressure exerted on the nerve by the contracted unyielding fibrous tissue. Where, as in a burn, the injured area is much greater in its superficial extent than in its depth, there is great tendency to marked *con-*

traction of the cicatrix, giving rise very frequently to great deformity. Thus the chin may be dragged down as the result of the contraction of the cicatrix after a burn of the neck, or the arm may be fixed to the side from the same cause after a burn in the region of the axilla.

Sometimes, especially in children, in the formation of a scar there is *excessive* growth of the new tissue, resulting in nodular masses which, being formed of cicatricial tissue, are hard and smooth. Not unfrequently they are very vascular. They are the so-called "*warty*" growths of cicatrices. Resembling these somewhat in appearance is the fibrous tumor found especially in the cicatrices of burns and scalds, and termed "*cheloid*" (*χηλῆ*, a claw). It is not connected with the formation of a scar, and may occur in it years afterward. It forms a flattened tumor, frequently overlapping the skin at its margin, and has what has been described as a "tied down" appearance. The growth is limited to the skin, it spreads along the fibrous sheath of the vessels, and frequently has a more or less claw-like form; hence the name *cheloid*.

A *weak* scar is the result of the process of superficial cicatrization taking place more rapidly than the formation of fibrous tissue, and its contraction in the deeper part of the wound. Owing to the diminished vitality, and therefore diminished power of resistance in a scar, it is liable, when irritated, to give way more easily than normal tissue, and to ulcerate. The epithelial tissue of the scar may take on an excessive growth of a malignant character, invading the deeper tissues, and form, in short, an *epithelioma*.

Treatment.—*Painful cicatrices* may be treated by division of the cicatricial tissues pressing on the nerve, or by division of the nerve itself if it be known, or by excision of the so-called "*neuroma*," *e. g.*, of a stump. In treating the deformity arising from the *contraction* of a cicatrix, especially when a plastic operation is required, the surgeon must be guided by the requirements of the special case. The chief indications are that the cicatrix must be carefully but thoroughly divided, and dissected off from the structures beneath. The part must be restored to its normal condition as nearly as possible, and means adopted to prevent contraction recurring. Transplanting of

a healthy flap of the skin may be required, or skin grafting may be of use.

The *warty* growths, as a rule, had better be left alone, unless they give rise to heat and tingling. If so, they may be treated by applying some form of local counter-irritation, or by removal.

A *cheloid* tumor should not be interfered with by operation, for, depending as it does on a constitutional condition, it is most liable to return in the new scar. Further, after reaching a certain size, it generally ceases to grow. Locally some sedative plaster may be applied if there be any irritation. The constitutional treatment does not seem to be satisfactory.

Malignant tumors are to be treated by free and early removal.

PROF. JOHN CHIENE.

Symptomatic Indications.—*Arnica* is the main remedy in all contused wounds; contusions and lacerations of muscular fibers; very useful after amputations, aiding in the union of surfaces. *Aconite*, valuable in surgical fever and inflammation of wounds, particularly after operations. *Belladonna*, for inflammation of absorbents in poisoned or dissecting wounds; injured part is very painful and swollen, with congestive headache. *Ledum*, in punctured wounds—wound feels cold to the touch and to the patient, does excellent service. *Hypericum* is very valuable in lacerated wounds and in injuries of parts rich in sentient nerves; prevents trismus. *Ruta*, for injuries of the periosteum, injuries of tarsal and carpal joints. *Apis*, for dissecting wounds, throbbing pain extending upward; erysipelas after wounds and operations; œdema. *Calcium sulphide* promotes and controls suppuration when unavoidable. *Silicea* is very useful when suppuration is too profuse and unhealthy.

WOUNDS, GUNSHOT.—The term *gunshot injury* is one which serves as the generic name for wounds inflicted by missiles from cannon, rifles, shot-guns, and pistols. The weapons have changed from smoothbored to rifled, and the bullets from spherical to conical, but the wound inflicted is called gunshot whatever be the nature of the weapon, or the kind or course of the bullet. Shell wounds alone are spoken of by a separate name.

Missiles.—The various missiles in use

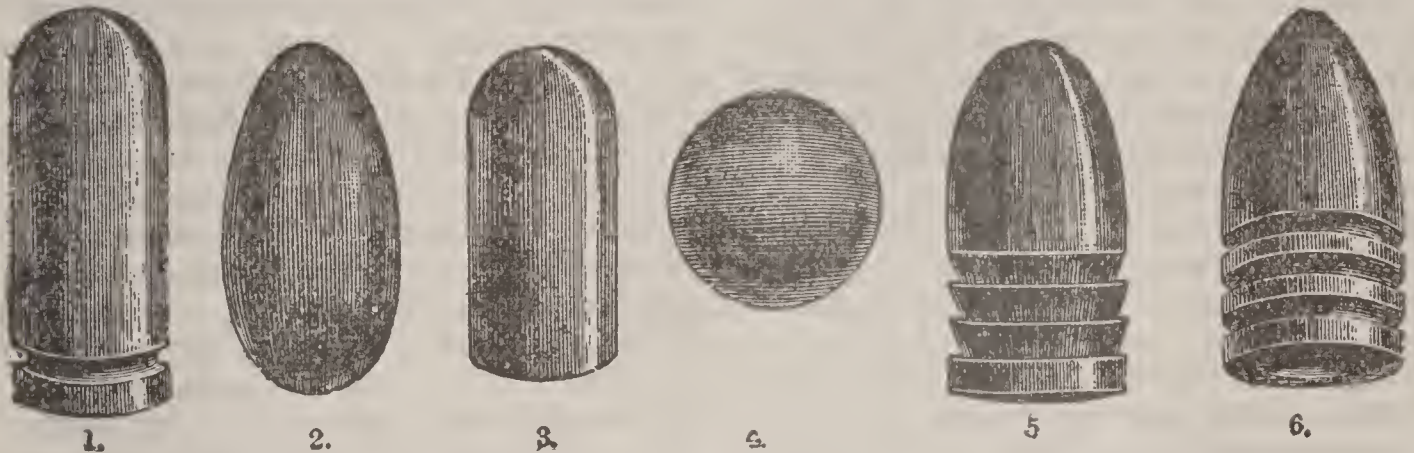
are: (1) "Shot" as distinct from bullets; one of the most common causes, in civil life, of gunshot wounds. The size of the particles may vary from the smallest "sparrow hail" to the largest "buckshot." They are usually numbered as No. 1, No. 2, and so on, up to No. 12, No. 1 indicating the largest, and No. 12 the smallest of the series. The weight of the particles in No. 12 shot is from $\frac{1}{8}$ to $\frac{1}{16}$ of a grain, nearly three thousand shot being present in one ounce. The weight of a buckshot, No. 1, is 133 grains.

(2) Pistol bullets, varying in size from about $\frac{1}{8}$ inch (.22) to $\frac{1}{2}$ (.50) in diameter; the weight may be as little as 25 grains, or as much as a rifle bullet, 350 grains.

(3) The round leaden shot used in the smoothbored gun, a thing of the past (Fig. 4). The bullets varied much in weight and shape, as every man could

The apertures of entrance and exit.

—In the old days of spherical bullet wounds the apertures of entrance and exit elicited much attention. With the conical bullet and its high rate of velocity the differences between the apertures have ceased to be of any marked character. In the case of the spherical bullet the aperture of entrance was small, circular, ecchymosed, and with slightly inverted edges; that of exit was larger, irregular, lacerated, and with everted edges. The rifle bullet at its entrance causes a larger wound than the spherical, and this wound is often lacerated, and of a linear crucial shape. Hence it is well-nigh impossible to tell the apertures one from another. A bullet may cause multiple wounds; as when firing in the lying or kneeling position a bullet may penetrate the left forearm, the left arm,



1. Martini-Henry. 2. Needle Gun. 3. Chassepot. 4. Musket. 5. Snider. 6. Enfield.

cast his own; their weight varied as much as from $\frac{3}{4}$ ounce to $1\frac{1}{2}$ ounces.

(4) The rifle bullet, the destructive missile of modern warfare. It is of a more or less conical shape; it varies in weight from 315 grains (the Swiss army bullet), to 480 grains (the British regulation bullet). The diameter of the Swiss bullet at the base is .41 inch, the British bullet .45 inch. Lead is the base of all bullets, but the Americans and British add tin to harden the lead (Figs. 5, 6).

(5) Bullets for machine guns, such as the Gatling, Gardner, Hotchkiss, mitrailleuse, and Nordenfelt; these threw bullets varying between $1\frac{3}{4}$ ounces to $\frac{1}{2}$ lb. in weight.

(6) Shot for field guns and siege guns, which throw either solid, grape, case, or canister shot, some of the canister containing as many as 280 small iron balls. In Figs. 1 to 6 the chief forms of bullet are shown in their natural size.

and finally the chest; and so with the lower limb in the kneeling position.

Two or more bullets may have entered the body at about the same moment, as in volley firing; and it is extremely difficult to ascertain whether it was or was not one and the same bullet which caused the various wounds. Deflection of a bullet in its track will also still further cause perplexity; and although the spherical bullet is more easily deviated by a bone, tendon, or blood vessel, a conical rifle bullet is liable to the same deviation to some extent.

The immediate effects of gunshot wounds depend upon the part of the body hit. The most frequent causes of sudden death on the field of battle are wounds of the brain, or one of the large blood vessels, arteries, or veins.

Primary hemorrhage is one of the most common causes of sudden death; wounds of the aorta, the iliacs, the fem-

orals, the subclavian, the axillary, and the carotid arteries, when the bleeding cannot be or is not restrained, will lead to the belief that the soldier was shot dead. It is astonishing, however, to note from injuries of what magnitude to blood vessels recovery is possible. This is to be accounted for by the lacerating nature of the missile, causing the contraction and retraction of the vascular walls necessary to the formation of a coagulum and the restraint of hemorrhage. A gush of blood may occur when a vessel is severed, and the hemorrhage thereafter cease. So often is this the case that a popular belief exists that bullet wounds do not bleed. The same may, however, be said of other lacerated wounds, and a bullet wound, after all, is a lacerated and contused wound, caused by a missile traveling at a high rate of speed.

Shock, as after all injuries of any magnitude, is a concomitant of gunshot injury. In warfare the previous excitement, in suicidal cases the mental tension, and in homicidal and accidental cases the sudden dread of death all contribute to account for the intensity of the shock after gunshot injuries. Most marked is the shock after abdominal wounds. This admits of ready explanation, since it is through the effects on the sympathetic system, more especially on the solar plexus and its large offshoots, that the phenomena of shock arise.

Pain.—In the heat of battle the soldier is frequently unconscious of being wounded, and it may be only from the fact that blood is found issuing from some part, or that a limb becomes useless, that the fact is brought home to the wounded man. Likewise in civil life the knowledge of being hit by a bullet need not be communicated by the pain, as frequently it is slight or altogether absent. Even the severance of a large nerve may cause little or no pain. However, after a time, pain usually supervenes, and may be of an acute burning, of a dull bruised, or of a tingling character.

Tetanus is a condition which the older surgeons have impressed upon our minds as associated with wounds on the field of battle. The disease is not so frequently met with in modern warfare; in fact, it is rather a rarity. Whether this is due to the change in the character of the bullets, or other causes, is a matter of uncertainty. Damp and chill nights, following a high

midday temperature, have been regarded as possible factors in the ætiology of tetanus.

The appearance of tetanus on the field of battle is speedy, compared with what we know of that disease in civil life. Should the wounded be left over night in a chill, dewy atmosphere, in tropical or subtropical regions, trismus, the precursor of tetanus, may have made its appearance, or well-developed tetanus may have come on before morning.

As in nerve lesions connected with an ordinary fracture of bone, so with bullet wounds, tetanus is more frequently met with when peripheral regions of nerves are injured, rather than when the larger trunks are divided.

The ultimate effects of gunshot injuries which are not immediately fatal will depend upon how soon the wounded man is brought under treatment, the nature of the tissue or organ wounded, the climate in which he is campaigning, the skill with which he is treated, and the hygienic conditions by which he is surrounded. If allowed to lie on the field of battle, the wounded man may die of secondary hemorrhage, shock, cold, exhaustion, or tetanus.

The *effects* of a gunshot wound vary with the nature of the tissue injured.

The *skin* when injured may be grazed only. This may be followed by the severe prickling and burning pain characteristic of a fall, causing skin scraping, and termed "brush burn." The pain is greatest when the slight erythema, which invariably follows, supervenes. The skin may be contused, and may subsequently slough. The elasticity of the skin may be so great when stretched, as in the kneeling position, that a bullet enters by almost an incised wound. A large shot or piece of shot may hit the skin, reduce the bones, muscles, etc., beneath it to a pulp, and may never penetrate.

The *fasciæ*, superficial and deep, behave somewhat differently. The superficial fascia may have blood extravasated into it far and wide around the bullet track; the deep fascia, on the other hand, is usually clean cut, and its fibers, separated for the moment, partially cover the track, obscure the path of the bullet, and prevent subsequent drainage.

Muscles are usually extensively injured. A bullet may pass through a muscle, making a round hole in it. A muscle

may be bruised and lacerated, and blood infiltrated into its sheath from end to end. When a muscle is completely divided the ends retract. When a limb is torn off by a large shot or shell, the muscles, as in other lacerated wounds, do not retract.

Tendons of muscles are more likely to escape injury than almost any other structure; from the fact that they are round, movable, and tough, they frequently deflect a bullet.

Bones are usually comminuted; they may be simply penetrated; they may be penetrated, contused, and split longitudinally; or a bullet may be lodged in a bone for an indefinite period.

Diagnosis of gunshot wounds in general.—At first sight it would seem as though it were easy enough to recognize the fact that a bullet had penetrated the body and lodged there, but this is not borne out in practice.

In the first place the missile may have caused a bullet wound in the skin, but may not have entered the body; this peculiar state is accounted for by the fact that the clothing may have been carried by a slowly traveling bullet into the skin, and that on removing the clothing to search for the body wound the bullet is dragged out.

Multiple wounds in the body may have been caused by one or more bullets. The possibility of a bullet entering and re-entering the body during the particular positions has been already dealt with.

The deflection of a bullet is apt to give rise to confusion as regards its course and position. The rule is that a conical rifle bullet goes straight through, but it is a mistake to assume that such is always the case. The deflection possible with spherical bullets, and pistol bullets in general, is a condition which must always be borne in mind when treating such injuries.

Fasciæ, bones, tendons, and arteries all tend to cause deflection, especially with spherical, but also, though much less frequently, with conical bullets. Hence, in examining for a bullet, attend to the following points: (a) Get the history of the case, if possible; this is especially necessary in suicidal or accidental injuries. (b) Examine the hole in the clothing, with the object of ascertaining whether it was completely perforated, whether a piece is torn out, or if the

clothing around is stained by the explosion of the gunpowder, as would happen at close quarters or in suicidal cases. (c) Place the body and limbs, if there is any doubt about the bullet track, in as nearly as possible the imagined position at the time of being hit. Especially is this essential with multiple wounds before it can be known whether one or more bullets caused the wounds. Even then the difficulty is not got over, as the fact of deflection must be reckoned upon. That a bullet is in the wound is to be judged by the fact that no aperture of exit exists, that the track is fairly deep; but the crucial test is recognition of the bullet by the finger or a probe. The introduction of a probe is uncertain and unsafe; the finger is true and devoid of danger.

The different appliances used are:

Nélaton's bullet probe. This is a probe tipped with "biscuit" porcelain, which, when it touches the leaden bullet, gains and retains a bluish stain. A piece of clay pipe stem may serve as an improvised means to the same end.

Sayer's vertebrated probe was devised as a means whereby the probe might follow the windings or unevenness of a bullet track.

Electric probes, whereby a galvanometer is deflected when the bullet is touched, may and have proved useful in the search for a bullet in some obscure cases.

The injection of a weak solution of an acid, capable of dissolving, and hence becoming stained by, the presence of lead is recommended; this device might be of service in some instances.

Cutting forceps, whereby a piece of the hard substance felt in a wound may be bitten off and examined, is an unwise method of procedure.

Examinations for the purpose of diagnosis must be made as soon after the infliction of the injury as possible, but any attempt to push the finger in, say twelve hours after, is attended by much pain. The finger is the means of diagnosis to be relied upon, and with the modern bullet and its large aperture of entrance, especially when a bony surface is beneath the skin of the part wounded, there is usually no difficulty of introduction. Probing wounds, especially in the flurry of a battlefield, ought to be strictly forbidden.

The prognosis of gunshot wounds is so dependent upon the nature of each case that it is impossible to lay down definite rules or even suggestions. The prognosis, to be of any value, is so bound up with the direction for treatment to be given on the first sight of the case that all consideration of the sort will be deferred until the treatment is discussed.

Treatment of gunshot injuries.—The general principles of treatment on the field are as follows :

Combat shock by ordinary restoratives.

Stop hemorrhage by digital and then by instrumental compression. A tourniquet may be improvised out of a handkerchief, bandage, brace, or such article, and a bayonet or sword-scabbard passed through the knot and twisted. A knot on the handkerchief, or a pad of some kind placed over the course of the artery above the wound, will aid in the more speedy and certain arrest of hemorrhage. Esmarch's elastic tourniquet is also effective and easily applied. If necessity arise the artery may be tied on the field of battle.

Allay pain, if possible, by position, by correcting a faulty posture, or by the administration of an opiate.

The further treatment to be adopted is, when it can be done, as follows : Syringe out the part with carbolic lotion (1 in 20) or chloride of zinc lotion (20 grs. to the ounce) ; cover the part with dry cotton-wool, which is absorbent and antiseptized with a non-volatile material such as salicylic acid, carbolic acid, iodoform, or boracic acid. Burdeleben's antiseptic tampon and Burrough's sponge are specially prepared applications, which may be clapped on a wound and held on by bandages and straps ; and, if necessary, the whole limb, if that is the part wounded, may be rendered immovable by being fixed to a rifle on the field, or by plaster of Paris bandages on the field or at the dressing station or field hospital. The further treatment of gunshot injuries is to be undertaken at the dressing station, field, or base hospital. At the dressing station an artery may be ligatured, and the tourniquet may be removed from the limb ; should no antiseptic dressing be available, the bullet wound may be explored ; but, if possible, it is better to delay that until the field hospital or even the base hospital is reached.

The exploration of the wound and extraction of the bullet.—As mentioned, the exploration is to be done by the finger, and it must be done by a clean finger, *i. e.*, one duly antiseptized. Probes are unsafe and uncertain. It may be necessary, when thorough exploration is advisable, to enlarge the wound.

Remove the bullet, or other foreign body, as soon as it is discovered. For this purpose many different forms of forceps have been devised, but the ordinary dressing forceps is practically the instrument mostly used. A fenestrated artery forceps with bulging blades, sharply hooked at the point, is at times successful where a dressing forceps fails. The bullet is extracted, as is any foreign substance, in the way which best suits particular cases ; therefore no definite rule can be laid down for the manipulation.

Subsequent progress of gunshot wounds.—When no antiseptic treatment is available for the treatment of the wound, the following train of symptoms usually develops. No sooner have the effects of shock gone by than reaction of an acute kind sets in, and the temperature rises to, it may be, 104° by the second day. The pains and suffering from the tension of the parts is usually very great upon the third day, by which time supuration may have set in. When free drainage is provided the patient has a chance of recovery, as shown by the subsidence of the inflammatory fever ; but frequently secondary hemorrhage, erysipelas, gangrene, septicæmia, or pyæmia supervene and carry off the patient.

Secondary hemorrhage may come on during the passage of the wounded soldier from the front to the rear, owing to the jolting of a rough road, etc. Especially when a bone is broken, is its jagged end likely to rub a hole in the vessel in contact with it. If a bullet is left in a wound and in contact with an artery, the vessel wall may either ulcerate or slough, and death may result by a succession of hemorrhages in the former case, or by a sudden gush in the latter. The usual causes of secondary hemorrhage are of course present factors in gunshot injuries, such as a bad ligature, a badly or a too hastily applied ligature, neglecting a fair-sized vessel which afterward bleeds, tying an artery too near to

the origin of a large branch, the supervention of erysipelas, scurvy, typhus, hospital gangrene, pyæmia, non-union of the flaps, hæmophilia, diarrhea, etc.

Septicæmia, pyæmia, hospital gangrene, gangrene, and erysipelas are diseases and conditions which are one and all associated with gunshot wounds in both civil and military practice. The nature of the wound: a long sinus with bruised and lacerated walls, which, when reactionary circulation is established, swell up and prevent exit of exudation matters. Besides, in military surgery, there is, and ever will be, a great danger of overcrowding in the field or base hospital. The wounded of an army in a hostile country can only be carried along one route and to one focus. Especially if that focus be a civil hospital, a church, or some large building, is it apt to get overcrowded.

Amputation for gunshot injury is required:

(a) When, in addition to fracture, fissure, or comminution of a bone, or penetration of a joint, the main vessels or nerves of the limb are injured or destroyed.

(b) When a cannon-shot scoops out a large piece of the soft tissues and of the bone of a limb.

(c) When part of a limb is carried away.

(d) When acute osteo-myelitis sets in.

(e) When gangrene results from local injuries.

(f) In some cases of tetanus.

(g) In cases of secondary hemorrhage which defies other means of cure.

The *time* at which amputation is demanded varies with circumstances and conditions.

When no antiseptic dressing is available in the form of antisepticized cotton-wool, gauze, etc., the limb should be amputated as the intensity of the shock is wearing off. Ether is the preferable anæsthetic during such amputations.

When an antiseptic dressing can be provided, and the wound is of such a nature that it is possible to convey the patient from the dressing station to the field hospital, or, still better, to the base hospital, if even that be a three days' journey, it is better to do so before amputating. The danger is that inflammatory reaction should come on during the transmission, when any operation is to be regarded as certain to cause death.

Operations before inflammation has appeared are called *primary*; operations performed during the inflammatory period are called *intermediary*.

When the symptoms of acute inflammatory fever are over and suppuration is fairly established, amputations (*secondary* amputations) may be performed with better hopes of success than during the inflammatory stage. The rule is, unless the bone is splintered and fissured, to amputate immediately above the injury in the soft parts; but a stump of bone which is fissured will only lead to the formation of fat emboli, osteo-myelitis, osteo-phlebitis, and pyæmia. Amputate through a joint where possible instead of through the lower end of the bone above; so, on the other hand, amputate below a joint if even two inches of bone can be saved thereby.

Injuries to bones form a very special part of military surgery. When a bone is *contused*, the immediate treatment is rest and the application of cold, and subsequently incisions may have to be made to release inflammatory effusion or relieve tension. Should the bone, after all, necrose, it must be dealt with in the ordinary way.

Fracture of bones.—Bullets give rise to such special forms of fractures that almost a new nomenclature is required to express the different kinds.

Almost all gunshot fractures are compound; but the bone may be fissured, comminuted, splintered, penetrated, perforated, or resected, *i. e.*, a large piece may be carried away.

The immediate treatment is that the bone of the fractured limb be rendered immovable as quickly as possible. When the wounded soldier is taken to the field hospital, the wound is to be washed out with an antiseptic lotion, and search made for the bullet by an aseptic finger. The bullet, bits of cloth, loose splinters of bone, or whatever else there may be in the wound, should, if possible, be withdrawn. The following plan is to be pursued unless amputation is called for. Wash the part clean, make counter-openings where necessary, and insert drainage tubes; cover the part with antiseptic cotton-wool, either salicylic, carbolized, iodoform, etc.; apply a plaster-of-Paris bandage over all, including the joints above and below the fractured bone; cut a hole opposite the seat of the drainage tubes of

wounds in the plaster-of-Paris bandage. To prevent the bandage cracking, owing to the weakening of its circumference by cutting holes, a splint of some kind should be applied over the plaster-of-Paris bandage.

Gunshot injuries of joints.—Since the practice of the application of antiseptic dressing has been introduced on the field of battle, the surgery of the joints has been thoroughly revolutionized. When the surgeon first sees a wound in the neighborhood of a joint, whether it penetrate the joint or not, he ought to inspect the wound carefully, syringe it out or wash its surface with chloride of zinc lotion (20 grains to the ounce), apply absorbent disinfectant cotton-wool, and cover the whole with a bandage. At the same time he should apply a long splint (a rifle) to the lower limb, or an angular splint to the upper limb, to render them immovable.

When the patient reaches the dressing station, the joint ought to be enveloped in plaster of Paris, and (when that is dry) he should be removed to the field or base hospital. There the wound should be examined, amputation performed if necessary, or the bullet or piece of clothing extracted if it can be found; counter-openings should be made and drainage tubes freely introduced if an attempt is to be made to save it. A covering of antiseptic cotton-wool or gauze should be applied and enveloped in plaster of Paris, trap-doors should be cut in the bandage opposite the wound, and a light splint should be applied, to keep the joints above and below quiet and prevent the plaster cracking during transmission.

A limb is condemned for amputation when the joint is opened, the soft tissues destroyed around it, and especially if the bones are fissured to a great extent and the main vessels or nerves of the part are destroyed.

Excision, however, presents a very favorable means of treatment for injured joints short of those requiring amputation. Excision may be performed before the shock has worn off (*primary excision*); during reactionary inflammation (*intermediary excision*); or after suppuration has existed some weeks (*secondary excision*). In all averages given, primary is more favorable than secondary, and secondary more favorable than intermediary.

In the joints of the upper limb primary excision is very much more favorable than in the case of the lower extremity. The following are some of the statistics collected by Otis.

After *excision of the shoulder-joint* the mortality is as follows: Primary, 24; intermediary, 45; secondary, 28.

After *excision of the elbow*, primary, 21; intermediary, 29; secondary, 28.

Bullet wounds of the wrist-joint generally require amputation.

Bullet wounds of the hip-joint are of a most fatal nature, whether treated by expectancy, excision of the splintered bone, disarticulation of the hip-joint, or amputation.

It seems the safest plan to enlarge the wound and remove the splintered bones; and, if the patient has to be removed afterward, to render the limb immovable. Bullet wounds penetrating the knee-joint require amputation at the lower third of the thigh when no antiseptic dressing is available. When, however, immediate antiseptic treatment can be employed as already detailed, there is good hope, according to Reyher's showing, of saving the limb and obtaining a useful joint. Bullet wounds of the ankles, especially when treated by antiseptic dressing, present a warrantable reason for averting amputation.

Gunshot injuries of the head.—When the scalp alone is wounded it is to be treated as other scalp wounds; and when the bullet or bird-shot is lodged, and there is much extravasation observed, the missiles are to be left until the swelling subsides before an attempt is made to remove them. The cranial bones may be contused or fractured. When contused, an attempt to check the onset of inflammation is to be made by the application of cold to the head; either an ice bag or a coil of tubing (the mediate irrigation coil). Should symptoms of supracranial or subcranial collections of pus develop, the pus is to be relieved by incisions or trephining in the usual way. When the bones are fractured, spiculæ must be removed from the meninges, the bone must be elevated if depressed, and the bullet must be extracted if it can be found without hunting in the brain matter. For all these plans of treatment the trephine will almost certainly be required. When the bullet has lodged about the base of the skull, as

in suicidal cases, through placing the pistol muzzle in the mouth or to the ear, the situation of the bullet is usually a matter of mere conjecture. Meningitis or cerebritis following bullet injuries of the brain present very slight hopes of surgical interference being beneficial.

Gunshot injuries of the chest.—

According as bullets in this region penetrate or not, so is the danger to be ranked. Besides, the tendency for a bullet to follow a rib and emerge from the skin as though it penetrated the lungs is always to be borne in mind. The parts which are wounded most readily are the ribs, the heart, the lungs, and the vessels of the chest-wall and at the root of the neck. When the wound is not immediately fatal, proceed as follows: Wash the part clean, and if the wound is large enough, examine the track with a clean finger. If the bullet, button, or piece of clothing can be felt, or is found projecting beneath the skin, remove it. Stop bleeding from the internal mammary by ligaturing both ends of the severed artery. Plug the intercostal space when an intercostal artery is bleeding and cannot be readily ligatured. Do not hermetically seal the wound of aperture or exit unless severe hemorrhage from the wound may seem to demand it. Subsequent tapplings for blood, pus, pleuritic effusion, or pneumothorax may be required. The removal of a necrosed or partially severed piece of rib should be delayed as long as possible.

Gunshot injuries of the neck are especially dangerous, as likely to wound the trachea, esophagus, carotid arteries, internal jugular veins, or the vagus nerve. Wounds of the trachea are to be closed immediately, unless bruising of the tissues around forbids, when a tracheotomy tube must be worn. The carotid arteries must be tied, the internal jugular vein (as are other large veins) may be either digitally compressed or ligatured. Wound of the esophagus recognized by the direction of the track of the bullet, and by the escape of food through the wound in the neck. Should the trachea and esophagus be both wounded, food would escape into the trachea, causing suffocation. The patient should be fed by a long tube passed into the stomach.

Gunshot injuries of the abdomen are, as may be expected, of an extremely fatal character, the danger depending upon possible wound of the viscera. It is

often impossible to diagnose the character of the visceral injury, unless the damaged part protrude through the wound. In any case of penetrating wound there will be collapse, and in wounds of the liver and spleen evidences of severe intraperitoneal hemorrhage. When the stomach has been perforated some of its contents may escape from the parietal wound, and there may be hematemesis. When the bowel is wounded intestinal matters may in like manner escape. In both of these injuries peritonitis supervenes early, should the patient survive the stage of collapse.

Perforation of the bladder will be attended by symptoms akin to those associated with rupture of that organ. A bullet has, however, lodged in the bladder, and has given little trouble until it became the nucleus for a calculus.

Wounds of the kidney and of the ascending and descending colon need not prove fatal if, as is often the case, the non-peritoneal surfaces of those viscera are the seat of the lesion.

The treatment of non-penetrating wounds presents nothing peculiar, but the treatment of perforating wounds involves many points of an exceedingly complicated character. In all cases wash the wound and remove foreign matter; do not use the probe, but the finger, and that very gently, wherewith to examine the wound. The treatment, up to quite recently, was simply to apply a wet compress and a bandage over the part, at the same time exhibiting opium largely. Since Listerism has been introduced, one is justified in opening the abdomen in almost any case.

When the laparotomy has been performed, any vessels that may be still oozing are to be tied, and search made for the wounds made by the bullet. If the stomach be wounded the hole may be carefully closed at many points by Lembert's suture; and to better effect such closure the margins of the aperture may be excised. This measure has been carried out with success by Kocher, in a case of pistol wound of the stomach. If the intestine be wounded the hole should be closed, when possible, by Lembert's suture; but if a segment of the bowel be so damaged as to render suturing ineffectual, the injured piece may be excised and the divided ends either united

at once and the abdomen closed, or an artificial anus established. In any case the abdominal cavity must be thoroughly washed out and cleansed. The sooner the operation is performed the better, but the outset of peritonitis should not be an absolute obstacle to the undertaking. If peritonitis should exist at the time, the cavity of the abdomen should be drained after the laparotomy.

For wounds of the liver little can be done, and in most cases the patient dies rapidly of hemorrhage. In cases involving wound of the spleen, the propriety of at once excising the damaged organ may be raised. Splenectomy, in cases of injury exposing the spleen, has been so successful a measure that it may fairly be applied to certain selected cases of gunshot injury, that, without some interference, would without doubt prove fatal.

Owing to the large non-peritoneal surface presented by the kidney, gunshot wounds of that organ may be best healed by efficient drainage.

Sword and Saber wounds are met with in modern warfare only after a cavalry charge. The cavalry sword does its work of destruction more by its weight than its sharpness; that is, it stuns rather than cleaves the skull. The sharp sword of the Sikh, on the other hand, will cleave the skull or shave off part of the cranial or other bone in its descent. Saber cuts, being incised wounds pure and simple, require similar treatment. Antiseptic cotton-wool or other dressing applied over an extensive saber wound has, when the edges have been neatly brought into apposition, brought about union by the first intention. A piece of the scalp, with a slice of bone adherent to its inner surface, should be replaced, if the attachment of the detached piece is wide; but if not, it would be better to remove the bone and leave the scalp and periosteal coverings to close up the wound. When the abdomen or chest is wounded by a sword, the usual rules, when penetration follows from other causes, are to be observed.

Bayonet wounds are of but infrequent occurrence since the introduction of breech-loading rifles, as two bodies of men approaching each other can fire up to the last moment, and one or other side must be decimated. The bayonet causes a punctured wound, presenting three lines

radiating from a center. A leechbite resembles a bayonet in miniature. The gravity of the wound will depend upon the depth to which the bayonet is driven and the part injured. The treatment is to secure rest and good drainage. When the chest or abdomen is wounded, lay the patient upon the wounded side and keep him quiet by opiates. Should suppuration and signs of deep-seated inflammation or sloughing supervene, the wound must be enlarged and free exodus of inflammatory matters must be allowed.

Arrow wounds.—In modern warfare the arrow has almost completely disappeared, the only instances met with of arrow wounds, to any great extent, being in the conflicts with the American Indians. Owing to the deadly effects of such injuries it was believed that poison was frequently smeared over the arrowhead; but the belief is for the most part erroneous, at any rate among the Indians.

An arrow causes a punctured and incised wound; and if it passes through the part struck, the aperture of entrance closely resembles a bullet wound, while its aperture of exit is most frequently linear.

Arrow wounds, like bullet or bayonet wounds, may cause instantaneous death from hemorrhage or injury to the cerebrum. Failing that, death may be caused by any of the secondary complications mentioned under gunshot injuries.

Treatment.—When an arrow has passed through any part, the resulting wounds are to be treated by exactly the same methods as those given for gunshot injuries. When an arrow is lodged, however, it requires careful and special treatment. If it is on the battlefield such an injury happens, the arrow should be removed if the base has not sunk beneath the skin, as may happen when its head is caught in the cranium, tibia, or other superficial bone. When, however, the arrow has disappeared beneath the skin, no attempt should be made to extract it in the heat of battle, but its shaft should be cut carefully, and without wriggling, close to the skin, the wound should be covered with an antiseptic dressing, and the patient should be sent to the rear. The subsequent removal of the arrowhead is essential, as it is not likely to get encapsuled as a bullet might, and consequently suppuration must result with great danger to limb and life. The first principle in the surgery of arrow

wounds is that every endeavor must be made not to separate the head from the shaft. This is so easily done that the utmost precautions in examination must be taken. In the first place, should an arrow be sunken far into, say the thigh, it is better to push it onward and cause it to protrude beneath the skin opposite the point of its entrance; then make a snick in the skin to allow of its exit, and breaking off the head, fix a drainage tube to the shaft and pull the shaft out, leaving the drainage tube to occupy the arrow track. The shaft of the arrow might be oiled to allow of its easier passage. When the arrow has to be removed from a bone into which it has penetrated, or where it is undesirable to push it onward, the plan of treatment is as follows: leave the shaft sticking in the wound, and do not attempt to pull it backward. Along the shaft as a guide pass a probe-pointed bistoury, until the head of the weapon is reached; then cut the soft tissues freely until it is possible for the index finger to touch the arrowhead, then pass a dressing forceps and seize the arrowhead, and attempt to remove. If this is impossible, from its tight fixation in a bone, a wire may be twisted around the arrow shaft and forceps, and the three firmly grasped may be removed together. Should it be found impossible to dislodge the arrowhead, the bone must be chiseled or even sawn in two, as, unless removal is effected, loss of limb or life must necessarily ensue. Should the abdomen be penetrated and the arrowhead broken off, laparotomy presents the last chance of recovery.

JAMES CANTLIE.

WRITER'S CRAMP (Scrivener's Palsy).—Writer's cramp is the most important member of a large class of diseases called "occupation neuroses." These usually affect people whose employment consists in the frequent performance of highly specialized co-ordinated movements, which become impossible on account of the supervention of spasm whenever they are attempted. All other delicate movements may be executed with impunity, but in the later stages of these affections they, too, may become implicated, especially if the required muscular combination form part of that primarily affected. The most frequent symptom is spasm, and hence the particular neurosis is generally expressed by affixing the

word cramp to the occupation which has given rise to the disease—*e. g.*, "telegraphist's cramp," "violinist's and pianoplayer's cramp," and "writer's cramp." There are many others, but the last mentioned is by far the most important member of the group, and will be taken as a type of the family. Several varieties of the affection are met with, in one of which spasm is the most marked feature, and in another pain, which may be referred to the muscles, bones, joints, or to the nerves themselves. Both these symptoms, however, are often present in the same case. Sometimes there is a weakness of some muscle or group of muscles underlying the affection, which at other times is stimulated by some organic disease, such as progressive muscular atrophy.

Symptoms.—These are, as a rule, gradually developed. It is perhaps noticed that an unusual feeling of fatigue is experienced in writing, and that a certain amount of effort is necessary to form the letters, which were before formed almost unconsciously. The index finger is apt to slip off the penholder, which is held more tightly than it used to be, and the hand may lie flat upon the paper instead of being held, as normally, three-quarters prone. The fingers feel clumsy, and with the increasing effort to guide the pen properly, a great amount of unnecessary strength is expended. Spasm of the flexors or extensors soon ensues, and gradually extends, so that after writing a few words the pen makes a splutter and falls from the grasp. Various devices are indulged in to overcome the difficulty. The chief movements may be relegated to the forearm, upper arm, and shoulder, and, as they also become involved, to the trunk muscles. The penholder may be grasped between the index and middle, middle and ring fingers, or with the closed fist. The patient is driven from one resource to another, and at length all fail, and he may not be able to form even a single letter. Some, with infinite labor, teach the left hand to write, but that also is often overtaken with the spasm. In some cases it is not so, and the rest thus afforded results in complete recovery of the right hand. In the early stage delicate movements, other than those of writing, may be performed with ease, but with the spread of spasm they also become involved. The muscles may not be de-

creased in size, but frequently they are distinctly flabby and the grasp is weak. It is often found that some of them respond less readily to the faradic current than those of the healthy arm, and sometimes too readily to the galvanic. The spasm is usually tonic in character, and comes on during the act of writing or the performance of some movement in which the grouping of muscles is somewhat similar. Spontaneous spasm, not only of the muscles engaged in writing, but of the shoulder and head, has been described in advanced cases. Tremor is sometimes a prominent symptom, and may itself cause the difficulty in writing or be associated with tonic spasm. In some cases the inability to write depends almost entirely upon a feeling of muscular fatigue; in others, upon actual pain, which may be referred to the course of the nerve, where tender points may sometimes be found. The pain, which is distinctly neuralgic in type, may at length come on independently of the act of writing, and in some cases tends to spread. Feelings of "numbness" and "pins-and-needles" are sometimes experienced, and anæsthesia was present in some cases described by Solly. The general health is sometimes good, but very often the patient is neurotic, irritable, and may become so despondent as to attempt suicide.

Diagnosis.—Since the act of writing is one of the most complicated man is called upon to perform, requiring a nice adjustment of nearly all the muscles of the arm, it is one of the first to be disturbed by any incipient disease specially affecting the upper extremity. Hence it is necessary to eliminate disseminated sclerosis, progressive muscular atrophy, neuritis, and even a gradually developing hemiplegia, before making a positive diagnosis in the early course of the disease. In the later stages the condition is quite unmistakable. Another difficulty arises from the fact that people are sometimes conscious of a feeling of fatigue and other sensations after prolonged writing, and, having heard, or probably read, of the affection, fear that it is about to develop. In such cases there is never any spasm, and a few days' rest relieves the symptoms.

Prognosis.—This is favorable under two conditions—that the disease is treated in an early stage, and that a prolonged rest is possible. Unfortunately, neither

condition is fulfilled in most cases, for men whose livelihood depends entirely upon their power of writing are particularly affected. They refuse, therefore, to give in until absolutely compelled to do so, and hasten back to work as soon as the symptoms are sufficiently alleviated to permit it. Although the prognosis in such cases is extremely bad, recovery sometimes ensues under the most disadvantageous circumstances.

Pathology.—No anatomical changes have yet been discovered. Many observers believe that the starting-point of the affection is a lesion of some muscle or group of muscles, or of the peripheral nerve terminations in them. The act of writing demands a most delicate adjustment of the muscles, especially of the hand and forearm, and the failure of a single muscle, therefore, to respond to the appropriate stimulus causes a want of harmony in the movements, while the overaction of the antagonists results in spasm. The exponents of this view point out that there is never any evidence of central change, and assert that, as compared with the healthy side, there is always a diminution of faradic excitability in some one or other of the intrinsic muscles of the hand engaged in grasping the pen, and that, as these are placed *hors de combat*, their functions are performed by others in the forearm, which in their turn fail and are replaced by upper arm, shoulder, and trunk muscles, which also at length succumb to chronic fatigue. Other observers have been unable to subscribe to this theory, because they find that spasm is in many cases the initial symptom, and often at last involves the very muscles which have ultimately become weak. According to their theory, the disease is of central origin, and arises in the following manner: The education of centers (which may be widely separated from each other) for the performance of any delicate movement is mainly accomplished by lessening the lines of resistance between them, so that the movement, which was at first produced by a considerable mental effort, is at last executed almost unconsciously. If, therefore, through prolonged excitation, this lessened resistance be carried too far, there is an increased and irregular discharge of nerve energy, which gives rise to spasm and disordered movement. According to this view, the muscular

weakness is explained by an impairment of nutrition accompanying that of function, and the diminished faradic excitability by the nutritial disturbance descending the motor nerves. This seems by far the more plausible theory, and is now perhaps most generally accepted.]

Ætiology.—There is often a neurotic predisposition, and the disease itself is sometimes inherited, as is illustrated by an instance recorded by Dr. Poore, in which three generations in a direct line were affected. Many patients also have a highly-strung nervous temperament, and the onset of the disease can often be traced to some great anxiety or worry. Those are particularly affected whose occupations require prolonged and frequently repeated efforts at writing. Dr. Gowers considers that writing a “cramped hand” is one of the most frequent causes, and accounts for the frequency of the disease among lawyers’ clerks. The extremes of life are little liable to writer’s cramp, which is most common between the age of twenty and fifty. Males are much more frequently affected than females.

Treatment.—Rest is by far the most important. This does not mean that all movements of the arm must be prohibited, but only those which tend to induce the spasm. Dr. Gowers strongly recommends that patients should be encouraged to cultivate a “running hand,” and asserts that, if this were universally adopted, writer’s cramp would become almost unknown. Quill nibs or pencils must also be employed instead of hard steel pens. The various devices invented by the patient should not be countenanced, for, although they certainly put off the evil day, they conduce to the spread of the spasm. The left arm may be educated to write, and, for those whose position allows it, a typewriter is of great service, for it affords rest to the affected group of muscles and at the same time enables the patient to write. Internally, nervine tonics, such as strychnine, are useful when a condition of nervousness and irritability seems to underlie the affection, and bromide of potassium is indicated in cases of great restlessness and insomnia. The neuralgic type should be treated with sedatives, both locally and internally, and counter-irritants may be applied over the painful points in the course of the nerves. The application of the galvanic

current, short of that which causes muscular contraction, combined with rhythmical movements of the affected muscles, has proved of the greatest service in the hands of Dr. Poore. Massage has also been recommended, and forms the principal feature in a highly successful mode of treatment practiced by a non-professional man in London whose method has been approved by leading physicians in Germany.

WM. GAY.

WRIST, DISLOCATION OF.—See DISLOCATIONS.

WRIST, EXCISION OF.—See EXCISION OF JOINTS.

WRIST DROP.—See SATURNISM.

WRY NECK.—See NECK, INJURIES OF.

XANTHELASMA.—See XANTHOMA.

XANTHELASMOIDEA is a term given to a rare form of eruption characterized by the presence of certain buff-colored patches that appear in a scattered form in young children, and at first sight look like xanthelasma, in small patches, so far as external features are concerned. The disease may be in part congenital, or it may appear soon after birth, usually when the babe is about two months old. Parents say that itchy bumps or places like fleabites, or even vesicles, first appear, and these turn into red, bumpy places, which speedily assume a buff color. The spots may be scattered sparsely or thickly over parts of the whole body. They are distinct the one from the other, and vary in size from a pea to a quarter of a dollar or so. The disease has been generally mistaken for syphilis. The spots are readily irritated, and “wheal-like” appearances are presented by the patches when freely rubbed; wheals are also produced by scratching in the healthy islets of skin, and this fact, coupled with the presence of the pigmentation, has led to the suggestion of the term *urticaria pigmentosa* for the disease; but the wheal-like aspect is only accidental and temporary; a superaddition, in fact, to the real morbid condition, which is clearly an increase of substance in the skin, that undergoes no change through a long series of years. Nothing is known of the nature of the disease histologically. The disease seems to be unaffected by remedies, to produce no disturbance of

the general health, to undergo little change except that the spots become less elevated and paler by age. The chief thing to recollect about it is its liability to be mistaken for congenital syphilis, an error that may entail considerable risk to the child from the adoption of an anti-syphilitic treatment for the disease.

Fox.

XANTHOMA (*Xanthelasma*, *Vitiligoidea*).—A rare chronic disease of the skin characterized by the presence of flat plates or raised tubercles of a yellowish color, and due to the development of a new fibro-cellular and fatty growth in the corium.

The two principal clinical varieties are usually recognized, but, as they frequently coexist, and as there is no essential difference in their pathological characters, they are described separately merely in accordance with custom.

X. Planum is much the commoner form. Its usual site is the eyelids, beginning in the great majority upon the left side, on the upper lid, and near the inner canthus. From this point it extends outward along the upper eyelid, downward to the inner side of the lower lid, then outward along it, so that in an exaggerated case the eye is surrounded by a ring of disease. The mischief pursues a similar course on the right side, the condition being after a time always bilateral and symmetrical. The initial patches vary in size from a pin's head to a finger nail; they are imbedded in the skin, which is scarcely, if at all, raised by them, and retains its normal suppleness and softness. Their color varies from a pale lemon yellow to a deep buff or bright orange, and they have been aptly likened to chamois leather let into the skin. Sometimes the color of the lesions is so faint that it is necessary to empty them of their blood by stretching before the yellow tinge can be verified. Their margin is well defined and either regular or serrated. No subjective symptoms are produced by the condition, unless it be so extensive as to cause some *gêne* in the movements of the eyelids. Patches have very rarely been observed upon the concha of the ear, the neck, chest, and prepuce. The plane variety is generally found in women of middle or advanced age, especially in those of dark complexion; it is very frequently associated with megrim, various

neuralgiæ, menstrual disorders, or "any conditions capable of producing dark areolæ round the eyes."

X. Tuberosum vel Multiplex is a rarer condition, more extensive in distribution, and more serious in character than *X. palpebrarum*. It may occur independently, but usually develops in persons suffering from the former variety. Often the extension of the malady is first evidenced by the appearance on the face of plane lesions in regions other than the eyelids, especially around the nostrils, mouth, or external auditory meatus. A few sparse and slightly elevated lesions may be present over the trunk, but the most numerous and most characteristically tubercular appear upon the extremities, especially upon their extensor surfaces, and on parts exposed to pressure. The seats of election are the tips of the elbows and knees, the shoulders, the buttocks, the backs of the fingers and toes, the palms and soles. In the two latter situations, as well as round the anus, where the natural lines are deep, the tubercles are arranged along and exaggerate them. The symmetry of the eruption is generally remarkable. The lesions usually vary in size from a hempseed to a pea; they are deeply set in the skin, and project prominently from it; the epidermis over them is smooth and unbroken; they are a little hard to the touch. Sometimes they coalesce to form veritable tumors as large as a hen's egg or small apple. When the case is a severe one, flat xanthoma patches often develop on the mucous membrane of lips, palate, gums, tongue, or fauces, on the esophagus, stomach, bile ducts, or intestine, on the trachea and bronchi, on the conjunctiva or cornea, on the peritoneum or pleura, or even on the endothelium of the heart or arteries. The development of the disease is usually slow, and the lesions once formed persist permanently without undergoing retrogressive changes. They do not as a rule cause subjective symptoms, but occasionally some pain is evoked by pressure.

X. Multiplex, like *X. planum*, is commoner in women than in men, especially about middle life; sometimes, however, it occurs in early childhood, and it is frequently hereditary, affecting several members of the same family. The most interesting point in its ætiology is its association with jaundice, which has been

noted in at least four-fifths of the published cases, although the exact relationship between the two conditions has not been definitely made out. In the majority of cases the jaundice precedes the xanthoma by a considerable time—generally by a year or more—but is still present on its development. In a not inconsiderable proportion of cases, however, jaundice has disappeared before the xanthoma lesions appear, while in others a persistent condition of yellow skin—*xanthochromia*—resembling, but not identical with, jaundice is present. The definite hepatic diseases which have been observed in this association are, in order of relative frequency, chronic catarrhal obstruction of the biliary ducts, hypertrophic cirrhosis, and carcinoma; while gout, lithiasis, dyspepsia, and similar conditions attributable, perhaps, to functional derangements of the liver are common concomitants. The disease is usually benign, but the internal lesions, especially of the heart and arteries, may occasionally prove fatal.

The *pathological anatomy* of the two varieties differs merely in degree. In both the epidermis and the upper layer of the derma is healthy, while the middle and lower layers of the latter are involved by a new growth of connective tissue, the amount of which is small in the flat variety and great in the tuberous. In the meshes of the fibers are numerous multi-nuclear epithelioid cells, containing much fat, along with crystals of tyrosin and cholesterin, as well as granular pigment which is not confined to the cells.

Treatment is seldom resorted to, as the disease is, in the majority of cases, absolutely benign, but occasionally it is desirable to take away patches from the eyelids, either to remove disfigurement, or to restore impaired movement. Excision is the most suitable procedure, great care being taken that no ectropion results. Painful outgrowths about the elbows have been removed by painting with a ten per cent. solution of corrosive sublimate in collodion; and Kaposi states that the troublesome condition of the palms and soles may be greatly benefited by vigorous rubbing with soft soap and by wearing india-rubber gloves and socks.

The disease described as **Xanthoma Diabeticorum** occupies a position as yet unsettled, but its closest affinities are

certainly with the foregoing. It differs in the following respects: (1) it is always associated with diabetes mellitus; (2) it develops rapidly and sometimes intermittently; (3) it afterward diminishes, or even entirely disappears without leaving any trace of its existence; (4) the lesions are denser and firmer than those of true xanthoma; (5) there is sometimes a bright congestive zone around their base, and at the apex they present a yellowish point like pus, but in reality are solid; (6) the tubercles are not generally bright yellow, while some are quite colorless; (7) they are abundant on the elbows and knees, common on the scalp and face, but never exist on the eyelids; (8) there is never jaundice present; (9) itching and tingling are always troublesome symptoms, and sometimes there is great tenderness; (10) although there is fibro-cellular infiltration of the corium, somewhat like that of xanthoma, it is more obviously in connection with the blood vessels and sweat and sebaceous glands, and the fat and cholesterin characteristic of true xanthoma are absent.

Treatment must be directed toward the accompanying diabetes, and is often successful in removing or diminishing the growth.

J. J. PRINGLE.

XERODERMA.—A name still unfortunately employed in this country to designate the mildest form of ichthyosis (*q. v.*). It bears no relation to the disease first described by Kaposi, which is discussed in the following article.

XERODERMA PIGMENTOSUM (*Atrophoderma vel Angioma Atrophicum; Melanosis Lenticularis Progressiva; Kaposi's Disease*).—A very rare condition of the skin, of which only between forty and fifty cases are on record. It usually affects more than one member of a family, or the various members of one sex in the same family, and generally begins in summer.

Symptoms.—In most cases the first signs observed are minute, measly, erythematous blotches upon parts exposed to the sun (face, neck, arms, legs). These soon disappear, leaving pigment spots like ordinary freckles, but attention is often attracted to these by their depth of color, close aggregation, and espe-

cially by their persistence during winter. The intermediate skin becomes dry, scaly, cracked, or slightly eczematous, and capillary dilatations (telangiectases) rapidly form, and heighten the color of the skin. Gradually the pigment disappears in places, the skin undergoing a spontaneous atrophy, which results in the formation of non-pigmented, glistening scar tissue. This change usually begins and is most marked on the face, especially about the nose and cheeks, and the ectropion thereby produced is characteristic, materially adding to the disfigurement. Possibly the tears have infective properties; at all events, those parts of the face over which they run, owing to the ectropion, or are wiped by the patient's mopping, undergo most rapid shrinkage, and form the favorite seats for the first development of the malignant, epitheliomatous growths which mark the commencement of the last stage of the disease. These begin as brownish, warty growths, which even from the first present the microscopic characters of epithelioma. They increase with varying rapidity to form growths of any size, and invade all tissues encountered in their onward march. Ultimately they soften, discharge, and fungate.

The disease begins in the first or second year of life, and is often apparently attributable to undue exposure to the sun; it is progressive despite all treatment and generally causes death from marasmus about puberty; but a considerable proportion of cases have succumbed within a few years, or, on the other hand, have lived to middle age.

Treatment.—Careful attendance to the maintenance of cleanliness contributes to the comfort of the patient, and probably the use of white precipitate ointment, to the face especially, retards the advance of the atrophic, cicatricial, and ulcerative lesions there. The epithelial growths should be excised or scooped out as soon as they appear, and the wounds thus caused heal kindly. Even large growths may be removed with advantage. Internal remedies exert no influence upon the disease.

J. J. PRINGLE.

XEROPHTHALMIA. — See CONJUNCTIVA, DISEASES OF.

XEROSIS.—See CONJUNCTIVA, DISEASES OF.

YAWS.—*Definition.*—A contagious disease of the West Indies and Africa, rarely seen in this country, characterized by the appearance of a pustular eruption, which is replaced by a series of ulcers and attended by considerable constitutional disturbance.

Symptoms.—It commences with feverishness, and soon after small papules are produced, which are most numerous on the face and extremities, and gradually grow until they reach the size of a dime. At the end of a few days a pustule forms on the elevation, and bursts, leaving a thick crust, beneath which ulceration takes place; on this ulcer large granulations grow, giving an appearance which has been compared to a raspberry, but eventually these cicatrize and heal. This condition may go on for months, during which successive crops of the pustules may be produced. The constitutional symptoms are feverishness, sore throat, and sometimes dropsy.

Diagnosis.—There is no disease for which this can be mistaken.

Treatment.—No specific treatment is known; the ulcers must be treated with stimulating applications, and the strength must be kept up with stimulants and a generous diet.

MALCOLM MORRIS.

YAWNING.—Yawning is a co-ordinated act of considerable complexity, consisting fundamentally of three parts: A prolonged and deep inspiration, accompanied with elevation of the soft palate and uvula, depression of the lower jaw, opening of the mouth, it may be to the fullest extent, and slight retraction of the head; a brief tonic spasm of the muscles concerned in these movements; and a prolonged expiration sometimes combined with a vocal sound. The depressed jaw and open mouth are not essential factors in the act, as those will have discovered, who, in the exigencies of social life, have endeavored to suppress their yawns. There are several occasional associations, *e. g.*, a click may be heard in the ears, a shiver felt down the back, or, indeed, all over the body, or there may be an almost irresistible impulse to stretch the limbs.

Yawning generally indicates a condition of fatigue and a necessity for rest. It is thus most common at night, but when sleep is deficient either in quality

or quantity, it may actually be most frequent immediately after getting up. It results as readily from mental as from physical fatigue, and is a well-known expression of ennui. One of the strangest characters of yawning is its infectiousness, which is sometimes very striking. As an indication of anxiety it may frequently be noticed, and it is then only one of many other evidences of the influence exercised by various emotions upon the respiratory centers. Yawning is one of the earliest of the premonitory symptoms of fainting, and may often be observed in the operating theater at the commencement of the session. It is very common as a symptom of seasickness, and frequently occurs in cases of dyspepsia after the ingestion of food. In a few cases of tetanus persistent yawning has been one of the earliest features of the disease. It is an old observation that the act of yawning is accompanied with extension of the fingers in certain cases of hemiplegia in which there is absolute paralysis and a strong flexor contracture. No altogether conclusive explanation of the nature of yawning has yet been put forward. Poore has suggested that it is practically a reflex spasm of the depressors of the lower jaw induced by fatigue of the elevators—a spasm commencing in the region of the fifth nerve and spreading thence into the other territories involved. Such a view is clearly only applicable to yawning as a result of fatigue. The theory enunciated by Hughlings Jackson in regard to the functions of the cerebellum affords a ready explanation of the nature of yawning. He believes, briefly, that the motor functions of the cerebellum are complementary to those of the cerebrum, in such a way that the former represents movements in the order from the general, or most automatic, to the special, or most voluntary, and the latter in the inverse order. Generally speaking, then, the peripheral groups of muscles are chiefly subserved by the cerebrum, the central muscular groups by the cerebellum, and the extensors are far more under the influence of the cerebellum than are the more highly specialized flexors. The movements of the lower jaw are looked upon as examples of those belonging to the general rather than to the special type, and are therefore represented in the cerebellum. The

extension of the head, the gape, the deep inspiration, and the stretching of the limbs, which is essentially a movement of extension, may all, according to this view, be regarded as of cerebellar origin, and the whole series of events be explained by “a wave of cerebellar influence.”

It must be rare, indeed, that yawning has to be treated *per se*. When too easily induced, however, it may be considered that the recuperative power of the individual is below par; an inquiry should then be made into the methods and habits of the life of the individual, and any irregularity corrected. There is frequently some gastric derangement, which has to be treated on general lines, and appropriate tonics may afterward be prescribed.

WM. GAY.

YELLOW FEVER.—An acute disease, accompanied by jaundice and hemorrhages, occurring only in certain subtropical regions, and due to the action of a specific poison of a nature at present undetermined.

Symptoms.—The incubation period is stated to vary between one and fourteen days; it is probably usually from one to four days. The onset is sudden, with a sense of chilliness, the temperature rising rapidly to 103° F., or even 105° F.; headache, sacral and lumbar neuralgic pains are frequently complained of, and delirium is not uncommon. Sometimes there is spontaneous vomiting. The bowels are usually sluggish; the urine tends to become scanty or is suppressed, and is often albuminous and contains casts. In the mildest cases the fever may attain its maximum in twelve hours, and recovery may commence at once; in others the maximum temperature may not be attained until the third or fourth day. The pulse is compressible, and not, as a rule, very frequent; perspiration is often a marked feature. After the paroxysm, in all but the mildest cases, a tendency to hemorrhage is developed, either from the nose, mouth, vagina, kidneys, or stomach. About the third day, but it may be the fourth or fifth, the skin and conjunctiva become of a yellow tint, which will vary in depth according to the severity of the attack, the skin sometimes assuming a deep olive or mahogany hue. The feces are not

usually clay-colored. The previous state of health exerts much influence on the course of the disease. The mortality is always rather high, but varies in different epidemics, the percentage of fatal cases being sometimes as low as fifteen, and in other epidemics as high as seventy-five. Fatigue, anxiety, grief, etc., diminish the patient's chance of recovery.

Prognosis.—The gravity of the case will be directly proportionate to the degree of hemorrhage.

Post-mortem Appearances.—The body is deeply jaundiced, the heart pale and soft, the pleuræ ecchymosed, the lungs may contain infarcts, there may be congestion of the lining membrane of the alimentary canal throughout, with hemorrhagic erosions of the mucous membrane of the stomach, the liver is of a *café-au-lait* color, and the hepatic cells under the microscope show granular disintegration; the kidneys are enlarged.

Ætiology.—The disease is certainly due to a specific poison, but the organism peculiar to it has not yet been isolated. It is believed by some writers to be allied to the malarial poison which is now known to be due to a micro-organism. It is met with only in epidemics in certain subtropical countries, and especially on the West Coast of Africa, America, and the West Indies. The disease is transmissible by the air for a short distance, but may be arrested by a high wall or a running stream; it is transportable by fomites to any distance, and is often borne by vessels from one port to another. Some writers, however, do not admit the contagious nature of the disease. Very few white persons who are exposed to it escape infection, but the negroes are much less liable to be attacked. One attack protects against subsequent seizures.

Treatment.—An emetic and a purge of castor oil may be given at the onset. Perspiration should be encouraged by warm drinks and clothing. There is no specific remedy, but quinine may be given, and, if there be hemorrhage, perchloride of iron. Until the paroxysm is over, nothing but effervescing drinks should be allowed, and, after that, only milk and barley-water. No solid food should be allowed for at least ten days after an attack, and even then caution is

necessary, as fatal relapses have often been induced by indiscretion in the matter of food at a more remote period than this. Where there is much vomiting, ice may be given and the patient be fed by nutrient enemata. The patient must be kept absolutely quiet, and the bedroom be well ventilated. Stimulants, such as iced soda and brandy or iced champagne, may be given freely.

JOHN ABERCROMBIE.

Symptomatic Indications.—*Aconite* is useful in the first stage, with burning heat, dry skin; full, hard, rapid pulse; restlessness; anxiety; headache; delirium. *Camphor* is useful to promote reaction when disease sets in with long, lasting chill; great coldness of the skin, yet cannot bear to be covered; prostration. *Arsenicum*, when there is rapid prostration; frequent stools, with tenesmus or painless and involuntary; violent vomiting after eating or drinking; burning in the stomach, with intense thirst for small quantities; extreme restlessness. *Bryonia* is useful in second stage; intense headache, worse from movement; sitting up causes nausea and faintness; food vomited immediately after eating; dryness of mouth and tongue; constipation. *Antimonium tart.*, continuous nausea and vomiting, with faintness and prostration; general prostration of the whole system; profuse, cold sweat; rapid, weak pulse. *Crotalus* is valuable in blood poisoning in second stage, with hemorrhages, exhaustion, fetid diarrhea; jaundice.

ZINC, POISONING BY.—There are only two salts of zinc of any importance—the sulphate, which is much used as an emetic and is a mild irritant poison, and the chloride. The latter is an irritant and corrosive poison, producing burning and pain in the mouth, throat, and epigastrium; vomiting and purging, the vomit and stools sometimes containing blood; cramps, collapse, and coma. Perforation of the stomach has been known to occur. In cases that do not prove immediately fatal, the patient may die at a later period from stricture of the esophagus.

Post-mortem Appearances.—The mucous membrane of the mouth and esophagus is white and tough, while that of the stomach and intestines shows more or less congestion or inflammation.

Treatment.—Vomiting should be en-

couraged by the administration of warm water, milk, and albuminous fluids. The stomach-pump must not be used; carbonate of soda in large quantities is the proper antidote. Milk and eggs may be given freely with tepid water; astringents and morphine are also useful.

ZYMOTIC (from ζυμώω, *I ferment*; "zymosis" and the verb from which it is derived occur in Hippocrates).—A word introduced into general use by Dr. William Farr to include the epidemic, endemic, and contagious diseases, and to express their "property of communicating their action, and affecting analogous transformations in other bodies." He included in this class of diseases "all the principal diseases which have prevailed as epidemics or endemics, and all those which are communicable either by human contact or by animals in a state of disease, as well as the diseases that result from the scarcity and deterioration of the necessary kinds of food or from parasitic animals."

Dr. Farr divided the class of zymotic diseases into four groups or orders: (1) **Miasmatic**, diffusible through air or water and attended by fever; the matter by which they are communicable is derived from the human body (smallpox), or the earth (ague). (2) **Enthetic**, which may be properly called contagious, as they are communicated by contact, puncture, or inoculation (syphilis, glanders). (3) **Dietetic**, which arise when the blood is supplied with improper food (scurvy, ergotism). (4) **Parasitic**, which may infest the skin, the intestinal canal, or all the tissues of the body.

This classification was, however, to a large extent non-natural, and has passed out of use, the term zymotic disease being now limited to the first two

groups. The diseases now placed under the head of zymotic diseases, and their classification are as follows: *Miasmatic Diseases*.—Smallpox, chicken pox, measles, epidemic rose rash, scarlet fever, typhus, relapsing fever, influenza, whooping-cough, mumps, diphtheria, cerebro-spinal fever, simple and ill-defined fever, enteric fever. *Diarrheal Diseases*.—Cholera, diarrhea, dysentery. *Malarial Diseases*.—Remittent fever, ague. *Zoöge-nous Diseases*.—Hydrophobia, glanders, splenic fever, cowpox, and other effects of vaccination. *Venereal Diseases*.—Syphilis, gonorrhea, stricture of urethra. *Septic Diseases*.—Phagedena, erysipelas, pyæmia, septicæmia, puerperal fever.

The term "zymotic diseases" is also regarded as an equivalent for the term "specific febrile diseases," and it is in this sense that it is generally understood.

The analogy between fermentation and the infective process was noted by Hippocrates, and the discovery that certain fermentations (as the butyric) and certain diseases (as splenic fever) are due to the growth of bacteria has tended to increase the force of the analogy. Certain pathogenic microbes (*e. g.*, the bacilli of anthrax and of diphtheria) produce, when grown outside the body, a decomposition of albumen, resulting in the formation of poisonous bodies (alkaloids and poisonous albumoses). That this action of the bacilli is of the nature of ferment action is generally recognized, and it would therefore appear that in certain febrile diseases the symptoms are due to a form of toxæmia, the toxic bodies being the results of the growth of an organized ferment in the tissues or fluids of the body in this limited sense then the analogy between the specific febrile process and fermentation holds good.

DAWSON WILLIAMS.

APPENDIX.

VACUUM TREATMENT.—**Vacuum.**—Pneumatic equalizing or hæmospastic treatment is a practical development of the classic dry-cup treatment, which has been developed and perfected from simple revulsive or counter-irritant treatment to a method capable of regulating and altering the atmospheric pressure upon the entire body or any portion thereof. It was first largely and successfully used in this country by Dr. Hadfield in 1865. The appliances used in this treatment consist of cups of various sizes and shapes, adapted to different parts of the body, which range, through many intermediate grades, from round cups one inch in diameter to oval cups twelve by seven inches, finger, hand, arm, foot, and leg receivers, and cabinets for the entire body, from which the air is withdrawn by means of an air-pump to the extent desired.

The results obtained by the use of these appliances vary according to the method of their employment, as they may be used like the dry cups as counter irritants merely to relieve inflamed or congested condition by withdrawing the excess of blood from the part, as cupping over the spine in the cervical region for congestive headache; or they may be used in cases of atrophy and functional weakness to promote the flow of blood through the affected part, to stimulate the nerve centers, and induce reparative changes, as the use of the arm or leg receiver in cases of rheumatism in the arm or leg, or paralysis of the extremities; or to bring to the surface blood clots or exudations, in the case of deep bruises, wounds, etc. From this it may be seen that the vacuum treatment has a very wide range of application to a number of widely different conditions, as acute and chronic inflammations, remote and local congestions, atrophy and functional weakness, neurasthenia, paresis, locomotor ataxia, infantile paralysis, rheumatism, neuralgia, spinal disease, insomnia, diseases of the kidney and of the liver, cardiac weakness, etc.

The treatment of disease by the vacuum method is an art of itself which can be acquired only by study and practice and which requires, in addition to a knowledge of disease and of the anatomy and physiology of the parts affected, delicacy of touch, comprehension, and judgment to obtain successful results.

In the application of this treatment in acute cases great gentleness in the application of the cups, discretion and judgment, carefully watching the effect of the application both locally and general, are essential. The symptoms should be carefully studied from day to day, the color of the blood brought to the surface, the reduction of tenderness, the tissue changes, and the general condition noted. When using the cups in acute cases it is best to begin with the smallest cup, which should be applied lightly close to, but not directly upon the affected part, the skin being brought up to the cup by the exhaustion of the air. The cup is then quickly removed and reapplied, working over the surface until the entire part has been subjected to the entire capacity of the cup, then gone over again with a larger cup in the same manner. In chronic conditions the treatment must be careful, continuous, and progressive until the blood is brought to circulate freely and thoroughly through the diseased tissues, the dead and inert matter cleaned away, and the parts revitalized.

X-RAY. — ROENTGEN RAYS. — For a thorough understanding of the Roentgen ray a consideration of the spectrum is necessary. When a beam of sunlight is allowed to pass through a small aperture into a dark room and fall upon a prism, the ray of light passing through the triangular piece of glass is decomposed, and on its emergence upon the other side is separated into the seven prismatic colors. If the axis of the prism is vertical and the decomposed ray is directed upon a white screen it will appear as a long narrow ribbon com-

posed of the seven primary colors, in which the red will be to the left, followed in order by orange, yellow, green, blue, indigo, violet. If the temperature of these colors be tested by the extremely delicate thermometer, the "thermo-electric pile," it will be found that there is no appreciable heat in the violet or any of the colors until the red is reached, and that, tested by the thermometer, the heat increases in the dark space beyond the red ray, which space is known as the infra-red, calorific, or thermal space.

If, on the contrary, a photographic plate is exposed to the action of the prismatic ray, it will be found that the red, orange, and yellow rays have no appreciable effect upon the sensitive coating upon the plate, and that it does not commence to darken until it is exposed to the blue light and that the shade gradually increases through the indigo and violet rays, reaching its maximum in the dark space beyond the violet, which space is known as the actinic or ultra-violet space. It is in this actinic space that the wonderful influence known as the cathode, X-, or Roentgen ray is found.

The accepted theory of the nature of the force known as light is the undulatory. According to this theory the entire universe is pervaded by an extremely attenuated mobile gas known as the luminiferous ether, which is imperceptible except when thrown into vibration. A vibration of many millions of waves a second which affects the nerves of feeling we recognize as heat; a still higher rate of vibration affects the nerves of sight and we recognize it as light. If the vibration comes from a solid body, as from the sun, from the fine particles of carbon in a lamp, or from a molten body, the vibrations are of all rates of frequency and all the colors of the spectrum are present, but, being intimately mixed and blended, we see only the white light.

The discovery of the cathode ray is due to the investigation of the effect of the electric spark upon the atmosphere. If an electric spark is passed through a tube or vessel containing air the effect is the same as when passed through the outside air, but if the air in the tube is partially exhausted by means of an air pump, the spark becomes broader, has less of a zig-zag direction, and with less noise. If the air is withdrawn as much as possible by the pump, there is no

longer any spark, but the whole vessel is filled with a beautiful purplish light. In the Geissler tubes, which are from six inches to several feet in length and from one-half to two inches in diameter, from which the air is almost but not entirely exhausted, hermetically sealed, and fitted with platinum wire at each end, the electric current can be passed through the rarefied atmosphere, producing a brilliant light, purple if the tube contains air only, red if it contains hydrogen, and various other colors with other and different gases. In the Crookes tubes, a modification of the Geissler tubes, the attenuation of the air is carried to so high a degree that it is estimated that a millionth part only of the ordinary atmospheric pressure is present. In seeking the rationale of the phenomena exhibited it may be said that the particles of the gas contained in the tubes when excited by the electric current, vibrate, each particular gas at a definite rate of speed, in a similar manner to the vibration of the strings of a musical instrument, each string vibrating at a certain rate to produce the note to which it is attuned.

If we regard the tube as a small box filled with small balls, the molecules of the gas, on shaking the box, as the balls cannot move, there will be no sound. If some of the balls are removed, the air withdrawn in the case of the tube, allowing the remainder to move freely, on shaking the box the balls will be thrown from side to side. If nearly all of the balls are removed, or the air exhausted, and the box violently shaken, the few balls left will strike against the sides of the box with much force. In the case of the Crookes tubes, where the rarefaction is very great, the particles of air are hurled from one end of the tube to the other with such force as to heat the walls of the tube or any object that they strike, in the same way that a piece of iron can be made red hot by hammering. These particles of air may be driven against the walls of the tubes with such force as to crack them or melt them by the heat produced.

It has been found by Nikola Tesla that the particles of air may be forced through the glass. This impact of the particles against the sides of the tube imparts to the luminiferous ether a peculiar vibratory motion which is continued through wood, metals, flesh, bone, and other

opaque objects, and after having passed through them is still capable of affecting a photographic plate and of bringing out fluorescence.

HOT AIR TREATMENT.—This consists essentially in the local application of a very high degree of heat by means of superheated dry air, 250° to 450° F., applied directly, by means of suitable apparatus, to the affected tissues. This method has been successfully employed in France and England, and later in this country, in the treatment of ankylosis, sciatica, rheumatism, neuralgia, stiffness of the muscular and fibrous tissues, swelling of the limbs and joints, infantile paralysis, muscular atrophy, periostitis, gout, nephritis, and similar conditions. The apparatus, by means of which dry hot air of any graduated temperature up to 400° F. may be directed to the affected part and the requisite temperature held for any length of time (Frank S. Betz & Co., Chicago, Ill.), consists of a cylinder thirty inches long

and fourteen inches high, lined internally throughout with asbestos, of ample size to receive the most abnormal limb. The spirit lamp or heater is placed on the floor, and over it rests a copper funnel with copper pipe connection which supplies hot air to the bottom of the cylinder, with valve for regulating the heat supply. The arm or leg enters the cylinder from the opposite end and rests upon the hot air chamber that runs the full length of the cylinder. A canvas sleeve is placed at the entrance which makes close contact with the body, and is fastened by means of straps. There is a convenient damper on the top of the cylinder for regulating the ventilation and circulation. The thermometer adjusted on top of the cylinder records the degree of heat inside.

When using the apparatus the limb or part to be acted upon should be protected by wrapping in a towel and the first application made at the lower temperature, increasing the temperature a few degrees at each application, which should last from thirty to ninety minutes.

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